MULGRAVE COMMUNITY WIND POWER PROJECT MULGRAVE, NOVA SCOTIA

ENVIRONMENTAL ASSESSMENT REGISTRATION DOCUMENT

PROPONENT

CELTIC CURRENT LP.
10442 Route 19,
Southwest Mabou, Nova Scotia, Canada
B0E 1X0

Report Prepared by:
McCallum Environment Ltd.

December 4, 2013

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Environmental Assessment Registration Document

Name of Project: Mulgrave Community Wind Power Project

Location: Mulgrave, Guysborough County, Nova Scotia

Size of the Project: 2.3 MW

Proponent: Celtic Current LP

Report Prepared by: McCallum Environmental Ltd.

Date: December 4, 2013

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Executive Summary

Celtic Current LP (Celtic Current) intends to construct a 2.3 MW (nameplate capacity) single turbine on private land [PID 35124452] within the Town of Muglrave, Nova Scotia. This Project consists of a single access road and turbine pad, a system of above ground distribution lines and an Enercon E-92 2.3 MW turbine. The proposed schedule involves construction during Spring 2014 with a tentative operation date of late Summer 2014.

The field data, regulatory consultation and subsequent conclusions of this assessment indicate there are no expected significant residual environmental effects resulting from the Mulgrave Community Wind Power Project once all appropriate mitigation and monitoring has been implemented and completed.

Standard construction mitigation methods will be implemented during all phases of the building of the Project to ensure there are no significant impacts of the Project on Valued Ecosystem Components (VEC). These methods were included in the development of the Environmental Protection Plan (EPP) which is included as part of this assessment.

The proposed turbine location is adjacent to a large clearcut area. The turbine will be located at the same location as the existing MET tower and the Project will be able to use the existing access road constructed for the MET tower installation as the access road for the entire scope of the Project.

Natural areas remaining following Project construction will continue to include disturbed and undisturbed tracts of forests, wetlands, or stands of trees or other vegetation within the Project Area. These forested natural areas are continuous, and provide suitable habitat, travelling corridors, thermal and security cover for wildlife, and are representative of forest systems throughout the Project Area. Habitat fragmentation will be minimal.

Species at risk inventories within the Project revealed that no flora species at risk were identified. It is expected that Mainland Moose use the Project Area. However, it continues to remain unknown how Mainland moose move through the area, at what times, or in what numbers. The small size of the Project and the construction of only a single access road are expected to result in low residual impact to the Mainland Moose.

Avian and bat species at risk were identified within or near the Project Area. The environmental assessment process has determined that residual environmental effects on birds and bats is expected to be low, post-mitigation, and Celtic Current is committed to completing follow up monitoring as recommended by CWS and NSDNR.

There are no areas of cultural significance identified with the Project Area during assessments of historical resources. As well there are no adverse effects anticipated on health and socio-

economic conditions, physical and cultural heritage areas, traditional land use, and traditional structures or sites as a result of environmental changes from the Project.

Celtic Current has exceeded typical residential setbacks, with the closest residence or other sensitive receptor being located 1008 meters from the turbine. Sound models indicate that the regulatory criterion of 40 dBA for sound at any identified receptors within 1500m is not expected to be exceeded.

Both McCallum Environmental Ltd. and Celtic Current are confident that the community-at-large support the development of this Project. Positive feedback received from the communities in proximity for the proposed Project, suggest that community support for this Project is positive. Celtic Current will continue to conduct public consultation on this Project.

The magnitude of disturbance and risk associated with the Project are all considered minimal given the size of the Project, abundance of similar VEC within the Project Area and the mitigation techniques and technologies currently available. Furthermore this assessment concludes there are no significant environmental concerns and no significant impacts that cannot be effectively mitigated through well established and acceptable practices, or ongoing monitoring and response. Residual environmental effects have been determined to be minimal or low for identified Valued Ecosystem Components.

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List of Acronyms

ACCDC	Atlantic Canadian Conservation Data Centre
AGL	Above Ground Level
AL-PRO	AL-PRO Wind Energy Consulting Canada Inc.
ASL	Above Sea Level
ATV	All-Terrain Vehicle
BOP	Balance Of Plant
BWEA	British Wind Energy Association
CanWEA	Canadian Wind Energy Association
CBC	Canadian Broadcasting Corporation
CLC	Community Liaison Committee
CMM	Confederacy of Mainland Mi'Kmaq
COMFIT	Community Feed in Tariff
COSEWIC	Committee On the Status of Endangered Wildlife In Canada
CWS	Canadian Wildlife Service
dBa	Decibel
DSME	Daewoo Shipbuilding and Marine Engineering
EMI	Electro-Magnetic Interference
EPP	Environmental Protection Plan
GASHA	Guysborough Antigonish Strait Health Authority
GE	General Electric
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning System
GRP	Glass-fibre Reinforced Plastic
IEC	International Electro-technical Commission
IPP	Independent Power Producers

ISO	International Standards Organization
KMK	Kwilmu'kw Maw-klusagn
KMKNO	Kwilmu'kw Maw-klusagn Negotiation Office
kV	Kilovolt
LIDAR	Light Imaging Detection And Ranging
MET	Meteorological
MORI	Market & Opinion Research International
MW	Megawatt
NSDNR	Nova Scotia Department of Natural Resources
NSE	Nova Scotia Environment
NSESA	Nova Scotia Endangered Species Act
NSPI	Nova Scotia Power Inc.
NSTIR	Nova Scotia Transportation and Infrastructure Renewal
PID	Property Identification Number
PIF	Partners In Flight
PM	Particulate Matter
POR	Point Of Reception
PPA	Power Purchase Agreement
RABC	Radio Advisory Board of Canada
SAR	Species At Risk
SARA	Species At Risk Act
SIA	Sound Impact Assessment
SSHD	Significant Species and Habitat Database
TBD	To Be Determined
TDG	Transportation of Dangerous Goods
TSP	Total Suspended Particulate
UTM	Universal Transform Mercator
VEC	Valued Ecosystem Components
WHMIS	Workplace Hazardous Material Information System
WNS	White Nose Syndrome
WPP	Wind Power Project
WTG	Wind Turbine Generator
ZVI	Zone of Visual Influence

1. General Information

Table 1. Project Summary

General Project Information	Celtic Current LP (Celtic Current) intends to construct and operate a community wind power project with 2.3 MW of total capacity, located on PID 35124452 .
Project Name	Mulgrave Community Wind Power Project (the "Project")
Proponent Name	Celtic Current LP (Celtic Current)
Proponent Contact Information	10442 Route 19, Southwest Mabou, Nova Scotia, Canada B0E 1X0 Business: (902) 945-2300 Facsimile: (902) 945-2087 email: martha@celticcurrent.ca
Proponent Project Director	Martha Campbell Peter Archibald Chief Executive Officer (CEO) Project Manager
Project Location	· The Project lands are located within the boundaries of PID 35124452 · The Project lands are located straddling the northwestern Town of Mulgrave town boundary with Guysborough County, Nova Scotia; · Project lands are located entirely within Guysborough County, Nova Scotia; and, · The approximate centre of the Project lands are located at 621992 m E and 5052984 m N.
Landowner(s)	The project lands are located on freehold (private) land
Closest distance from a turbine to a residence	The nearest house will be **1008 metres** from the proposed turbine location
Expected rated capacity of proposed project in MW	2.3 MW consisting of one Enercon 2.3 MW (nameplate capacity) turbine. Two 50 kW turbines may be considered in the future. As a result, Project efforts were focused on the entire PID to assess for the potential placement of these two turbines in the future.
Federal Involvement	No federal departments are providing funding. No Canadian Environmental Assessment Act triggers (*Section 5, CEAA*) occur or are expected.

Required Federal Permits & Authorizations	· Department of National Defense Authorization; · Transport Canada; · NAV Canada; · No other federal authorizations are anticipated at this time;
Provincial Authorities issuing Approvals	a. Nova Scotia Department of Environment; b. Nova Scotia Department of Natural Resources; c. Nova Scotia Transportation and Infrastructure Renewal;
Required Provincial Permits & Authorizations	The following permits, authorizations and/or approvals may be required for this Project which will allow for the construction and operation of the Project 1. *Environmental Assessment Approval.* Approved pursuant to Section 40 of the *Environment Act* and Section 13 (1)(b) of the *Environmental Assessment Regulations* in Nova Scotia, Canada; 2. *Approval to Construct – Culvert(s),* Pursuant to *Part V of the Environment Act, S.N.S 1994-95, c.1;;* *3.* Nova Scotia Transportation and Infrastructure Renewal: *Work within Highway Right of Way Permit;* *4.* Service Nova Scotia and Municipal Relations: *Special Move Permit for over dimensional and/or overweight vehicles and loads* 5. *Wetland Alterations* Pursuant to Activities Designation Regulations, Division I, Section 5(1)(na)
Provincial Regulatory Authorities Consulted during EA and Project Development Process	Nova Scotia Environment (NSE), Policy & Corporate Services: · Steve Sanford, Environmental Assessment Officer Nova Scotia Department of Natural Resources: · Mark Elderkin, Species at Risk Biologist · Peter MacDonald, Large Mammal Biologist · Mark Pulsifer, Co-Chair, Mainland Moose Recovery Team Office of Aboriginal Affairs: · Laurent Jonart, Consultation Advisor
Municipal Authorities	County of Guysborough and Town of Mulgrave
Required Municipal Permits & Authorizations	*Development Permit* – Town of Mulgrave

Environmental Assessment Document Completed By:	Meghan Milloy, MES Robert McCallum, P.Biol Melanie MacDonald, MREM McCallum Environmental Ltd. **McCallum Environmental Ltd.** 9 North Street Bedford, N.S. B4A 2N1

2. Project Information

2.1 PROPONENT PROFILE

Celtic Current LP (Celtic Current) intends to own and operate community based wind projects in northeastern Nova Scotia . Their goal is to generate up to 10 MW of electricity annually under the Community Feed in Tariff (COMFIT) program in Nova Scotia. Celtic Current currently holds COMFIT approvals for 8.7 MW of renewable wind energy and is proposing turbines in the communities of Cheticamp, Mulgrave, Goldboro, Point Acoini and Bateston.

Celtic Current is committed to the development of renewable energy projects utilizing the best available wind technologies. Celtic Current constructs, develops and operates renewable energy generation facilities on behalf of its investors and in cooperation with the landowners and communities where the projects are located. Celtic Current is committed to using their combined strengths and capabilities to promote strong sustainable communities.

Celtic Current's Executive Management Team consists of:

- Leonard van Zutphen, President
- Martha Campbell, Chief Executive Officer (CEO)
- Peter Archibald, B. Eng, CSS, Director and Project Manager

The Environmental Assessment Project Team is:

- Meghan Milloy, MES, McCallum Environmental Ltd.
- Robert McCallum, P.Biol., McCallum Environmental Ltd.
- Melanie MacDonald, MREM, McCallum Environmental Ltd.
- Kirk Schmidt, Al-Pro Wind Energy Inc.
- David Johnston, avifaunal specialist
- Jody Hamper, Wildlife Technician
- Steve Davis, Professional Archeologist, Davis McIntyre & Associates

2.2 NEED FOR PROJECT/REGULATORY FRAMEWORK

The Government of Nova Scotia has committed to a target of 25 percent renewable electricity supply by 2015 as part of Nova Scotia's Renewable Energy Plan that was announced in 2010. Nova Scotia's total renewable electricity content is expected to more than double from 2009 levels to satisfy this target. Furthermore, the Government of Nova Scotia has committed to a target of 40% renewable electricity supply by 2020. The renewable energy production is expected to include hydro, wind, biomass, and tidal sources.

As legislated in the 2010 amendments to the *Electricity Act,* Nova Scotia will produce 25% of total electricity from renewable energy by 2015. To enable the province to achieve this goal, a minimum of 100 MWs will be procured through the Community Feed in Tariff (COMFIT) program administered by the Nova Scotia Department of Energy. The Nova Scotia Community Feed-In Tariff, or COMFIT, is designed for locally-based renewable electricity projects. To be eligible, the projects must be community-owned and connected at the distribution level (i.e., typically under 6 MW).

This Project is being developed in response to this government initiative, and has received COMFIT approval under this program from the Nova Scotia Department of Energy

2.3 PROJECT LOCATION

The project lands are located at the northwestern boundary of the Town of Mulgrave and PID 35124452 straddles the Town line with the Municipality of Guysborough in Nova Scotia (Figure 1). The Project lands are located on PID 35124452 and approximately 2 kilometres northwest of the centre of the Town of Mulgrave. The approximate centre of the Project lands is located at 560247m E and 5048919.15 m N.

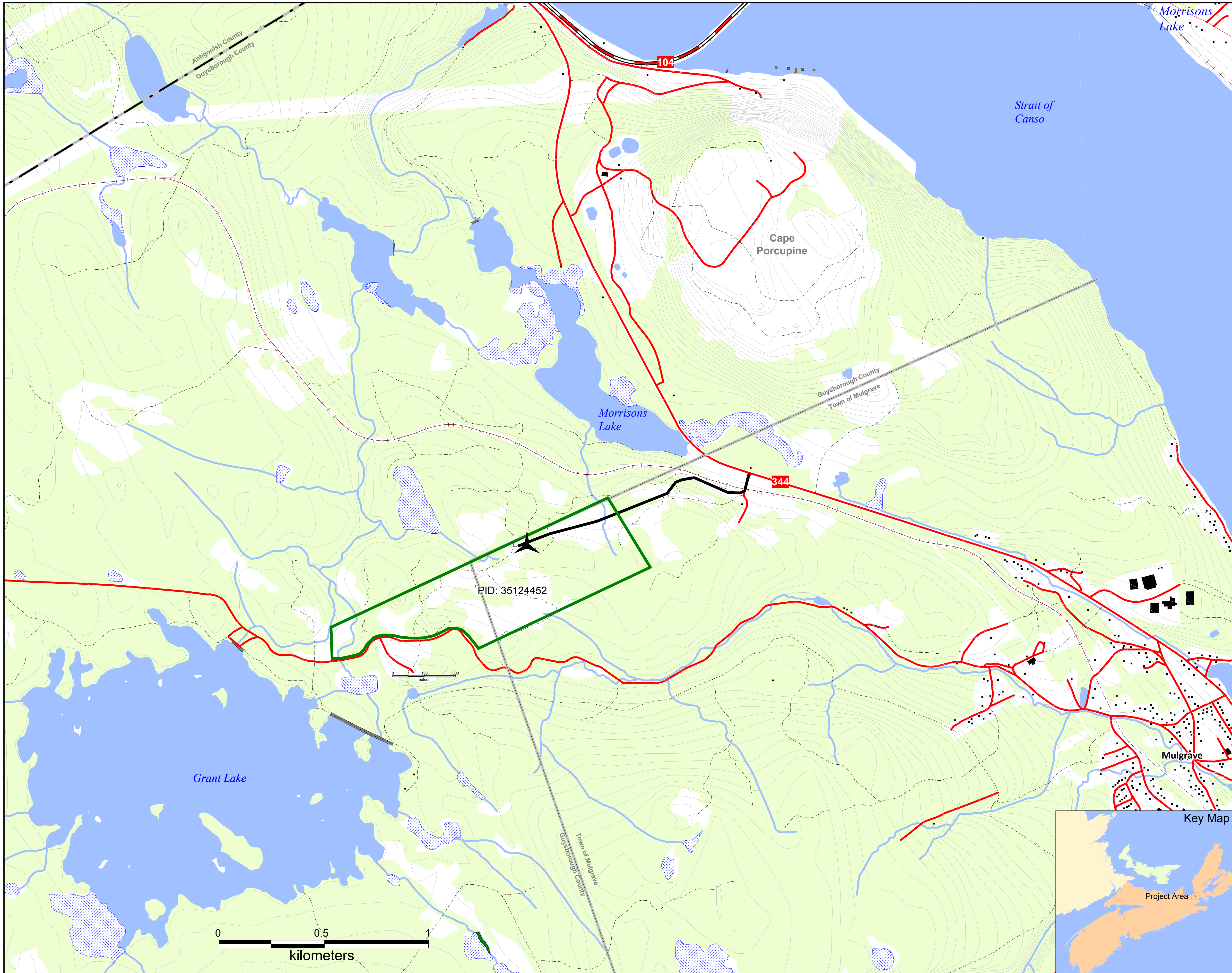
The southwestern boundary of the Project is marked by the Old Mulgrave Road. Grant's Lake is located to the west of the Project. The northern boundary of the Project is marked by the Town of Mulgrave boundary. Directly east of the Project is a small quarry development and Highway 344 is located farther east. Morrison's Lake is located northeast of the Project.

Physical access to the project site will be from Highway 344 to the east across the quarry property. The connection point to the distribution lines is located at the takeoff pole near the entrance to the project area on feeder circuit 100C-442. The 25 kV feeder runs adjacent to Highway 344 from the Cape Porcupine Sub-station (100C) past the Project Area toward the Town of Mulgrave. From this point of interconnection to the turbine's location, 1.23 km of new overhead line will be installed to the riser pole. From this point, approximately 50 meters of underground cables will be installed to connect to the transformer and switchgear located inside the tower.

The Project Area is situated in a sparsely populated rural setting. The land proposed for the site is undeveloped in various stages of re-growth. This property is set back from residences, roads and other public areas.

The nearest house will be **1008 metres** from the proposed turbine location.

The Project Area is defined in its entirety by PID 35124452. Please refer to Figure 1 for a map with the property location and PID boundaries



CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT

Mulgrave Community Wind Project Area

Figure 1

Project Lands

PID:35124452

Legend:

Project Features

- Project Area
- Existing Access Road
- Proposed E92 Turbine

Existing Features

- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water
- Swamp
- Existing Building
- Forest

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 17,500

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB)	
Nov 28, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.1

GIS By: Nortek Resource Solutions Inc.

2.4 PROJECT COMPONENTS

The Mulgrave Community Wind Power Project will be powered by one Enercon E-92 turbine rated with a nameplate capacity of 2.3 megawatts (MW). Under optimal conditions, the turbines would operate 24 hours per day, 7 days per week. However, as is fairly typical in the wind industry, turbines usually only operate at a 30-40% capacity factor.

The key components of the Project include the wind turbine generator (the “turbine”) with a total installed capacity of 2.3 MW, a pad-mounted or nacelle situated transformer, a 25 kilovolt (kV) electrical collector system with both overhead (1.23km) and buried cable (50m), and a single access road to the turbine from Highway 344 located east of the Project Area.

Two additional small 50 kW turbines are considered for this project. However, at the time of environmental assessment registration, it has not been determined if these turbines are viable in the wind regime at the Project. The environmental assessment was completed with the expectation of three turbines and the entire PID 35124452 was considered in all site activities. Should these two small turbines be determined to be viable, a request for change in scope will be requested from Nova Scotia Environment. This issue has been discussed with Steve Sanford of NSE and he agreed this is a reasonable approach.

2.4.1 Turbine

The representative values for the characteristics of the proposed wind turbine manufacturer are shown below.

Table 2: Turbine Characteristics Enercon E-92

OPERATING DATA	
nominal power	2.35 MW
Cut-in wind speed	3 m/s
Rated wind speed	8.5 m/s
Cut-out wind speed	28 – 34 m/s (with activated storm control features)
Hub height	98 m
ROTOR	
Pitch system	Principle: Independent Blade Pitch Control Actuation: Individual Electric Drive
Diameter	92 m
RPM	5-16 min^{-1}
Blade material type	Glass-fibre reinforced plastic (GRP)/Epoxy
GENERATOR	
Type	Synchronous, direct drive ringgenerator
Rated power	2300 kW

Rated voltage	400 Volts
Frequency	60 Hertz
Protection	IP 23
BRAKING SYSTEM	
Aerodynamic brake	Electrically independent blade pitch systems with emergency supply
Rotor brake	Exists. But no technical details available

Wind turbines and supporting structures typically consist of eight key components:

1. tower foundations;
2. three or four tower sections of steel or concrete with service access provided by stairs and/or service person lifts;
3. stainless steel nacelle housing the mainshaft and generator,
4. three fibre glass or carbon fibre rotor blades;
5. cast iron hub;
6. tower mounted transformer;
7. electrical and grounding wires; and
8. buried grounding grid at perimeter of foundation

The average cleared area required for the turbine, including assembly areas for the turbine components but excluding the access road, power line and temporary laydown area, will be 0.8 hectares.

The 2.3 MW turbine will be 98 metres in height from ground level to the hub (“98 metre hub height”). The swept diameter of each three bladed rotor will measure 92 metres. Therefore all components will reach a maximum height of 144 metres. The rotors are variable speed, with revolutions per minute dependent upon wind conditions.

The nacelle includes bedplate/frame, stainless steel enclosure, rotor hub, mainshaft, generator, turbine control equipment, instrumentation, and cooling/heating equipment. These components are located at the top of the tower sections and are connected to the three bladed rotor via a main shaft and hub assembly. Tower foundations may range from three to eight metres in depth depending upon site-specific soil conditions.

A transformer and switch gear is located in the tower base of the turbine to transform the low voltage electricity created in the nacelle to medium voltage collection system level (i.e., 400 V to 25 kV). The electrical collection system will be comprised of an above ground power lines to the turbine. The cables will then go underground from the last riser pole to the turbine pad mounted transformer or directly into the turbine tower.

2.4.2 Lighting

Turbine lighting will meet the design requirements and quality assurance for lights required under *Canadian Aviation Regulations 2010-1* Part VI - General Operating and Flight Rules Standard 621.19 - Standards Obstruction Marking, Section. Transport Canada generally recommends the use of medium intensity flashing red beacon lights.

2.4.3 Electrical Collection System

The 25 kV medium voltage collection system will be used to take the power from the wind turbine to the Nova Scotia Power distribution lines located along Highway 344 east of the Project Area.

An underground collection line (50 m) will be installed from the turbine out to the main access road. At the main road, an above ground collection system will be used (Photo 1).

Photo 1. Example of above ground distribution line

2.4.4 Access Road

At the commencement of the environmental assessment process, an access road was present commencing at Highway 344 east of the project, travelling west across the adjacent quarry property and continuing west to the proposed turbine location. This road was built to facilitate the installation of the site MET tower.

The current access road will be upgraded and built to accommodate the size requirements of the crane and the load specifications to support the delivery of turbine and crane components. The final access road surface may be 8m wide along straight sections, but may be widened through turns if necessary to allow adequate access for turbine components. Ditches and culverts will be added where required to allow for proper drainage. The surface soil and grubbing will be re-located in borrow areas along the road side and graded to prevent erosion and sediment runoff. The ditches will be constructed along the road edge following provincial guidelines and procedures to control for surface water runoff. Crossover culverts have already been installed under the road as necessary.

The access road is approximately 1 km long and provides access to the turbine from Highway 344 east of the Project Area.

The access road will be constructed similar to the ones shown in the following photo.

Photo 2. Example Access Road

2.4.5 Meteorological (MET) Towers

There is a single Meteorological Tower located within the Project Area. This MET tower carries meteorological instrumentation and anemometers (devices to measure wind speed) installed at different heights on the mast, and one or two wind vanes (devices to measure wind direction). These are connected to a data logger, at the base of a mast, via screened cables. This system is battery operated using a solar panel for recharge.

Signals that are recorded for each sensor with a ten-minute averaging period are as follows:

- Mean wind speed;
- Maximum gust wind speed;
- True standard deviation of wind speed;
- Mean wind direction;
- Mean temperature;
- Air Pressure;
- Logger battery voltage.

In recent years, it has become standard practice to download data remotely, via either modem or a satellite link. This approach has made managing large quantities of data from masts, on a range of prospective sites, significantly more efficient than manual downloading.

This MET tower was installed in April 2012 and has been collecting valuable wind and meteorological data for 1.5 years.

2.4.6 Temporary Components

During the construction phases of the Project, the following temporary Project components may be required:

1. A storage yard will be required to store construction equipment, the turbine, cranes, shacks, offices, parking and other necessary components. An operations building or trailers will be brought in prior to leasing or purchasing of a building for the operation and maintenance facility; and,
2. Temporary work space may be required along the access road and at the turbine site. These temporary work spaces will be used as required and will be reclaimed/restored following turbine erection.

2.5 PROJECT ACTIVITIES

2.5.1 Anticipated Schedule of Activities

The following milestone schedule outlines the typical project schedule.

Table 3. Schedule Of Project Activities

Task	Anticipated Completion Date
Geotechnical Study	completed
Engineering Design	Winter 2013
Environmental Assessment Approval	February 2014
Turbine Purchase Agreement	Winter 2013
Commence Construction -Pour concrete mud slabs for turbine foundations -Turbine foundations, turbine delivery, erection	Spring 2014
Commercial Operation Date	Summer 2014

2.5.2 Activity Phases

Phase	Details
Pre-Construction	
	· Notification of residents/landowner of construction commencement · Survey turbine site location in field · Trucking & set up of temporary facilities – construction offices, workers trailers, temporary washroom facilities, etc. · Construction equipment delivery
Construction	
General	· Clearing and Grubbing of overstory vegetation where necessary · Construction of storage yard · Construction of temporary work space
Civil	· Stripping of surface soils at turbine location and at other required work areas · Widening and final construction of access road · Construction of turbine location and crane pad · Installation of erosion and sediment control structures · Site grading · Excavation of foundation with blasting (as required) and excavator · Creation of crane pad using excavated material · Installation of site drainage (aka- weeping tile) at base of turbine foundation · Installation of re-bar at turbine foundation · Installation of below ground transmission infrastructure · Installation of turbine base · Pouring of concrete for foundation · Testing of concrete foundation · Backfilling of foundation with previously excavated soils · Reclamation of surplus soils · Grading of site
Turbines	· Turbine component delivery · Crane delivery · Tower/turbine erection · Install Turbine Electrical & Padmount Transformer
Collection System	· Installation of poles and guide wires for overhead (O/H) collection system · Run overhead wires and associated infrastructure · Install and connect underground collector system
Operations & Maintenance	
	· Reclamation of subsoils and disturbed surface soils · Weed Control · Re-seeding of disturbed soils · Grading of road · Road maintenance · Culvert maintenance

	· Turbine maintenance · Equipment testing
Decommissioning	
	· De-energize facility · Removal of above ground infrastructure which includes turbine blades, nacelles, tower components, O/H distribution lines, power poles, and other support structures · Removal of crane pad and gravel from access road · Recontouring of crane pad and access road grades · Reclamation of surface soils · Re-seeding or re-planting · Reclamation monitoring

2.5.3 Access Road Construction Methods

As discussed, an access road was constructed prior to installation of the site MET tower at the location of the proposed turbine. Minimal upgrades to the existed access road may be necessary in order to facilitate turbine component delivery. Should upgrades be necessary, the Proponent will follow the following standard methodologies for road widening:

- Cutting, de-limbing and decking all salvageable timber, as necessary, using feller buncher, skidders, chainsaws and logging trucks;
- Following removal of overstory vegetation, lands will be brushed with a bulldozer and backhoe to remove non-salvageable wood and brush. Scrub brush/grubbings will be piled along disturbance boundaries and will have breaks installed to allow for water flow where necessary. Limbs and non-merchantable material may be left in brush piles or buried underground for natural decay; depending on the site conditions;
- Dozers will push soils to the edge of the access road boundary;
- Subsoils will be excavated with a backhoe from a trench line that parallels the access road alignment. These subsoils will be placed on the area of travel for the access road;
- Previously removed grubbings and topsoils will be placed into the excavated trench line and the trench line recontoured;
- Subsoils placed on the access road traveling area will be spread out using a dozer;
- This new access road will the packed with a roller;
- Crushed rock may be placed on the road and re-packed with a roller;
- A second and final layer of crushed rock may be placed over top and packed with a roller if required;
- Gravel may be used on the access road on an as-needed basis during the construction and operational life;
- The access road will be compaction tested to ensure it meets the compaction requirements for turbine component delivery;
- All ditches will be re-vegetated as per the Environmental Protection Plan (EPP), provided in Appendix I;

2.5.4 Turbine Site Construction

The erection of a turbine requires a large level work area for safe operation and the following site dimensions will be typical for the project (refer to Drawing on following page):

Table 4. Infrastructure and associated dimensions of workspace

Infrastructure	Dimensions of Workspace Required
Total Cleared Work Space Per Turbine (required for storage of turbine blades, nacelle, and tower sections during the erection process)	90 m x 90 m
Permanent Lease: Turbine base with Power Cables and Pad Mounted Transformer for use during operational life	25 m x 25 m
Crane Pad	16 m x 25 m

Initial clearing and levelling was completed prior to the environmental assessment commencing and during MET tower installation. Final construction of the turbine locations will consist of the following:

- Surveying of the turbine site boundaries to 90 metre x 90 metre dimensions;
- Boundaries will be flagged by surveyors;
- Cutting, de-limbing and decking all remaining salvageable timber using feller buncher within the remaining turbine pad area where clearing was not completed for MET tower installation;
- Following removal of overstory vegetation, lands will be brushed with a bulldozer and backhoe to remove non-salvageable wood and brush. Scrub brush will be piled along disturbance boundaries and will have breaks installed to allow for water flow where necessary;

Photo 3. Typical clearing operations of a turbine site following timber removal

- The turbine site may require soil stripping and leveling using a two lift soil stripping method in areas where bedrock is not found at or immediately below the surface;
- Drainage patterns will be maintained by installing adequate crossing structures;
- Blasting of uneven surface bedrock and foundation areas will be completed as required. All blasting will be conducted in accordance with the *General Blasting Regulations, N.S. Reg. 77/90*, or any updated versions thereof;
- Following blasting of bedrock, blasted bedrock will be excavated and used for the development of a crane pad on the turbine location. The turbine base will be excavated to appropriate dimensions (determined by engineering requirements);
- The turbine base is anticipated to require installation of a support structure using approximately 300 m^3 of cement and re-bar (Photos 6, 7);
- Installation of rebar and other required infrastructure;
- Pouring of concrete;

Photo 4. Typical turbine re-bar installation for the spread foot foundation.

Photo 5. Typical turbine spread footing foundation following concrete pour. Note blasted rock from foundation used on site.

2.5.5 Turbine Erection

The erection of the turbine is based upon specific site conditions found at the turbine site. Engineering lift procedures will be required for the turbine and generated by the construction contractor.

- Lifting and construction equipment will be placed on the ground and leveling techniques will be used as required, for the safe operation of equipment;
- Two cranes will be used for each turbine component installation (one main lifting crane and one tailing crane). The main lifting crane will be situated on the leveled crane pad area immediately adjacent to the foundation pedestal. The tailing crane will be located nearby.
- Hydraulic torque wrenches will be used to tighten bolted connections between turbine tower sections.

Photo 6. Tower section installation

Photo 7. Nacelle Installation

Photo 8. Hub and Blade Lift.

2.5.6 Equipment Delivery

For the Mulgrave Community Wind Project, turbine components are expected to be shipped to the Port in the Town of Mulgrave and then loaded onto trucks and transported by road along Highway 344 3.5 km to the Project Site.

This route has been chosen due to equipment and truck sizes, turning radii available on the route, avoidance of major traffic corridors, and road characteristics. The route will be subject to Nova Scotia Transportation and Infrastructure Renewal (NSTIR) approval and transportation company (TBD) approval and may therefore change.

The following types of construction vehicles are expected to be used to construct the proposed wind turbine:

Foundation Construction

- Track Hoe
- Loader
- Roller
- Concrete Trucks
- Concrete Pump Truck
- Tractor Trailer (rebar, anchor bolts& templates)
- Rock Trucks

Access Roads Construction (if necessary- final road construction)

- Bulldozer
- Grader

- Gravel Haul Trucks

Collection System Installation

- Trackhoe or Trencher
- Tractor Trailers (delivery of cable spools and transformers)

Turbine Erection

- Tractor Trailers (required for delivering crane components to project area. Turbine components would be delivered using tractor trailers of various lengths, widths and axle configurations required to accommodate the large weights and dimensions of the components).

Component deliveries / turbine include:

- Down Tower Assembly (6 delivery trucks)
- Hub (1 delivery truck per turbine)
- Nacelle (1 delivery truck per turbine)
- Tower Sections (3 delivery trucks per turbine)
- Blades (1 delivery trucks for every turbines, i.e. three blades per truck)

The approximate sizes of trucks required to deliver equipment are listed as follows:

Component	Length of trucks (feet)	Height of trucks (feet)	Approx. Gross Vehicle Weight (lbs.)	Clearance Radius on Turns (feet)
Nacelle	112’ 10”	14’ 8:	197,000	111’ 3”
Hub	78’ 0”	13’ 6”	75,000	48’ 4”
Blade	153’ 11”	13’ 6”	<70,000	133’ 0”
Tower Base	140’	15’	212,000	80’ 5”
Tower Mid	128’ 2”	15’	132,000	75’ 0”
Tower Top	123’ 7”	14’ 6”	112,000	74’ 6”

- Two support cranes will be required to offload each of the turbine components at their respective turbine site laydown area(s).
- Tower components will be either erected directly from delivery trailers or stored at the turbine laydown site.

2.5.7 Electrical Collection System

The Collection System will be installed within the Project boundaries, and will mainly consist of above ground utility wooden power poles, spaced approximately 50 metres apart. All power poles will be purchased from a supplier which has treated the poles in accordance with appropriate regulations.

Construction of the 1.23 km long collection system will consist of the following:

- Surveying of the pole locations;

  If necessary, drilling of borehole into bedrock to approximately 5 – 8 metres depending upon subsoil/bedrock conditions;
- Installation of power poles;
- Installation of cross arm supports and pole infrastructure;
- Unspooling and stringing of power lines and fiber optic cable; and,
- Installation of pole-mounted disconnect switches as may be required by the electrical design.

2.5.8 Waste Disposal

All hazardous materials on work sites are controlled under federal and provincial legislation. The legislation requires that employers provide specific information to workers for the safe use, handling, production and storage of hazardous materials on work sites.

There are limited waste by-products created from the wind energy generation process. Some waste will be produced from ongoing maintenance for the turbine (e.g., lube and hydraulic oils). Hazardous waste materials will not be generated in large quantities and will be disposed of through conventional waste-oil and hazardous waste disposal streams as regulated in the province of Nova Scotia.

All solid waste must be properly sorted for recycling, reuse, composting, or landfilling. The segregated materials must be stored in a manner so that they will not degrade, burn, or become buried on site until they are sent to the appropriate, provincially approved waste disposal, recycling, or composting facilities.

Non-hazardous waste will be disposed of through conventional, local waste handling facilities operated by the local municipalities. As appropriate, materials suitable for recycling will be reused and/or recycled.

Controlled products are products, materials, and substances that are regulated by Workplace Hazardous Materials Identification System (WHMIS) legislation. All controlled products fall into one or more of the six WHMIS classes and each has specific handling, transport, storage, and safety requirements.

3. PROJECT SCOPE

3.1 Site Sensitivity

The determination of site sensitivity was undertaken in consultation with the Canadian Wildlife Service (CWS) and the Nova Scotia Department of Natural Resources (NSDNR).

Based on the document Nova Scotia Environment (NSE) *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE September 2008), facility size and site sensitivity combine to determine the Level of Concern.

The Mulgrave COMFIT Wind Power Project area is located approximately 28 km east of the nearest Important Bird Area (NS009, Pomquet Beach Region, IBA, 2012). While the Project area itself does not contain any landforms that are likely to concentrate bird activity, it is located 2.2 km southwest of the Strait of Canso, which is a known migratory flyway, particularly for migrating sea ducks. Porcupine Mountain is a prominent landscape feature which lies between the Project area and the Strait of Canso, which appears, based on baseline surveys, to be reducing the usage of the Project area by passing migrants.

Based on MBBA data and results from surveys conducted in 2012, the site is used by several species of conservation interest, but is not believed to be regionally or locally important to birds. A priority list of species was compiled to identify potential species of conservation interest and species at risk which may be using the Project Area and surrounding lands. The priority list of species is included in Appendix II. A review of Atlantic Canada Conservation Data Centre findings confirms the presence of several priority species in and around the Project Area (ACCDC report included in Appendix IV). A summary of federally and provincially protected bird species identified within 20km of the Project Area (along with preferred nesting habitat) is listed below. Breeding status as documented in the Maritime Breed Bird Atlas square summary (square 20PR25) is also included. If the species was observed during atlas surveys, with no breeding evidence noted, this is indicated below as well. Those species actually observed within the Project area during the baseline assessment are identified below as well.

- Common Nighthawk – NS Threatened, COSEWIC & SARA Threatened
    - Nests in gravelly substrates, and even on rooftops
    - MBBA – confirmed breeder
- Canada Warbler – NS Endangered, COSEWIC & SARA Threatened
    - Nests in cool, moist woodlands in a nest of dried leaves, often at the base of a stump
    - MBBA – probable breeder
- Olive-sided Flycatcher – COSEWIC & SARA/NS Threatened
    - Softwood forests, near openings such as burns, ponds, and bogs
    - MBBA – observed, possible breeder
    - Observed within the Project area during baseline surveys
- Rusty Blackbird – NS Endangered, COSEWIC & SARA Special Concern

    - Prefers beaver ponds, roadsides, landfills, wet meadows and shrubby shorelines
    - MBBA – observed only during first atlas survey, no breeding evidence noted
- Piping Plover – NS, SARA & COSEWIC Endangered
    - Nearly always found in open sandy areas near water.
    - MBBA – not observed
- Bobolink – COSEWIC & SARA Threatened
    - Preferred habitats include prairies and meadows; and marshes during migration
    - MBBA – observed, no breeding evidence noted
- Barn Swallow – NS Endangered, COSEWIC Threatened
    - Preferred habitats include agricultural lands, marshes, suburban areas and lakeshores
    - MBBA – observed, possible breeder
- Eastern Wood Pewee – NS Vulnerable, COSEWIC Special Concern
    - Preferred habitats include orchards, parks, roadsides and suburban areas
    - MBBA – Observed, probable breeder
    - Observed within the Project area during baseline surveys

These species of conservation interest or species at risk have been identified within 20km of the project area as recorded by the ACCDC. This data, supplemented by observations recorded within MBBA atlas square 20PR25 and those identified within the Project area during baseline assessments, confirm the presence of species of conservation interest. As well, 2012 assessment involving transects for the Mainland Moose identified moose scat just east of the Project Area. As such, the site sensitivity for the Mulgrave Community Wind Power Project is designated as "Very High". The facility size is small (1 to 10 turbines), thus the Level of Concern is Category 4.

Category 4. *Projects in this category present a relatively high level of potential risk to birds, and consequently are likely to require the highest level of effort for the EA. As with category 3 projects, relatively comprehensive baseline surveys will usually be required. In many cases, these can still be completed over the course of one calendar year, unless there are specific factors that require more intensive survey.*

Based on the Category 4 classification, the methodologies for field surveys were established keeping the recommendations noted above in mind. Baseline information was collected over a period longer than one calendar year, and bird monitoring was completed in consultation with Environment Canada and CWS employing appropriate standards and protocols (CWS 2007).

3.2 Assessment Scope

Environmental Assessments ("EA") are extremely important planning tools. They are used to predict the environmental effects of a proposed project, identify measures to mitigate potential adverse environmental effects, and attempt to predict whether there will be significant residual adverse environmental effect after mitigation is implemented.

The EA focuses on specific environmental components called valued environmental components (VECs). VECs are specific components of the biophysical and human environments that, if altered by the project, may be of concern. A valued ecosystem component is important (not only economically) to a local human population, or has a national or international profile. If altered, a VEC will be important for the evaluation of environmental impacts of industrial developments (NSE 2007, updated 2012)

The scope of the assessment for this Project includes: selection and assessment of potential interactions and identification of VECs; identification of environmental effects; and identification of the standards or thresholds that are used to determine the significance of residual environmental effects.

3.3 Spatial and Temporal Boundaries of the Assessment

Assessment of effects was undertaken for the area identified as the Project Area [PID 35124452] (Figure 1). For the purpose of data collection and the socioeconomic environment, the Municipality of Guysborough was considered. In addition, residences located within a 1.5 km buffer of the Project site were assessed as potential receptors for the purposes of evaluating potential impacts from sound.

The temporal scope of this assessment covers the construction, operation, and decommissioning phases of the Project, and associated activities.

3.4 Site Optimization and Constraints Analysis

A key aspect of planning a wind power project is the determination of project lands for the development and the subsequent identification of specific turbine location(s) within these lands.

This chapter details how Celtic Current determined project lands and turbine locations:

A. Site Optimization: determination of the most appropriate location for the project to minimize overall impact on the landscape.
B. Project Level Constraints Analysis: analysis used to determine appropriate lands for the Project.
C. Turbine Level Constraints Analysis: assessment within identified project lands to determine available lands for the placement of wind turbines.
D. Turbine Site Selection: final determination of optimal turbine locations based on the wind resource, engineering and turbine manufacturer requirements, and environmental and social considerations.

This section describes how multiple factors were considered in order to determine the project footprint for the Mulgrave Community Wind Project. These factors include technical (i.e. wind resource), financial, construction, socio-economic, landowner, biophysical constraints, as well as any community and stakeholder feedback.

This exercise was completed considering three turbines (one utility scale 2.3 MW machine, and two small 50 kW machines). As discussed, the two small machines have not yet been confirmed and do **not** form a portion of this environmental assessment registration document. However, work was completed across the Project Area considering three turbine locations through 2013. The Project Area and turbine locations were chosen for the following reasons:

1. **Appropriate wind regime** to make the Project economically viable.
2. Presence of **freehold lands** for placement of turbines.
3. **Detailed biophysical and technical assessment** of the Project Area allowed for identification of potential lands for the placement of this community wind farm.
4. **Existence of network of current road infrastructure** to reduce overall habitat fragmentation and reduce overall project costs.
5. **Relatively level topography and land characteristics** to allow placement of turbines as close together as practical to minimize project footprint.
6. Ability to place turbines to **meet regulatory setbacks for sound** from receptors.
7. Ability to place turbines to **meet municipal and/or Town setbacks from property lines and residences**.
8. **Proximity to the NSPI grid** to connect the Project without a significant length of interconnection.
9. **No unique or isolated habitat types** identified within the Project area, and,
10. Suitable available land area to allow for **adequate setbacks between turbines**. Turbines can only be placed a certain distance from each other to limit the wind turbulence they create which can interfere with adjacent turbines. This interference makes each turbine less productive.

Once this more general process of site optimization was completed and a Project Area confirmed, more detailed and site specific process of constraints analysis was completed as a major component of project planning and final turbine micro-siting.

A constraint can be specified as something to *maintain* or something to *avoid*. Many constraints can be expressed either way, such as to maintain a certain separation between known classes of objects. The desired effect of constraints analysis is to reduce the number of possible non-compliant results of Project development, while at the same time increasing the proportion of acceptable ones. A constraint can be *independent* or *contextual*. Independent constraints consider only one object, e.g., the setback distance around a known species at risk. Contextual constraints consider relations between objects, e.g. Use of a habitat area by a species at risk, resulting in expansion of the constraint.

Site specific constraints that were used for the Mulgrave Community Wind Power Project are as follows:

- Wind regime mapping was used to identify optimal wind resource areas within the land base. This allows for effective placement of the turbines to maximize power generation from the wind resource for the Project based upon expected energy outputs within the modeled wind regimes. The mapping was completed using meteorological tower data which has been collected continuously for approximately 1.5 years;
- Once wind resource mapping and optimization of the wind resource models were completed, different wind turbine manufacturers were selected for modeling. As each manufacturer has different engineering inputs, designs, and outputs, each manufacturer had to be modeled independently. Each turbine type was then placed within the wind regime and mapped within the available lands according to specific engineering criteria for power production, yield, energy loss;
- Geographic Information System (GIS) mapping of the Project lands was completed using datasets for landform, land use, topography, watercourses, historical resources, and wildlife. In addition, aerial photography was used to complement the GIS datasets, with the final goal of building a robust, dynamic, and temporally valid constraints map that can be modified as turbine selection is finalized;
- Within the GIS datasets the following parameters were mapped:

    1. Project area;
    2. Topography;
    3. Land Use;
    4. Existing infrastructure;
    5. Broadcasting (T.V. & Radio);
    6. Meteorological Towers;
    7. Residences;
    8. Existing roads (classified & unclassified) and including ATV trails;
    9. Existing distribution lines;
    10. Known wildlife sites;
    11. Known species at risk locations;
    12. Known heritage sites;
    13. Lakes, ponds or other visible open water bodies;
    14. Watercourses;
    15. Wetlands; and
    16. Property boundaries (PIDs);

- Once mapping of the above parameters was complete, setbacks were placed on the datasets for planning purposes:

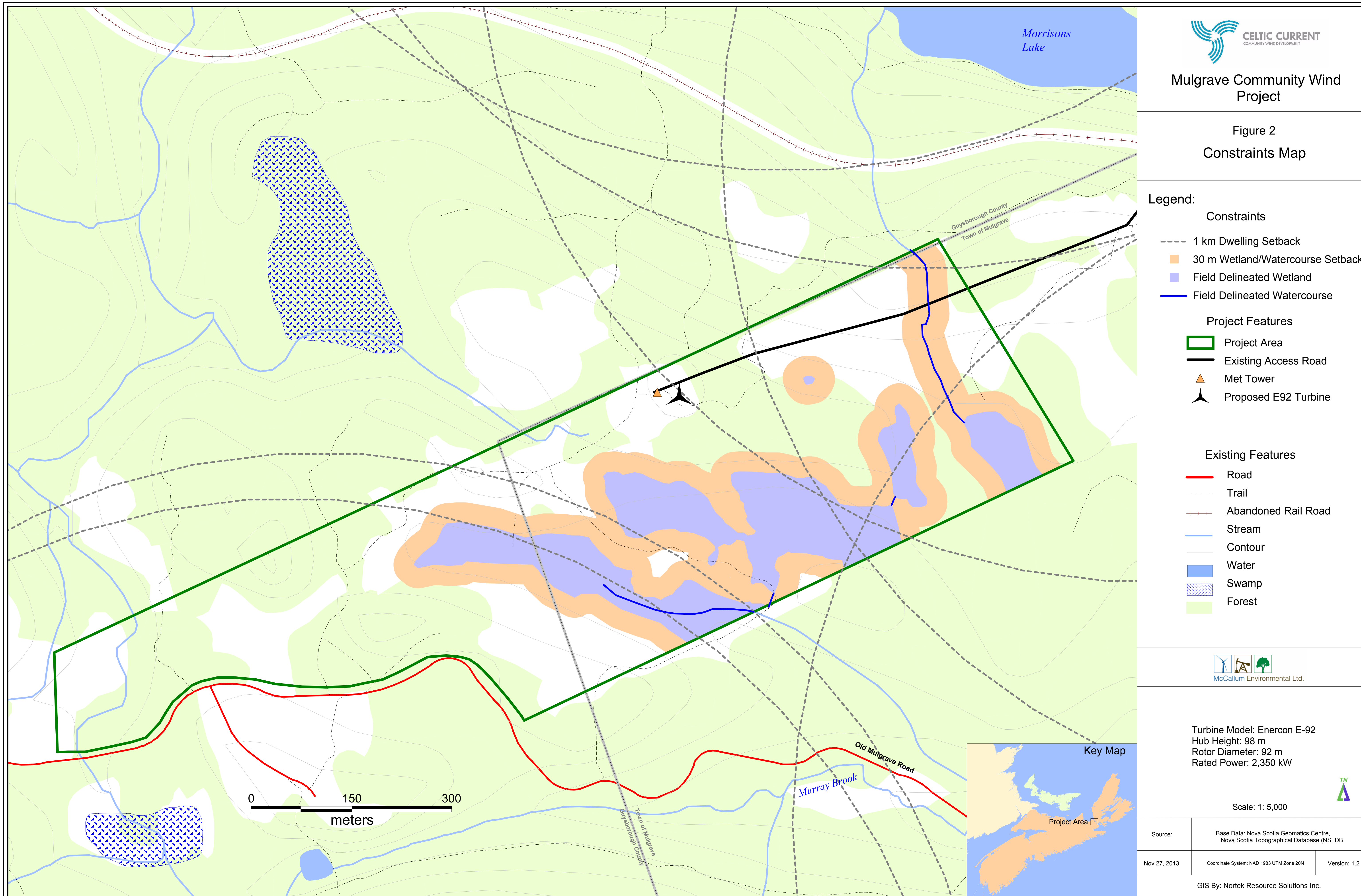
    - A minimum thirty (30) metre setbacks from lakes, ponds, open water, watercourses, and wetlands were imposed;
    - Celtic Current has been able to meet a one thousand (1000) metre setback from the proposed turbine.

- No turbines will be sighted on the Municipality of Guysborough western side of the Project Area. Therefore, only Town of Mulgrave setbacks for development were considered;
- Setbacks between turbines. As a general rule, due to wake loss and turbulence from blades while they are in operation, a minimum five (5) times rotor diameter (100 metres) (= 5 x 100 metres = 500 metre) setback distance is required in the prevailing wind direction between turbines, and minimum three (3) times rotor diameter (300m) setback distance is required perpendicular to the prevailing wind direction between turbines. As a starting point for planning purposes, this setback was placed between turbines.

- Once known site specific setbacks were incorporated, the Project lands GIS map was created to show available lands for Project development after setbacks were imposed (Figure 2)**;**
- The wind analysis was completed, resulting in the turbine locations being placed onto this setback map;
- GPS coordinates were then used to field verify the turbine locations. Further constraints analysis was completed during field assessments;
- Using the above noted information, Balance of Plant (BOP) was created (BOP includes all remaining infrastructure requirements such as the access road and distribution lines using the same datasets and field data to ensure regulatory setbacks are maintained for all phases of the Project;
- Constraints analysis using GIS based systems, and subsequent field verification methodologies allowed development of the layout and BOP in an environmentally sustainable and regulatory compliant manner.

Figure 2 shows the constraints identified for the Mulgrave Community Wind Project. Celtic Current understands the importance of minimization of the project footprint in order to protect habitat and reduce overall fragmentation of the landscape for wildlife, at risk species, and general ecosystem health.

The proposed 50 kW turbine manufacturer has gone out of business. As a result, the small machines have been left out of the final turbine layout. As mentioned previously in this document, they may be re-introduced within the Town of Mulgrave eastern side of the Project Area at a later date (subject to wind regime and confirmation of a turbine manufacturer and regulatory approval – through a change in scope as indicated by Steve Sanford NSE).


CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT
Mulgrave Community Wind Project
Figure 2
Constraints Map
Legend:
Constraints
1 km Dwelling Setback
30 m Wetland/Watercourse Setback
Field Delineated Wetland
Field Delineated Watercourse
Project Features
Project Area
Existing Access Road
Met Tower
Proposed E92 Turbine
Existing Features
Road
Trail
Abandoned Rail Road
Stream
Contour
Water
Swamp
Forest
McCallum Environmental Ltd.
Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW
TN
Scale: 1: 5,000
Source:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB
Nov 27, 2013
Coordinate System: NAD 1983 UTM Zone 20N
Version: 1.2
GIS By: Nortek Resource Solutions Inc.
Morrisons Lake
Guysborough County
Town of Mulgrave
Old Mulgrave Road
Murray Brook
Key Map
Project Area
0
150
300
meters

4. ENVIRONMENTAL ASSESSMENT METHODOLOGIES

The EA registration document for the Mulgrave Community Wind Project will first describe the biophysical, social, and economic environment, as well as outline other considerations considered important for wind power projects. All Valued Ecosystem Components (VECs) will then be identified, and the potential for interaction between individual VECs and Project activities will be determined. Methods to minimize and mitigate environmental effects resulting from the Project will be provided.

Through an evaluation of the VECs, the project team identified project environmental effects that, post-mitigation, have the potential for a residual effect on the environment. The significance of these residual effects was then determined and evaluated (Section 10.2).

This chapter details the following key aspects of the environmental assessment methodologies:

A. Biophysical: birds and bats, species at risk, wildlife, vegetation, watercourse identification, aquatic habitats, and wetland assessment and delineation.
B. Electro-magnetic interference assessment
C. Archaeological Resource Assessment;
D. Sound Assessment; and,
E. Visual Influence Assessment.

4.1 Biophysical Assessments

The field components of the biophysical environmental assessment were initiated in Spring 2012 and carried through until Fall 2013 complying with the *Category 4* requirements listed in Section 3.1. These studies were aimed at highlighting the ecological linkages within the Project area, as well as with the habitats surrounding the Project area. This work included:

1. Spring and Fall bird migration surveys 2012; Breeding bird surveys (Summer 2012); follow up Spring bird migration surveys 2013; and adverse weather surveys for birds (May to October 2013);
2. Vegetation surveys for priority species across the Project Area (August 2013);
3. Bat monitoring using an ANABAT detector (August to September 2013);
4. Opportunistic herpetofauna and mammal survey for priority species across the Project Area (May to September 2012 and 2013);
5. Transects for Mainland Moose observations across the Project Area Spring 2012 and Winter 2013); and,
6. Wetland and watercourse identification and surveys across the Project Area.

4.1.1 Wildlife Species and Habitats

Assessment of wildlife, including vegetation, and habitat was completed based on the requirements outlined in the Nova Scotia Environment (NSE) *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE September 2008). Development of a priority list of species for each taxonomic group was completed based on a compilation of listed species from the following sources:

1) Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Federal Species-at Risk Act (SARA 2003). All species listed as Endangered, Threatened, or of Special Concern.
2) Nova Scotia Endangered Species Act (NSESA 1999). All species listed as Endangered, Threatened, or Vulnerable.
3) Nova Scotia General Status of Wild Species: All species designated as Species of Conservation Interest (Red or Yellow).

This priority list of species was narrowed by broad geographic area (for the Mulgrave Community Wind Project- the geographic area considered was mainland Nova Scotia: North). The priority list of species was then further narrowed by identifying specific habitat requirements for each species. For example, if a listed NSESA species required open water lake habitat, and no open water lake habitat is present inside the Project footprint, this species was not carried forward to the final list of priority species for field assessments.

The final priority list of species used for field assessments is attached in Appendix II.

Field surveys were completed in Summer 2013 to assess for all identified priority species across the Project Area. For this survey, a list of all rare species records found within 100 km of the Project area was also assembled prior to the survey being undertaken (from Atlantic Canada Conservation Data Centre- ACCDC data results) to provide additional information regarding the potential presence of priority species within the Project area.

General vegetation and habitat observations were also noted at each turbine and access road location across the Project lands.

4.1.2 Avian Monitoring

Bird surveys were completed from Spring 2012 to Winter 2013 by a local bird expert, Mr. David Johnston. Avian surveys were conducted in accordance with methodologies outlined in *Wind Turbines and Birds: A guidance Document for Environmental Assessment* (Environment Canada/Canadian Wildlife Service, 2006) and the protocols recommended by CWS (2007).

Initial regulatory consultation with Nova Scotia Environment and Nova Scotia Department of Natural Resources Wildlife Division was completed in April 2013 when McCallum Environmental Ltd. (MEL) was retained to complete the environmental assessment on behalf of Celtic Current. As a result of this consultation process, additional spring migration field surveys were completed in early Spring 2013, along with adverse weather surveys for birds from Spring to Fall 2013. An avian use report was prepared by MEL in Spring 2013 outlining the methodologies and results of the first year of baseline work. This report was submitted to NSE and NSDNR for review in June 2013. This report is included as Appendix III.

Additional Spring migration surveys were completed in early Spring 2013 (mid-April through mid-May) following the same methodologies as outlined in the MEL report (June 2013). In addition, monthly adverse weather surveys (2/month) were completed by local expert Mr. David Johnston in an attempt to understand how birds respond to fog and rain within the Project Area. These adverse weather surveys each consisted of a two hour watch count at the proposed turbine location.

4.1.3 Bat Monitoring

Monitoring for bats occurred on the Project Area in 2013 as part of the baseline assessments. The methodologies used were as follows:

McCallum Environmental Ltd. used an Anabat bat detectors in August and September 2013 (Titley electronics, Ballina, NSW, Australia) to passively record the echolocation calls of bats at the MET tower location.

Table 5. Anabat Monitoring Location, Fall 2013

Anabat #	Anabat Location	Coordinate NAD83 UTM Zone 20T	Date Deployed	Date Removed	Notes
Anabat 1	MET tower	622021.46 m E 5053091.40 m N	August 26, 2013	September 22, 2013	Hoisted on 3 m pole on western section of the cleared area for the MET tower

Anabat 1: located near the western end of the clearing for the MET tower hoisted on a 3 m pole near the forest edge. No significant water was identified near this location.

The Anabat detector was deployed to cover the Project Area in order to gain a general understanding of bat species present in the area. The location was identified to reflect where the 2.3 MW turbine will be placed. The location was also chosen at the edge of forested habitat.

The detecting distance of the Anabat is affected by a number of factors, the most important one being the species of bat. Bats with high frequency, quiet or directional calls (such as horseshoes or long eared bats) may only be detected at distances of typically less than 5 metres. Bats with low frequency and loud calls such as Noctules and Serotines may be detected as far away as

100m or more. The detection range is therefore dependent on the sound characteristics of the call rather than the detector, although the most receptive zone of the Anabat is within a 90 degree cone in front of the microphone.

The raw acoustic files collected by MEL were then analysed by Boreal Environmental Ltd. (Mr. Derrick Mitchell). The objectives of this Project were:

(1) To provide information on occurrence and relative magnitude of activity level in the proposed development area, based on analysis of acoustic data;
(2) To provide relevant information on resource requirements of local species that might be useful for informing the decision-making process on the proposed development; and,
(3) To make any relevant recommendations based on the results of this Project and any recent developments in the field.

Identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton and 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 bat and little brown bat), there was no attempt to identify sequences to the species level, as their calls are too similar to be reliably separated. Identifications were accomplished using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). An Anabat echolocation file approximates a call sequence, defined as a continuous series of greater than two calls (Johnson et al., 2004), and this was used as the unit of activity

4.1.4 Wetlands & Aquatic Surveys

A desktop review of available topographic maps, appropriate provincial databases and aerial photography was completed to aid in determination of wetland habitat and watercourses on the Project Site. Predicted wetland areas were identified from the NSDNR Sensitive and Significant Habitats Database. Stereo pairs of air photos were also consulted as a predictor of where wetlands may exist within the landscape. Topography maps were reviewed (1:50,000, 1:30,000, and 1:10,000) to identify all mapped watercourses.

During field surveys conducted between June 1 and August 31st, 2013, each proposed turbine and access road location was assessed in the field for the presence of wetland habitat and compared against the predicted wetland areas from the desktop review. All watercourses observed across the Project Area were field assessed for general characteristics, fish habitat and navigability.

Although no NSDNR mapped wetlands and few shallow water table areas appeared to exist within the Project Area based on the desktop review, several wetlands were identified during field surveys. All wetlands were delineated within the Project Area.

Delineation was completed based on micro-topography, and observed surface hydrology and vegetation and soils in accordance with Nova Scotia Environment wetland delineation methodology. Wetlands were delineated by approved wetland delineators. Wetland boundaries were documented using an SXBlue GPS unit and hand held field computer capable of sub 1m accuracy. Any inlet and outlet streams or features to each wetland were marked during the delineation processes and walked and mapped as necessary where stream crossings may be required for access.

All identified watercourses within the Project Area were assessed. Each watercourse was walked and stream habitat was assessed, morphological channel measurements were taken, and pool habitats were visually observed for presence of fish.

The locations of delineated wetland habitats and identified watercourse features were mapped as shown in various Project Figures throughout the EA document and were then considered as biological constraints to the layout and development of the proposed Project.

4.1.5 Herptofauna and Mammal Surveys

Herptofaunal searches of rock outcrops, deadfall, wetland, and stream habitats were conducted and incidental observations were recorded during completion of other field surveys. No targeted mammal surveys were undertaken, other than surveys associated with the Mainland Moose, described in the following section. Incidental observations of mammals and various mammal signs across the Project area were documented and photographed during field surveys. Signs included such features as dens and nests, scat, tracks, and forage evidence. Herptofaunal and mammal observations were collected between April and October 2012 and throughout the field season in 2013.

4.1.6 Mainland Moose Assessment

Celtic Current completed field assessment for the Mainland Moose including the following monitoring efforts:

- One moose pellet group inventory (Spring 2012)
- One snow tracking survey (Winter 2013)

A total of eight transects were completed by foot in May 2012 by Mr. Jody Hamper to assess for the presence of pellet piles across the project area. Each transect was 1100-1200 m long and Mr. Hamper recorded all information regarding moose and deer presence along each transect.

A single snow tracking survey was also completed in March 2013 by foot by Ms. Melanie MacDonald to look for sightings of moose and deer, as well as for observable tracks, pellets, and carcass/antlers of the Mainland Moose. Ms. MacDonald walked the Old Mulgrave Road along the western edge of the Project Area the day after a 10cm+ snowfall.

UTM coordinates were recorded using GPS wherever moose and deer track-ways crossed survey transects, or occurred within or adjacent to survey trails. Any unusual sightings (i.e. a moose or deer carcass, bear den, etc.) were photographed with a digital camera and UTM coordinates recorded.

4.2 Archaeological Resource Assessment

Davis MacIntyre and Associates Limited completed an archaeological resource impact assessment for the Mulgrave Community Wind Power Project in March 2013. This assessment consisted of two components:

i. Phase I archaeological resource impact assessment
ii. Field reconnaissance Phase II archaeological resource impact assessment

The methodologies of these two components are described below.

4.2.1 Phase I

The assessment included consultation of historic maps, manuscripts, and previous archaeological assessments as well as the Maritime Archaeological Resource Inventory in order to determine the potential for archaeological resources in the study area.

As part of this assessment, a historic background study was also conducted. Historical maps and manuscripts and published literature were consulted at Nova Scotia Archives and Records Management in Halifax. The Maritime Archaeological Resource Inventory, held at the Nova Scotia Museum’s Heritage Division, was searched to understand prior archaeological research and known archaeological resources neighboring the study area.

4.2.2 Phase II

A field reconnaissance of the proposed impact areas (access road and three turbine candidate sites) was directed by Stephen Davis on May 7, 2013.

GPS tracklogs of all reconnaissance areas were retained for records, and any sites determined to have potential for archaeological resources were recorded with photographs and GPS coordinates. The terrain and vegetation at each of the candidate sites was noted in the interest of recording negative evidence for historic cultural activity.

4.3 Sound Impact Assessment

The objectives of the Sound Impact Assessment (SIA) are to:

1. Confirm the sound level limit requirements for the Project;
2. Predict the noise levels generated by the Project and adjacent existing projects at all Points of Reception within 1.5 km of the turbines.
3. Compare the predicted sound level from the Project with the sound level limit.

The SIA also provides information on the noise sources, the prediction method and the parameters used for the assessment.

8 receptor locations (i.e. Points of Reception) for the Project were validated within 1.5 km of one or more of the Mulgrave Community wind turbines and were considered in the analysis.

The predicted overall (cumulative) sound pressure levels at each critical noise receptor for the aggregate of all wind turbines associated with the Project were calculated based on the ISO 9613 method, using the Wind Pro Version 2.9 software.

4.4 Visual Influence

The degree of visibility of the wind turbines depends on their number, their relative distance, and on the span of their layout. The visibility of a project is evaluated with two tools.

The first tool is the zones of visual influence (ZVI) cartography. It illustrates the degree of visibility across the overall study area by taking into account the locations of the wind turbines and the topography of the study area. Vegetation cover and existing structures are not considered.

The second tool is the photomontages. Photomontages are produced by the superimposition of a technical drawing that shows wind turbines on the photograph of a landscape. Photomontages allow the appreciation of the degree of perception from specific viewpoints that are selected for their representativeness or for their sensitivity (inhabited areas, road of moderate to high traffic, trails and/or tourist attractions). Photomontages underline the importance of land components such as topography, vegetation cover and existing structures which all influence the degree of visibility of the wind turbines.

4.5 Electro-magnetic Interference (EMI) Assessment

A system inventory was compiled for potential receptors surrounding the Mulgrave Community Wind Project area.

This system inventory is consistent with the requirements of the documents: *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems, Radio Advisory Board of Canada and Canadian Wind Energy Association, 2010* (RABC/CanWEA, 2010) and *the Guidelines for a Technical Engineering Report on the Impacts of Wind Turbines on CBC/Radio-Canada Services, Canadian Broadcasting Corporation - Société Radio-Canada Services, June 2008* (CBC, 2008).

5.0 BIOPHYSICAL ENVIRONMENT

5.1 General Spatial Setting for Project

The proposed Project is located in the Nova Scotia Uplands Ecoregion and the Mulgrave Plateau Ecodistrict, as defined by the Nova Scotia Department of Natural Resources (Neily, Quigley, Benjamin and Stewart, 2003).

The Nova Scotia Uplands Ecoregion stretches from Cape Chignecto in Cumberland County to Kellys Mountain in Cape Breton. There are eight ecodistricts within this ecoregion, with average elevations of 150 to 300 m on both the mainland and Cape Breton Island.

The ecoregion is geologically diverse and complex with remnants of the Cretaceous peneplain surface, composed of metamorphic, intrusive and volcanic rocks of the Precambrian to Paleozoic eras. The lowlands within this ecoregion are underlain by Paleozoic sedimentary rocks. Several major faults border or transect this ecoregion, most notably the Cobequid-Chedabucto Fault zone and the Hollow Fault. The total area of the ecoregion is 9,862 km_2 or approximately 17.8% of the province (Neily et al., 2003).

5.1.1 Natural Subregion

The Nova Scotia Uplands Ecoregion is further subdivided into eight Ecodistricts. The Mulgrave Community Wind Power Project exists in the Mulgrave Plateau Ecodistrict.

This ecodistrict has been described by Roland (1982). The part of the Mulgrave Plateau north of the fault-controlled Roman Valley is underlain by strongly folded sedimentary rocks of the Horton Group. The area between Roman Valley and the Chedabucto Fault is underlain by the Guysborough Group, consisting of sedimentary and volcanic rocks. Both plateau portions are comprised of extensive areas of imperfectly drained level to hummocky topography. The steep slopes of these elevated plateaus, approximately 200m above sea level, are well drained and support a mixture of tolerant hardwoods and softwoods (Neily et al., 2003).

The total area of the Mulgrave Plateau ecodistrict is 896 km_2 or 9% of the ecoregion. The Roman Valley River flows towards Chedabucto Bay via the Milford Haven River which, along with Guysborough Harbour, is an example of a drowned estuary (the mouth of a river submerged due to a rise in sea level).

The eastern portion of the ecodistrict is appreciably wetter than the western portion and is drained by the St. Francis Harbour River which flows out of Goose Harbour Lake which has been dammed for use as an industrial water supply in Port Hawkesbury. Two other lakes, Grant and Summers Lake, have also been dammed for water supply for Mulgrave, while another reservoir has been created at Melford Lake for future industrial use. However, only 3.3 % of the ecodistrict is covered in fresh water (2,955 hectares). Low relief drumlins dot the eastern portion of the ecodistrict around Goose Harbour Lake.

The soils of the ecodistrict are mostly well drained, gravelly sandy loams except for the eastern portion which is imperfectly drained. Clay loams on the drumlinized till plain are also imperfectly drained.

The ecodistrict is bordered by the waters of the Northumberland Strait and the Strait of Canso with both areas prone to strong coastal winds. The forests on the well-drained, coarse textured hills that border this water are similar to the coastal forests of the Atlantic Coastal Ecoregion. An association of red maple and yellow birch dominate the drumlins with scattered sugar maple on the lower slopes. Red spruce and hemlock are more prevalent in the sheltered ravines and along streams and steep slopes of the ecosections. The forest is mostly black spruce and red maple on the wetter soils, with tolerant hardwoods, red spruce and white pine on the better drained soils found on the hills and steeper hummocks. Balsam fir usually regenerates on the better drained land and much of the area is used for Christmas tree production.

5.1.2 Land Use

The following table displays the land use components and area (in hectares) of each component within the Project area:

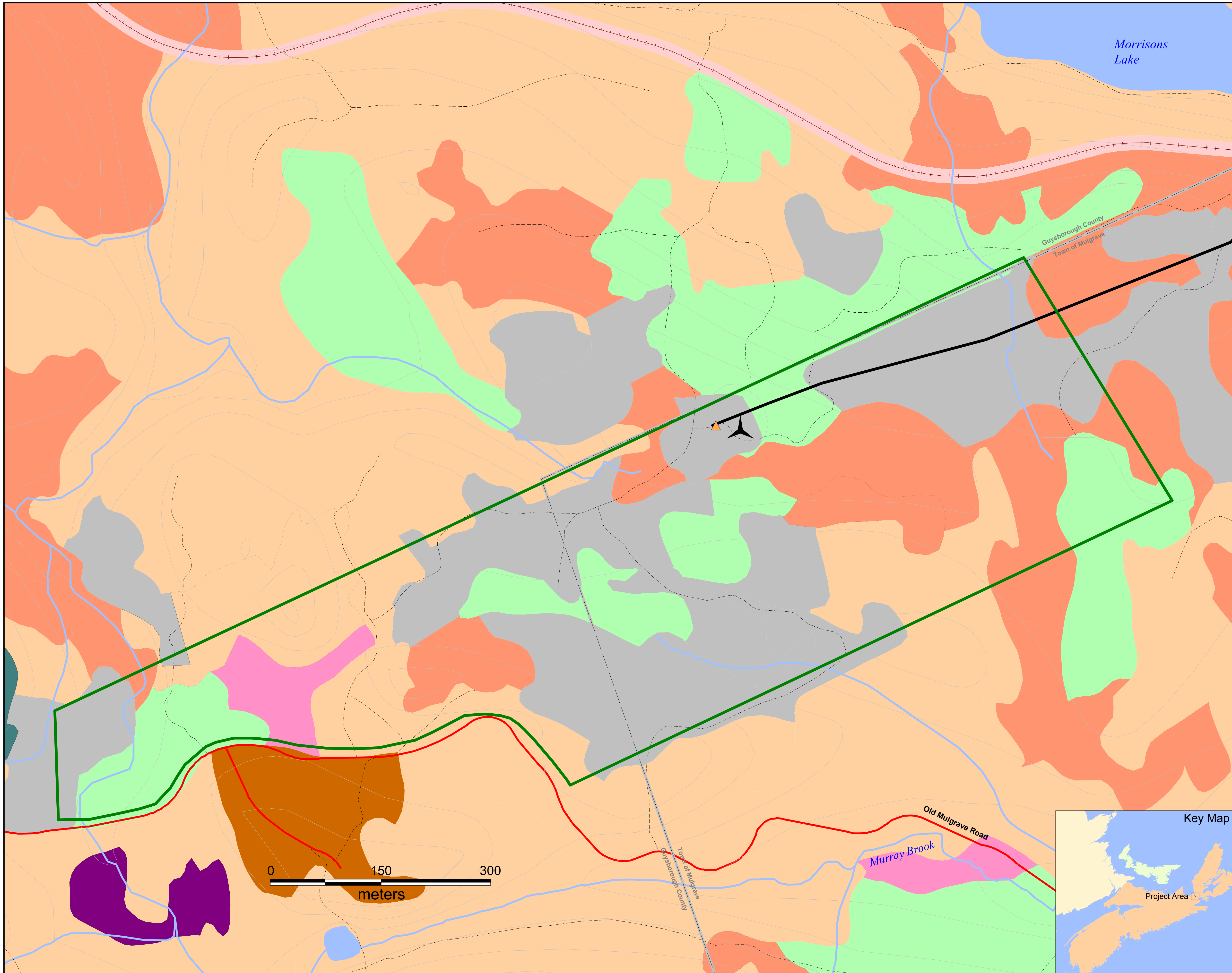
Table 6. Calculations of Land Use

Land Use/Land Type	Area (hectares)	% of Project Area*
Treed Bog	1.5	3.2%
Tower Pad	1.0	2.2%
Productive Forest	22.3	48.1%
Recent Harvests	18.8	40.5%
Partial Cuts- forested	1.1	2.4%
Forest- Silviculture	1.7	3.7%
TOTAL	46.4	100%

Land use within the Project area is dominated by an even mixture of undisturbed forest and recently harvested lands. The total area of forests (including recently harvested) accounts for 89% of the Project Area land base.

There is very limited access into the Project Area and only very few trails are present. There are several wetlands and watercourses across the southern portion of the Project area that are not accounted for in these calculations (based on interpreted land use – aerial photography).

Figure 3 shows land use within and adjacent to the Project Area.



CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT

Mulgrave Community Wind Project

Figure 3

Land Use (Habitat Type)

Legend:

Habitat Type
- Softwood Forest
- Mixedwood Forest
- Hardwood Forest
- Recent Harvest
- Treed Bog
- Wetlands
- Alders
- Railway ROW
- Gravel Pit

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB)	
Nov 25, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.

5.2 Atmospheric Environment

5.2.1 Weather and Climate

The average low temperature (based on statistics from the past 30 years) was recorded at -9.9 degrees Celcius in January and the average high temperature was recorded at 25.5 degrees Celcius in July (recorded in Port Hawkesbury Nova Scotia), across the Strait of Canso from the Project Area (The Weather Network, 2013). Average annual rainfall is 1100 mm with maximum rainfall levels in November of each year (average 142mm in November). Average annual snowfall has been measured at 218 cm with the maximum snowfall occurring each year in January (53cm).

According to the NS Wind Atlas (NSDE 2007), average wind speeds at 30 m above the ground at the Project site range from 6.01-6.5 m/s. At 50 m, the average wind speeds range from 6.5-7.0 m/s to and from 7.51-8 m/s at 80 m above the ground.

5.2.2 Air Quality

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

Nova Scotia monitors air quality at six stations throughout the province. Measured parameters include ground-level ozone (O3), particulate matter (PM2.5), and nitrogen dioxide (NO2), and these values are used to calculate a score on the Air Quality Health Index (AQHI) (EC 2011). The AQHI is a scale from 1-10+, in which scores represent the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+). The AQHI monitoring station closest to the Project site is located at Port Hawkesbury, Cape Breton, located just across the Strait of Canso. The AQHI at this site is usually low at all times of the year (EC 2011b).

5.3 Geophysical Environment

5.3.1 Physiography and Topography

On the hummocky terrain of the Mulgrave Plateau, St. Mary's River and Central Uplands, red spruce, balsam fir, white pine and hemlock are common on the well-drained soils. Occasionally these tolerant softwoods mix with the tolerant hardwoods to create diverse mixed wood forests (Neily et al., 2003). Plateau portions are comprised of extensive areas of imperfectly drained level to hummocky topography. The steep slopes of these elevated plateaus, approximately 200m above sea level, are well drained and support a mixture of tolerant hardwoods and softwoods.

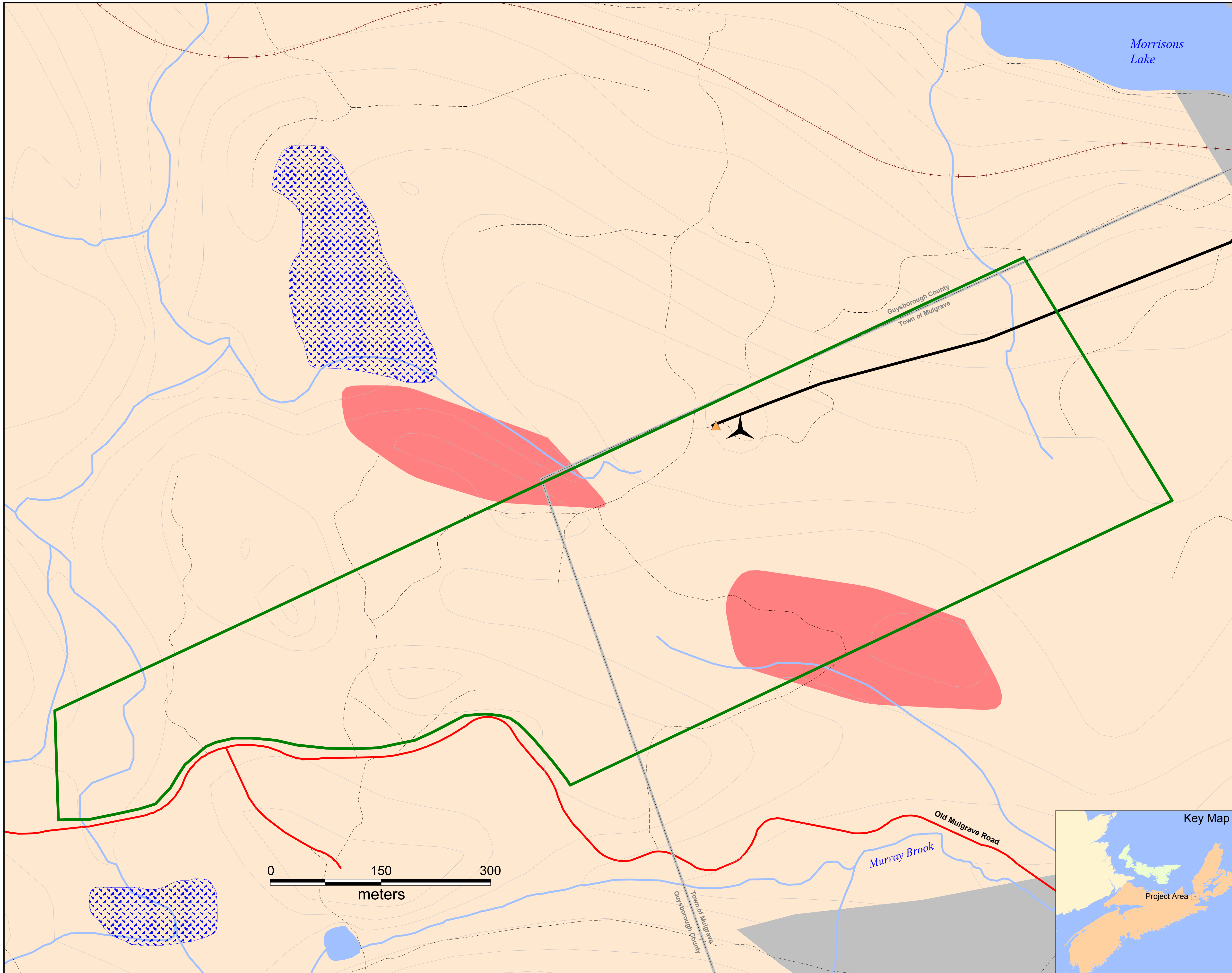
5.3.2 Surficial Geology

Surficial soils within the Project Area are dominated by fluvial deposits consisting of gravel, gravelly sand, silt, minor clay and organic material, forming river point bars, channel and bank deposits, fine grained deposits in floodplains (sands/silt/clay: 2-15m thick). Two drumlins are present within the Project Area defined as Sugar Camp Till with Drumlin Facies. These soils consist of reddish brown, matrix-supported, silty till; moderately compact, massive, polymictic with sedimentary and igneous rock types, ground moraine and drumlins (3-10m thick).

5.3.3 Bedrock Geology

The Project Area is located on a bedrock divide between two formations of the Horton Group. The eastern portion of the Project Area contains bedrock of the Halfmoon Member (CHtrh) consisting of grey sandstone, quartz rich and in part arkosic with polymictic channel lags and interbeds of dark grey siltstone. The western half of the Project Area contains bedrock of the Linconville Member (CHtrl) consisting of siltstone, grey and dark grey, in part highly calcareous, with interbedded quartz rich sandstone.

Surfical geology and bedrock geology within the Project Area are shown on the following two figures (Figure 4 and Figure 5).



CELTIC CURRENT

Mulgrave Community Wind Project

Figure 4

Surficial Geology

Legend:

Surficial Geology

- Bedrock
- Creignish Hills Till
- Fluvial Deposits
- Sugar Camp Till: Drumnlin Facies

Project Features

- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features

- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water
- Swamp

McCallum Environmental Ltd.

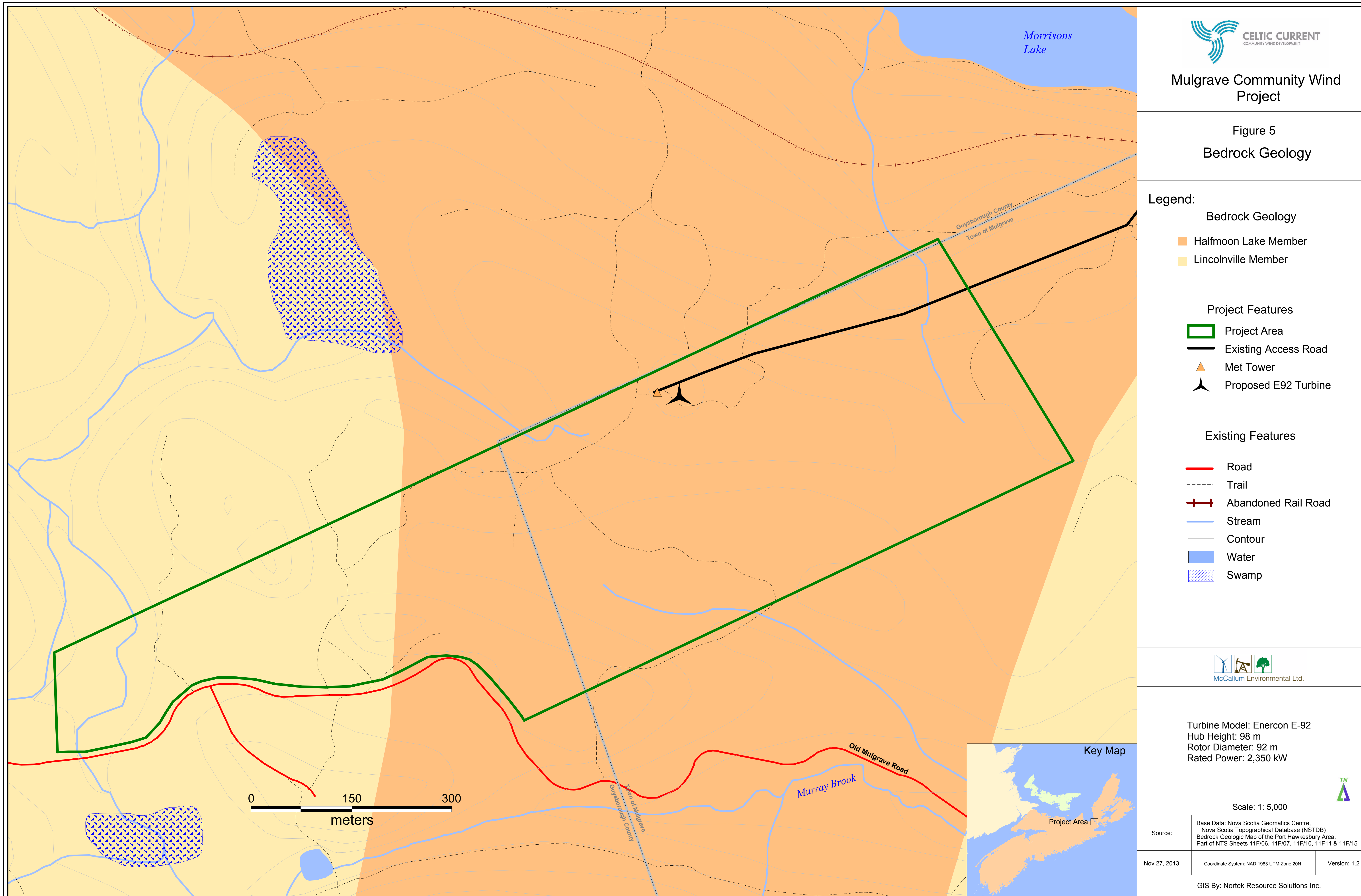
Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB Surficial Geology Map of the Port Hawkesbury Area (NTS 11F/11))	
Nov 27, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.


Morrisons Lake
Guysborough County
Town of Mulgrave
Old Mulgrave Road
Murray Brook
0
150
300
meters
Key Map
Project Area
CELTIC CURRENT
Mulgrave Community Wind Project
Figure 5
Bedrock Geology
Legend:
Bedrock Geology
Halfmoon Lake Member
Lincolnville Member
Project Features
Project Area
Existing Access Road
Met Tower
Proposed E92 Turbine
Existing Features
Road
Trail
Abandoned Rail Road
Stream
Contour
Water
Swamp
McCallum Environmental Ltd.
Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW
TN
Scale: 1: 5,000
Source:
Base Data: Nova Scotia Geomatics Centre,
Nova Scotia Topographical Database (NSTDB)
Bedrock Geologic Map of the Port Hawkesbury Area,
Part of NTS Sheets 11F/06, 11F/07, 11F/10, 11F11 & 11F/15
Nov 27, 2013
Coordinate System: NAD 1983 UTM Zone 20N
Version: 1.2
GIS By: Nortek Resource Solutions Inc.

5.3.4 Hydrogeology and Groundwater

Water supplies for individual homes near the Project Area are either provided by surface water supply (Grant's Lake and the Town of Mulgrave Public Water Supply) or through individual drilled or dug on-site potable wells.

Details associated with individual drilled or dug wells within a 4 km radius of the Project Area were identified through a review of the NS well logs database (NSDNR-http://www.gov.ns.ca/nse/groundwater/welldatabase.asp). This database provides information on more than 100,000 water wells in the province, including information on well locations, geology and well construction, well depth and yield. A search of this database was completed for the Project Area in Guysborough County. A total of 12 well logs were available for review. General conclusions relating to the groundwater resource in the Project area were derived from this information.

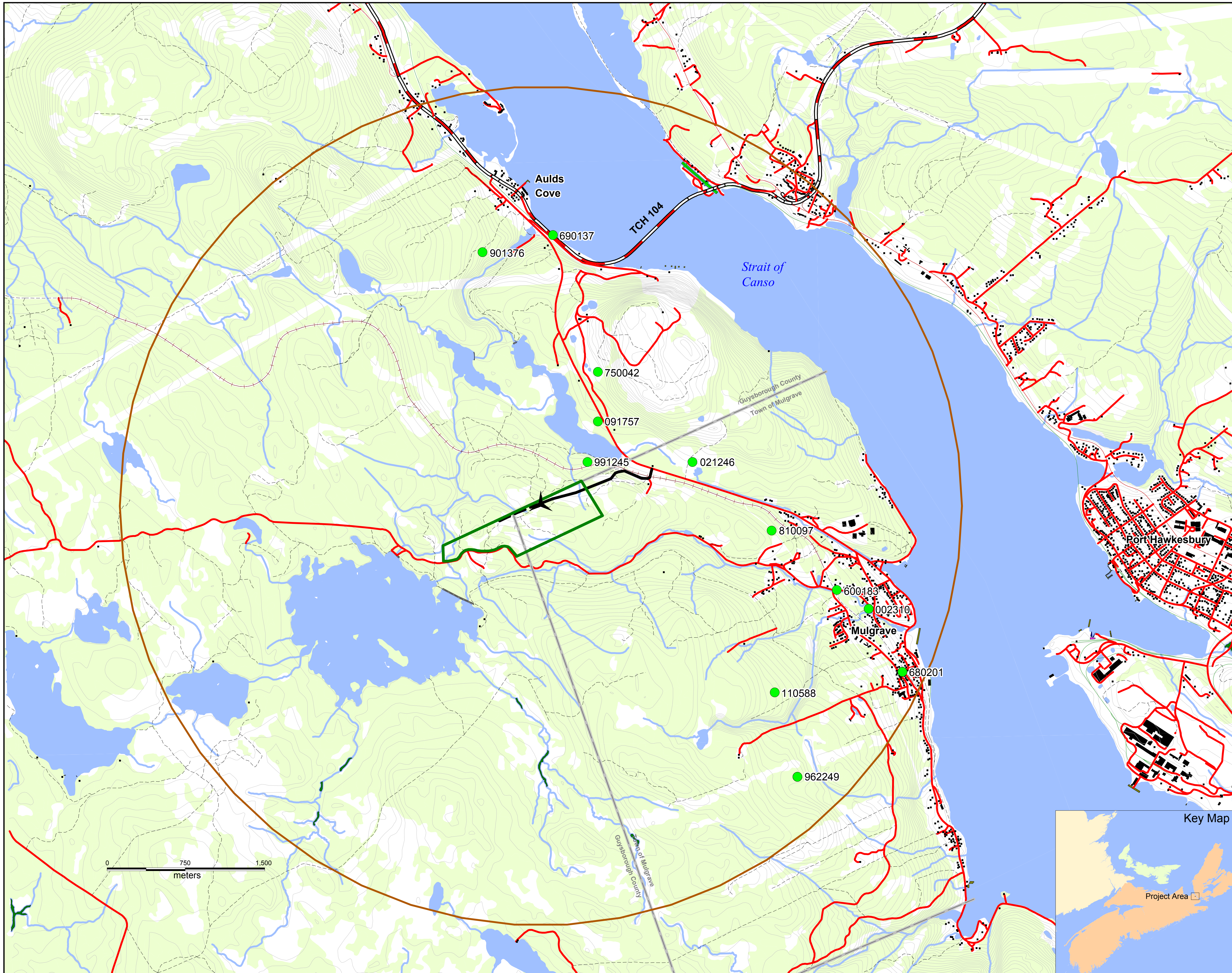
The geology of the Project area was described from the drilling processes as consisting of a clay till with boulders overlying shale and granite bedrock. The average depth to bedrock based on drilling data was generally 15-20 feet. Wells appeared to be drilled to an average depth of 140 feet below grade, and were constructed as 6 inch wells with standard 50-60 feet depths of casing. Information provided on depth of water bearing fractures during drilling activities indicated that the average depth to the shallowest water bearing fractures was approximately 50 feet below grade. Static water levels were not always recorded in the well logs, but information that was provided indicated an average static depth to water of 15-20 feet. A general review of water yields for these wells indicated an average yield of approximately 8 imperial gallons per minute (igpm).

Groundwater resources within the Project area are not used to supply residential potable water as there are no residential dwellings within the Project Area. According to the information available in the Well Logs Database, the nearest (drilled) groundwater well used for potable purposes is located just south of Morrison Lake. The Project Team field verified that there is no residential dwelling located at this location and have therefore concluded that the coordinates provided in the Well Log Database are not correct. The closest verified well location is just over 1000m away from the turbine location (well #091757). Please note however that the location of wells in the well log database does not provide exact geographic coordinates. Older references indicate a map number only. Newest references are accurate within 50 m. This well log database also only identifies drilled wells. Dug wells may be present in closer proximity to the turbine location.

Please refer to Figure 6 for the location of domestic potable wells surrounding the Project Area.

The Project area is located 1.2 km east of Grant's Lake which supplies potable water for the Town of Mulgrave, located just south of the Project Area. All surface water located with the Project Area drains southeast towards the Town of Mulgrave and the Strait.

There will be no interaction between the access road and turbine construction and surface water within the local catchment of Grant's Lake and therefore no impact from Project development on the Town of Mulgrave potable water supply.



CELTIC CURRENT

Mulgrave Community Wind Project

Figure 6
Potable Drilled Well Locations

Legend:

Ground Water Wells
- 4 km Buffer
- 87302 Well and ID

Project Features
- Project Area
- Existing Access Road
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Raod
- Stream
- Contour
- Water
- Building

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 35,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB) Nova Scotia Well Logs Database	
Nov 28, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.

5.4 Terrestrial Environment

5.4.1 Vegetation

During the field season in 2013, an assessment of vegetation was completed at each of the three candidate turbine site locations as well as across the Project Area. Each candidate site was classified for vegetation by forest cover and age class. Age classifications were based on natural breaks in the data. Forest stand age class (Overmature, Mature, Immature and Regenerating) was determined through qualitative observations of multiple factors. Dominant tree species were identified at each potential turbine site, as seral age is a useful determinant of stand age. Approximate forest stand age was determined based on a number of criteria, such as total basal area, level of canopy coverage, and species composition of the understory herb and shrub layers. Observations of size and abundance of coarse woody debris were noted. Finally, the level of anthropogenic disturbances was described; particularly the presence of logging roads and harvested trees (clear cut or selective harvest, and approximate time since harvest). All of these factors were used in combination to determine the forest stand age class at each potential turbine location.

As described in the *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document* (NSE, Sept 2008), a full vascular plant survey was not completed. The vascular plant surveys focused on identifying general vegetative communities, with particular focus on identifying priority species. The priority list of vegetation species prepared for this project is attached in Appendix II.

Results

Several major habitat types are present within the Project Area. Large tracts of the Project Area have been clear-cut, and are in early stages of regeneration. These areas generally lack tree cover, and are dominated by early colonizing species such as Red Maple and Balsam Fir, along with Speckled Alder, White Meadowsweet, and Red Raspberry. Coarse woody debris is relatively abundant within this habitat type.

Photo 9: Vegetation Typical Across Project Area

Mature softwood stands are dominated by White Spruce and Balsam Fir, with relatively sparse understory and ground cover vegetation.

Photo 10: Mature Softwood Stands

Immature deciduous stands are also present throughout the Project Area. These stands contain a mixture of early colonizers such as Red Maple and White Birch, along with Yellow Birch, Striped Maple and the occasional Sugar Maple. Ground cover within these immature deciduous stands is relatively sparse, but contains species such as Evergreen Wood Fern, Sarsparilla, Yellow Bluebead Lily, Whorled Aster and Bunchberry.

Photo 11: Immature Deciduous Stands

The Project Area contains several large wetland systems. These are predominantly tall shrub dominated and mixed-wood treed swamps, with the exception of one freshwater, Cattail dominated marsh. Vegetation within the wetlands is relatively diverse, with species such as Pussy Willow, Red Maple, Speckled Alder, Flat-topped White Aster, Spotted Jewelweed and Broad-leaved Cattail. The identified wetlands drain south and flow east towards the Old Mulgrave Road.

The proposed E92 turbine is located within a disturbed habitat type. An access road has been built to provide access to the existing MET tower, which coincides with the proposed turbine location. This area has been graded and cleared of vegetation and exists on the edge of a relatively large clearcut area.

A list of all species identified within the Project Area is provided in Table 7 below.

Table 7: Vegetation List Mulgrave Community Wind Project

Common Name	Latin Name
Balsam Fir	*Abies balsamea*
Striped Maple	*Acer pensylvanicum*
Red Maple	*Acer rubrum*

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Sugar Maple	*Acer saccharum*
Mountain Maple	*Acer spicatum*
Yellow Birch	*Betula alleghaniensis*
Paper Birch	*Betula papyrifera*
Paper Birch	*Betula papyrifera var. cordifolia*
White Ash	*Fraxinus americana*
White Spruce	*Picea glauca*
Eastern White Pine	*Pinus strobus*
Pussy Willow	*Salix discolor*
Speckled Alder	*Alnus incana*
Bartram's Serviceberry	*Amelanchier bartramiana*
Sheep Laurel	*Kalmia angustifolia*
Mountain Holly	*Nemopanthus mucronatus*
Pin Cherry	*Prunus pensylvanicum*
Chokecherry	*Prunus viriginana*
Shining Rose	*Rosa nitida*
Blackberry	*Rubus alleganiensis*
Red Raspberry	*Rubus ideaus*
Bebb's Willow	*Salix bebbiana*
Red Elderberry	*Sambucus racemosa*
American Mountain Ash	*Sorbus americana*
White Meadowsweet	*Spiraea alba*
Red Osier Dogwood	*Swida sericea*
Wild Raisin	*Viburnum nudum*
Sarsparilla	*Aralia nudicaulis*
Lady Fern	*Athrium filix-feminina*
Devil's Beggarticks	*Bidens frondosa*
Fringed Brome	*Bromus ciliatus*
Bluejoint Reed Grass	*Calamagrostis canadensis*
Drooping Woodland Sedge	*Carex arctata*
Brownish Sedge	*Carex brunnescens*
Nodding Sedge	*Carex gynandra*
Bristly-stalked Sedge	*Carex leptalea*
Sallow Sedge	*Carex lurida*
Cyperuslike Sedge	*Carex pseudocyperus*
Awl-fruited Sedge	*Carex stipata*
Three-seeded Sedge	*Carex trisperma*
White Turtlehead	*Chelone glabra*
Yellow Bluebead Lily	*Clontonia borealis*

Goldthread	*Coptis trifolia*
Bunchberry	*Cornus canadensis*
Pink Lady's Slipper	*Cypripedium acaule*
Flattened Oat Grass	*Danthonia compressa*
Poverty Oat Grass	*Danthonia spicata*
Hay-scented Fern	*Dennstaedtia punctilobula*
Flat-topped White Aster	*Doellingeria umbellata*
Spinulose Wood Fern	*Dryopteris carthusiana*
Crested Shield Fern	*Dryopteris cristata*
Evergreen Wood Fern	*Dryopteris intermedia*
Ovate Spikerush	*Eleocharis ovata*
Northern Willowherb	*Epilobium ciliatum*
Bog Willowherb	*Epilobium leptophyllum*
Woodland Horsetail	*Equisetum sylvaticum*
Tussock Cottongrass	*Eriophoum vaginatum*
Spotted Jow-pye Weed	*Eupatorium maculatum*
Common Boneset	*Eupatorium perfoliatum*
Large-leaved Aster	*Eurybia macrophylla*
Grass-leaved Goldenrod	*Euthamia graminifolia*
Fringed Black Bindweed	*Fallopia cilinodis*
Wild Strawberry	*Fragaria virginiana*
Common Hemp-nettle	*Galeopsis tetrahit*
Rough Bedstraw	*Galium asprellum*
Common Marsh Bedstraw	*Galium palustris*
Creeping Snowberry	*Gaultheria hispidula*
Slender Manna-grass	*Glyceria melicaria*
Fowl Manna-grass	*Glyceria striata*
Common Oak Fern	*Gymnocarpium dryoptereis*
Water Pennywort	*Hydrocotyle umbellata*
Spotted Jewelweed	*Impatiens capensis*
Short-tailed Rush	*Juncus brevicaudatus*
Soft Rush	*Juncus effusus*
Northern Twinflower	*Linnaea borealis*
Canada Fly Honeysuckle	*Lonicera canadensis*
American Water Horehound	*Lycopus americana*
False Lily-of-the-valley	*Maianthemum canadense*
Three-leaved False Soloman's Seal	*Maianthemum trifolium*
Ostrich Fern	*Matteuccia struthiopteris*
Whorled Aster	*Oclemena acuminata*

Sensitive Fern	*Onoclea sensibilis*
Cinnamon Fern	*Osmunda cinnammea*
Common Wood Sorrel	*Oxalis montana*
Northern Long Beech Fern	*Phegopteris connectilis*
Common Plantain	*Plantago major*
Ragged Fringed Orchid	*Platantheria lacera*
Christmas Fern	*Polystichum acrostichoides*
Creeping Buttercup	*Ranunculus repens*
Skunk Currant	*Ribes glandulosum*
Smooth Gooseberry	*Ribes hirtellum*
Bristly Dewberry	*Rubus hispidula*
Dwarf Red Raspberry	*Rubus pubescens*
Common Woolly Bulrush	*Scirpus cyperinus*
Small-fruited Bulrush	*Scirpus microcarpus*
Marsh Skullcap	*Scutelleria galericulata*
Downy Goldenrod	*Solidago puberula*
Rough-stemmed Goldenrod	*Solidago rugosa*
American Bur-reed	*Sparganium americanum*
Lance-leaved Aster	*Symphyotrichum lanceolatum*
Common Dandelion	*Taraxacum officinale*
New York Fern	*Thelypteris noveboracensis*
Northern Starflower	*Trientalis borealis*
Broad-leaved Cat-tail	*Typha latifolia*
Common Speedwell	*Veronica officinalis*
Kidney-leaved White Violet	*Viola renifolia*
Small White Violet	*Voila macloskeyi*

Species of Conservation Interest (SOCI) and Species at Risk (SAR)

Each turbine site and associated access or spur road was assessed for rare, sensitive and at-risk vegetation during the field surveys in 2013. Multiple transects across the Project Area were also completed to assess for rare vegetation. Assessment was completed for all priority species identified during preliminary evaluations (desktop) as described in Chapter 3. Care was also taken to assess for potential rare vegetation species that were identified from the ACCDC data search. The ACCDC report documenting the table and map of 4706 records of 380 taxa from 89 sources, which is identified by ACCDC as a relatively low-to-moderate density of documented taxa, is provided in Appendix IV.

A 100km buffer around the study area contains 1018 records of 224 vascular, 21 records of 12 nonvascular flora.

During field studies at the candidate turbine site, access road and transects across the Project Area, no flora species of conversation interest (SOCI) or species at risk (SAR) were identified.

5.4.2 Herpetofaunal Species

Herpetofaunal species were inventoried at the Project Area through both targeted searches of appropriate habitats and through incidental observations. Specific focus was given to priority species identified as having appropriate habitat within the Project area.

Assessed habitats included deadfall within hardwood areas, south facing rocky outcrops, and aquatic habitats such as wetlands, streams, riparian zones, and vernal pools across the landscape.

Table 8. Herpetofaunal species inventoried during 2013 field surveys.

Scientific Name	Common Name	ACCDC Prov. Rank	NSDNR Gen. Status
Rana sylvatica	Wood Frog	S5	**Green**
Rana palustris	Pickerel Frog	S5	**Green**
Rana clamitan	Green Frog	S5	**Green**
Thamnophis sirtalis	Maritime Garter Snake	S5	**Green**

The Project area provides limited herpetofaunal habitat. The limitation for many turtle and amphibian species is the lack of open water habitats, particularly associated with wetlands. Although there are a number of wetlands across the Project Area, most do not exhibit vernal pool and open channel habitat. In those wetland areas where there is limited open water habitat, it is extremely unlikely that fish are present, and therefore predation would be low. Species that may use intermittent stream channel habitats are more likely to find adequate habitat within the Project Area. Wood Frog (*Rana sylvatica)* and Pickerel Frogs *(Rana palustris)*, which reproduce in running water and ephemeral bodies of water, were observed quite commonly and widespread over the Project area. In contrast, Green Frogs (*Rana clamitans)* require deeper and more permanent water bodies for reproduction (University of Guelph, 2011). Observations of Green frogs were relatively more limited across the Project.

Rare, Sensitive, At-Risk Herpetofaunal Species

No herpetofaunal Species at Risk or species of conservation concern were found within the Project Area during 2013 field surveys.

5.4.3 Mammals

Incidental observation of mammal species was documented during all field survey activities during 2012 and 2013 across the Project Area. Specific focus was given to priority species identified as having appropriate habitat within the Project Area. These species included:

- Mainland Moose;

- Little Brown Bat;
- Long-Tailed Shrew;
- Northern Long-Eared Bat;
- Eastern Pipistrelle;
- Southern Flying Squirrel; and,
- Fisher;

Table 9 lists those species that were confirmed on the Project Area either visually or by sign (scat, footprints, etc.). Presence of bats in the Project Area is described in subsequent sections.

Table 9. Confirmed mammalian species during 2012-2013 field surveys.

Scientific Name	Common Name	ACCDC Prov. Rank	NSDNR Gen. Status
Alces alces Americana	Moose*	S1 (Endangered)	Endangered (NSESA)
Odocoileus virginianus	White Tailed Deer	S5	Green
Procyon lotor	Raccoon	S5	Green
Canis latrans	Coyote	S5	Green
Erithizon dorsatum	American Porcupine	S5	Green
Tamiasciursus hudsonicus	American Red Squirrel	S5	Green

* moose was identified on the adjacent eastern parcel of property from the Project Area.

Ungulate species expected to inhabit the vicinity of the Project were established by examination of distribution maps, comparison of preferred habitat with that in the vicinity of the proposed location and field assessments. Mammal species observed within the Project Area include the white-tailed deer **(***Odocoileus virginianus)***.** Optimal habitat for deer species occurs within young forest stands and riparian and shoreline areas within drainage systems within the Project Area. White-tailed deer forage on grasses, forbs and shrubby browse. They require large amounts of easily digested food (Buckmaster et al., 1999).

Raccoon and coyote sign were observed within the Project Area. Other common carnivore/omnivore species such as Red fox *(Vulpes vulpes),* Bobcat (*Lynx rufus),* American mink (*Mustela vision),* Striped skunk (*Mephitis mephitis),* Short-tailed weasel (*Mustela erminea)* are expected to inhabit the Project Area, at least periodically.

Rare, Sensitive, At-Risk Mammals

Table 10. Potential Mammalian Species of Conservation Interest within Project Area

Scientific Name	Common Name	ACCDC Provincial Rank	NS Protection or NSDNR General Rank
Alces alces	Moose	S1	Endangered

americana			
Glaucomys volans	Southern Flying Squirrel	SNA	Yellow
Martes pennanti	Fisher	S2	Yellow

The Fisher is a Yellow ranked species in the Province of Nova Scotia, and the ACCDC ranks it as an S2 for the Province. These rankings suggest the species is both rare and sensitive to human or natural disturbance. Mixed wood forests and rock piles, both found within the Project Area, are appropriate habitats for the Fisher. Fishers inhabit upland and lowland forests, including coniferous, mixed, and deciduous forests. They occur primarily in dense coniferous or mixed forests, including early successional forest with dense overhead cover. Fishers commonly use hardwood stands in summer but prefer coniferous or mixed forests in winter. They generally avoid areas with little forest cover or significant human disturbance and conversely prefer large areas of contiguous interior forest.

The habitat preferences for the fisher are not present within the Project Area. The Mulgrave Community Wind Project is located within the Town of Mulgrave town limits and adjacent to the Martin Marietta Porcupine Mountain quarry. The Project Area has been forested in the past and does not contain blocks of contiguous interior forest.

The Southern Flying Squirrel (yellow ranking) prefers deciduous and mixed forests, particularly beech- maple, oak-hickory and poplar and also occurs in old orchards. The squirrel favours small, abandoned woodpecker holes for den sites; also uses nest boxes and abandoned bird and squirrel nests outside tree cavities. *G. volans* occurs in southern Nova Scotia in an area roughly bounded by the South Mountains in the north, the Gaspereau Valley (Kentville) to the west, the New Ross area in north-east Lunenburg County to the south and Kejimkujik National Park in the west. The Project Area does not support southern flying squirrel habitat.

Moose

Mainland Moose (*Alces americana)* is the only Species at Risk or Species of conservation interest identified (?) during the 2012 and 2013 field surveys. A single Moose was observed near the access road at Highway 344 on the eastern adjacent parcel of land.

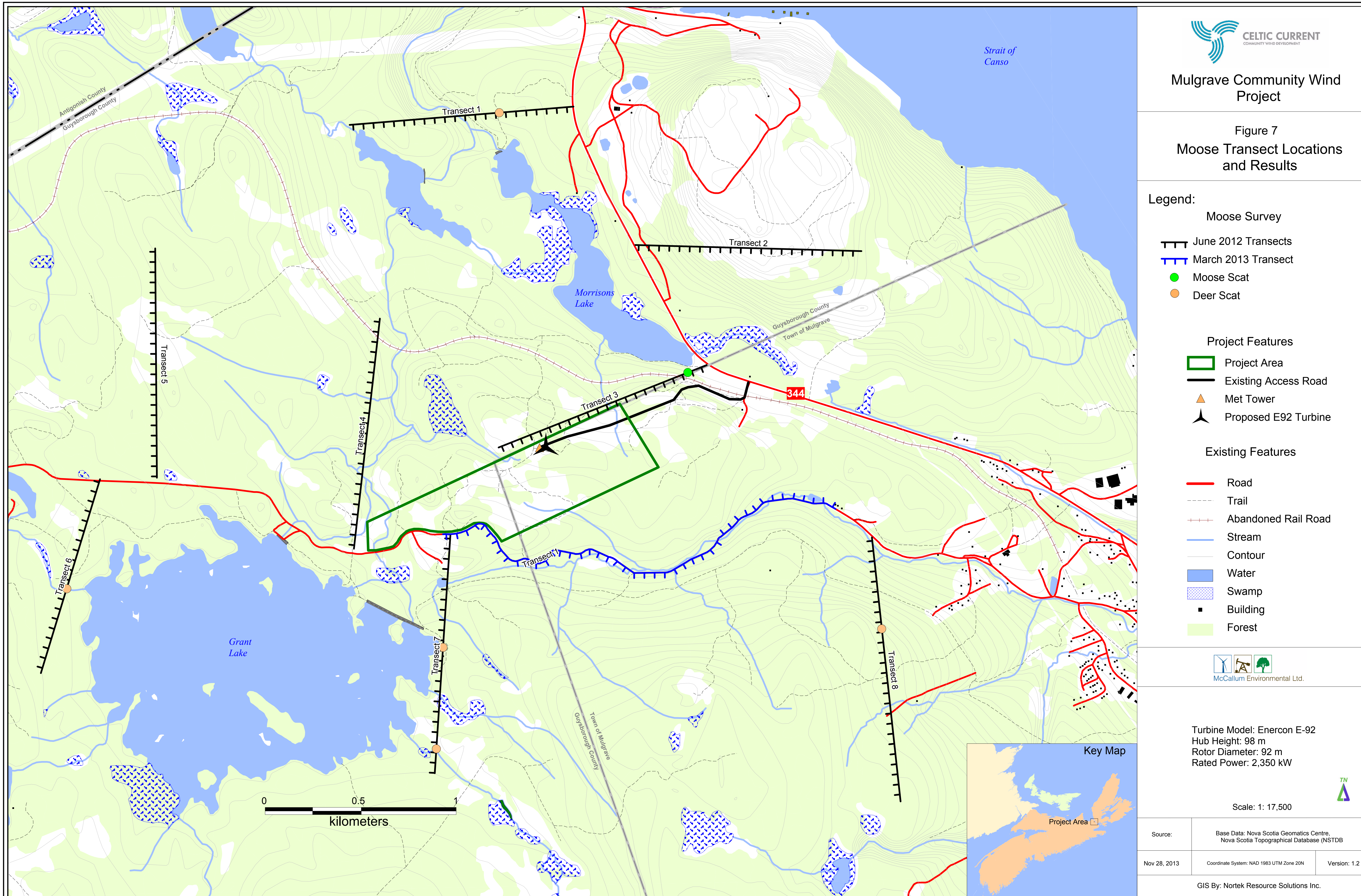
Assessment for the Mainland Moose was completed during field surveys completed in 2012 and 2013 across the Project Area and at the adjacent eastern parcel of land (near Highway 344). A single observation of scat was documented during the Spring 2012 pellet pile field surveys completed by Mr. Jody Hamper.

Moose scat was observed on the east end of Transect 3 east of the Project Area near the entrance to the access road at Highway #344 [UTM 622794 m E, 5053477 m N] in May 2012.

Observations of deer browse and scat were observed along transects 1, 6, 7, and 8.

No Moose tracks or scat were identified during the Winter 2013 snow survey. No observations of Moose were recorded as incidental sightings during field assessments throughout Spring, Summer and Fall 2013 within the Project Area.

Transect locations and results from 2012 and 2013 field assessments for moose observations are shown on Figure 7. Mainland Moose habitat is present inside and adjacent to the Project Area, and mainland moose has been documented through one observation of scat at the eastern extent of the access road near Highway 344 (outside of the Project Area).


CELTIC CURRENT
Mulgrave Community Wind Project
Figure 7
Moose Transect Locations and Results
Legend:
Moose Survey
June 2012 Transects
March 2013 Transect
Moose Scat
Deer Scat
Project Features
Project Area
Existing Access Road
Met Tower
Proposed E92 Turbine
Existing Features
Road
Trail
Abandoned Rail Road
Stream
Contour
Water
Swamp
Building
Forest
McCallum Environmental Ltd.
Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW
TN
Scale: 1: 17,500
Source:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB
Nov 28, 2013
Coordinate System: NAD 1983 UTM Zone 20N
Version: 1.2
GIS By: Nortek Resource Solutions Inc.
Key Map
Project Area
Strait of Canso
Morrisons Lake
Grant Lake
Antigonish County
Guysborough County
Town of Mulgrave
344
Transect 1
Transect 2
Transect 3
Transect 4
Transect 5
Transect 6
Transect 7
Transect 8
0
0.5
1
kilometers

5.4.4 Avian Use Assessment

Baseline assessment for birds was completed during the environmental assessment for the Mulgrave Community Wind Power Project from May to October 2012 by a local bird expert, Mr. David Johnston. Consultation was completed with Nova Scotia Environment and Nova Scotia Department of Natural Resources (NSDNR) in April 2013 (Steve Sanford and Mark Elderkin) with MEL. Based on comments received from Mark Elderkin regarding potential bird usage associated with the Project Area based on the proximity of the Project to the Strait of Canso, additional surveys were completed through 2013 to supplement surveys completed by David Johnston in 2013. David completed all additional surveys in 2013.

The baseline report is provided in Appendix III for the 2012 surveys (spring and fall migration, breeding birds) and 2013 winter survey, including detailed methodology and all results. This report was provided to Environment Canada Canadian Wildlife Service (CWS) and NSDNR in June 2013 with a request for comments and feedback. None were received.

Follow up assessment was completed during the early Spring 2013 (migration surveys) and adverse weather surveys were completed from May to October 2013 to assess the potential for bird usage within the Project Area in times of wind, rain, fog and other adverse weather conditions.

2012 Baseline Survey

In total, 2238 individual birds, representing 60 species were identified within the Project Area during baseline avian surveys from May 15 2012 to January 2013. The average survey length was 3 hours long, for a total of 75.25 hours of survey time. As indicated in the methodology, the survey times consisted of a combination of Point Count and transect surveys.

Bird species were identified based on functional bird groups to understand how each group of birds is using the Project Area. These functional groups include landbirds, waterfowl, waterbirds, raptors, shorebirds, and owls. The most abundant group observed on site is landbirds, which account for 75% of all species, and 95% of all individuals.

During spring migration in May 2012, 535 individuals representing 42 species were observed through a series of five site visits, conducted between May 15 and May 29, 2012. The most abundant species were Ovenbirds, White-throated Sparrow and Magnolia Warblers. Based on the lack of diverse habitats available within the Project Area, these habitats do not offer many obvious attractants to passing migrants. Several obvious migrants were observed during spring. Obvious migrants were primarily solitary, and were not observed in long flight paths or flocks, with the exception of a flock of 24 Blue Jays observed on May 15, 2012. No obvious concentration of sea ducks or shorebirds were observed.

Ten site surveys were conducted during the summer breeding period and early fall migration, between June 1 and August 31, 2012. A total of 842 individuals representing 47 species were observed during the breeding season; the most abundant of which were Red-eyed Vireo, White-throated Sparrow and American Robin. All of the species identified with high breeding evidence are native species expected to be found in this area of Nova Scotia and across the province in general, and within the typical and common habitat associated with the Project Area and surrounding landscape.

During fall migration in 2012, a total of 153 individuals were observed, representing 33 species. The most abundant species observed were the Black-capped Chickadee, Dark-eyed Junco, and American Robin.

One visit was made per month during the winter season, in November 2012, December 2012, and January 2013. A total of 32 individuals representing 7 species were observed during the transect surveys. The most abundance species observed were the Black-capped Chickadee, American Crow, and Herring Gull. This site does not support a diverse or abundant community of winter resident species.

Flyovers

Ducks and Common Loons were observed as occasional flyovers throughout the baseline survey in 2012. There are a number of lakes in the vicinity of the Project Area, including Grant Lake and Morrison's Lake, both of which likely provide habitat for ducks and loons. However, these birds were not seen regularly or even occasionally within the Project Area, suggesting that this area is not a supporting habitat for ducks and common loons who might be present in closer proximity to the lakes. Occasionally, Double-crested Cormorants, Great-blue Herons and Herring Gulls were identified as flyovers.

Other species commonly noted as flyovers include raptors such as Sharp-shinned Hawks and a single Merlin. Bald Eagles and Red-tailed Hawks were occasionally observed in the vicinity of Morrison's Lake, but less frequently within the Project Area.

Landbirds such as the Common Raven, American Crow and various species of woodpeckers were frequently observed as flyovers. A single flock of 30 unknown ducks observed during the summer breeding season was the largest flock of birds observed during the entire baseline assessment, followed by a single flock of 24 Blue Jays, observed during spring migration.

While it is known that the nearby Strait of Canso is used as a flyway and staging ground by migratory seabirds (The Canada-Nova Scotia Strait of Canso Environment Committee 1975), the Project Area itself does not appear to serve as a flyway. Porcupine Mountain lies between the Strait of Canso and the Project area, which may be acting as a barrier to passing migrants which are attracted to the Strait of Canso. The Project Area does not support habitat for birds during migration (lack of extensive open water wetland and surface water systems, no open water lakes or ponds) and little mature growth forest stands, and has significant anthropogenic influence. Furthermore, surrounding properties continue to reduce the quality of the habitat with three active quarries, road and highway development, residential and industrial developments present surrounding the Project Area on three sides within 200-500 m.

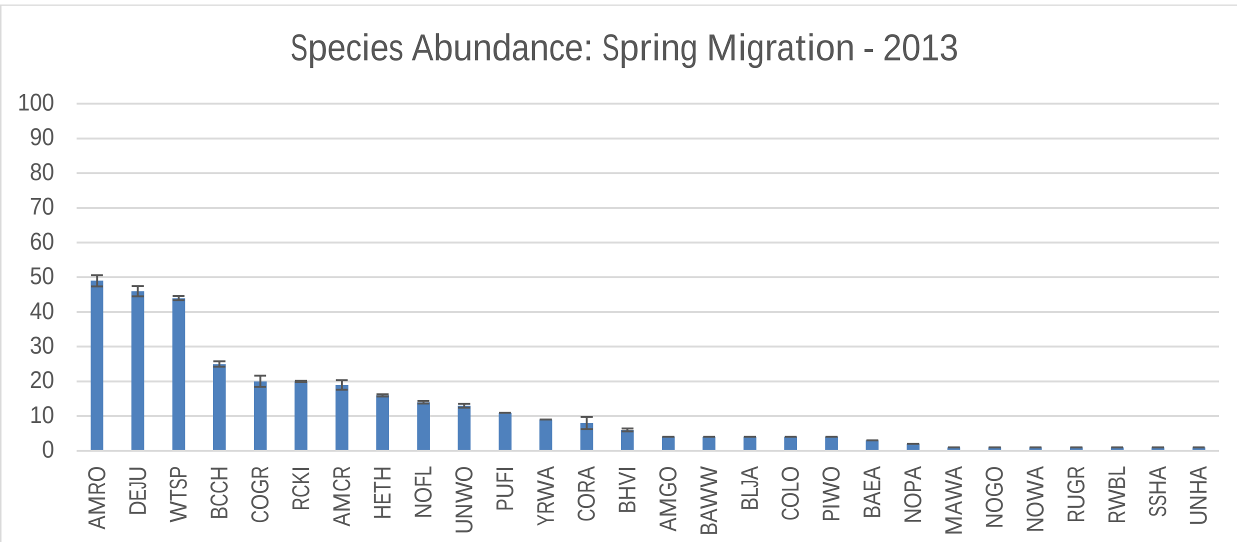
2013 Updated Spring Migration Survey

During early spring migration surveys completed from mid-April to mid-May 2013, 332 individuals representing 27 species were observed through a series of four site visits. Several species of birds were identified during the spring surveys 2013 that were not identified during baseline assessment s in 2012. These birds included:

- Bald Eagle
- Northern Goshawk
- Red-Winged Blackbird
- Sharp-skinned Hawk
- Hawk (unknown species)

The most abundant species were American Robin, Dark-eyed Junco and White-throated Sparrow. A Figure 8 below identifies abundance of avian species identified during early Spring 2013 surveys.

Figure 8: Avian Species Abundance Spring: Mid-April to Mid May 2013



Based on the lack of diverse habitats available within the Project Area, the habitats do not offer many obvious attractants to passing migrants. Obvious migrants were primarily solitary or in pairs, and were not observed in long flight paths or flocks.

No obvious concentration of sea ducks or shorebirds were observed.

2013 Adverse Weather Surveys

Adverse weather surveys were completed during rain, wind or fog events in order to quantify avian usage of the Project Area under adverse conditions. Each month, from the end of April through October 2013, Mr. David Johnston completed a two hour watch count at the Mulgrave Community Wind MET tower to assess behaviour and movement of birds. All of these surveys were completed during a significant rain event (>10mm), wind event or during significant fog and Mr. Johnston spent the two hours walking the perimeter of the cleared area surrounding the MET tower recording what birds he heard and/or saw.

Table 11: Adverse Weather Survey Details

Date	**Temp** (˚C)	**Weather**	**Visibility**	**Wind Speed (km/h) & Direction**	**Survey Start & End Time**	**Fog[1] Estimate**
April 20, 2013	14-13	Rain, fog	Fair	32-39 SSW	9:30-11:30	1
April 26, 2013	5-5	Drizzle, fog	Fair	7 N	8:00-10:00	2
May 13, 2013	12-14	Heavy overcast	Good	19-24 SSW	8:00-10:00	1
May 23, 2013	6-7	Rain, fog	Fair	13-17 SE	8:00-10:00	3
June 12, 2013	12-12.5	Rain, fog	Fair	13-15 E	7:45-9:45	2
June 19, 2013	14-16	Rain, fog	Fair	2-9 S	7:45-9:45	2
July 18, 2013	18-19	Rain, light fog	Good	20 SW	6:45-8:45	1
July 25, 2013	20	Rain, fog	Fair	4-6 S	7:30-9:30	2
July 30, 2013	18-20	Heavy fog	Poor	6-11 S	7:45-9:45	3
August 14, 2013	18-19	Heavy fog	Poor	9 ESE	6:30-8:30	3
August 30, 2013	17-16	Drizzle, windy	Good	7 SSW	7:15-9:15	1
Sept. 3, 2013	17-17	Rain, heavy fog	Poor	16 SE	8:00-10:00	3
Sept. 14, 2013	19-20	Warm, foggy	Poor	17 S	10:15-12:15	3
October 17, 2013	16-17	Rain, windy	Fair	25 S	8:30-10:30	1
October 27, 2013	7-9	Rain, light fog	Poor	15 S	8:30-10:30	1

1. Fog Conditions: 1- light, 2:- moderate, and 3- heavy

Limited findings were recorded during these adverse weather surveys. A total of 45 species of birds were identified during the adverse weather surveys. The most abundant bird species observed during these surveys was the Dark –eyed Junco with 64 individuals, followed by the White-throated Sparrow (36) and American Goldfinch (36), the Blue Jay (27) and the Magnolia Warbler with 18 individuals.

The only species of conservation interest or species at risk identified during adverse weather surveys were the Olive-sided Flycatcher and the Common Loon. These observations are described in Section 5.4.3.4.

The Straight Area is not prone to fog. The data presented supports this conclusion. The surveys confirmed that the valley south of the turbine locations is richer in bird species (abundance and diversity) that the higher elevation grounds where the turbines and associated infrastructure have been proposed. The habitat to the south of the turbine locations is more diverse. The majority of the birds seen or heard during the surveys were identified near the southern perimeter of the cleared MET tower site.

David Johnston confirmed that when fog was present and densest along the Strait of Canso, the Project Area was generally free of fog. Wind and rain events were consistent across the Project Area and surrounding landscape. Bird activity and movement during these adverse weather surveys was significantly reduced compared to standard survey times and follow standard survey protocols.

Avian Species of Conservation Interest and Species at Risk

Two avian Species at Risk (SAR) and seven species of conservation interest (SOCI) were identified within the Project area during the baseline avian use assessments from Spring 2012 to Fall 2013. A Species at Risk is one which is legally protected under the federal Species at Risk Act (SARA) or the provincial Nova Scotia Endangered Species Act (NSESA), while a species of conservation interest is one which is listed by the Committee on the Status of Endangered Wildlife In Canada (COSEWIC) or one which is classified as red or yellow by the Nova Scotia Department of Natural Resources (NSDNR) general status of wild species (Province of Nova Scotia, 2011). The species observed include:

- Boreal Chickadee (SOCI);
- Common Loon (SOCI);
- Eastern Wood Pewee (SAR);
- Golden-crowned Kinglet (SOCI);
- Gray Jay (SOCI);
- Killdeer (SOCI);
- Northern Goshawk (SOCI);
- Olive-sided Flycatcher (SAR); and

· Ruby-crowned Kinglet (SOCI).

The Boreal Chickadee, Golden-crowned Kinglet, Gray Jay, Killdeer and Ruby-crowned Kinglet are listed as ‘yellow’ under NSDNR’s general status ranks. These species have been flagged as 'early watch' species by the Province, but they are not currently protected by the NSESA (Province of Nova Scotia, 2011). As some of these species are potentially in decline, they will remain priority species for all future monitoring within the Project Area. The most abundant of the ‘yellow’ listed species is the Ruby Crowned Kinglet, with a total of nineteen individuals observed during all baseline surveys. These species are fairly common in coniferous and deciduous forests throughout Nova Scotia. The Project Area does not offer any rare or unique habitat types upon which these species rely.

The Eastern Wood Pewee is listed as ‘vulnerable’ under NSESA, and is listed as a ‘species of concern’ by COSEWIC. This species is one of the most common and widespread songbirds associated with North America’s eastern forests. While the species is apparently resilient to many kinds of habitat changes, like most other long-distance migrants that specialize on a diet of flying insects, it has experienced persistent declines over the past 40 years both in Canada and the United States. A single Eastern Wood Pewee was observed on two occasions during the summer breeding (potentially the same individual), but no breeding evidence was observed (Government of Canada, 2012a).

The Common Loon is classified as ‘red’ under NSDNR’s general status ranks. It is not currently protected under the NSESA, SARA, or listed by COSEWIC. In total, 38 individuals were observed through the spring, summer and fall surveys. They are most susceptible to activity in and around lakes (for example, boating and shoreline development), so construction of turbines is not likely to impact their breeding habitat, particularly within this Project Area, as it has no water bodies. Loons were commonly observed as flyovers, likely moving over the Project Area to either Grant Lake or Morrison’s Lake which is assumed to be their primary habitat. Loons are most susceptible to activity in and around lakes (for example, boating and shoreline development), so construction of the turbine will not directly impact their breeding habitat. Of the 38 Loon detections during baseline assessments, 36 were heard at a distance greater than 100m from the observer, while a single loon was observed as a flyover.

The Olive-sided Flycatcher was identified during the breeding bird survey in 2012 and is listed by SARA and NSESA as 'Threatened'. In total, 9 individuals were observed late in the breeding season within the Project area in 2012. These observations included fledged young. The Olive-sided Flycatcher was not observed within the Project area during June and July in 2012, when the species is typically nesting. It was originally concluded that the Olive-sided Flycatcher was likely breeding nearby, and was observed during a migration stopover during early fall migration.

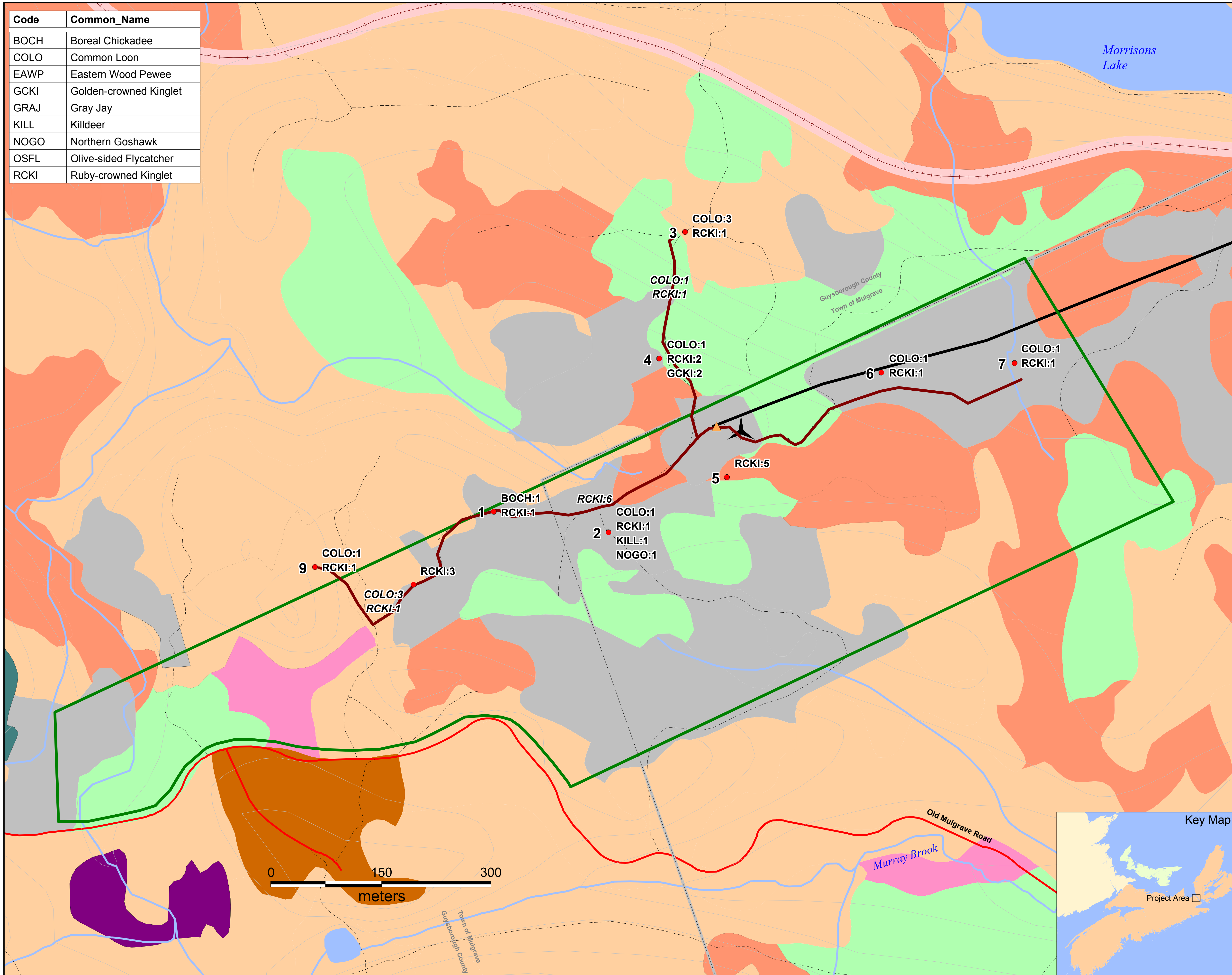
The Olive-sided Flycatcher was also observed within the Project Area during the adverse weather surveys one two occasions, once in June and once in July 2013. On both occasions, the bird was heard, not observed, greater than 100 metres south of the MET tower location. There is wetland habitat south of the MET tower location which is consistent with the desired habitat type for the Olive-sided Flycatcher. Based on these observations, and the 2012 observation of fledged young in August, it is reasonable to assume the Olive-sided Flycatcher is a probable breeder within the valley south of the proposed turbine locations within or adjacent to the Project Area.

Olive-sided Flycatchers are listed as threatened in SARA and NSESA as a result of continuous and considerable declines in the population. Not much is known about the cause of this decline. Much of this decline is attributed to large scale changes in North American breeding habitat, as well as loss of habitat in their wintering grounds of Panama, Venezuela and Bolivia (Government of Canada, 2012b). In the North American breeding grounds, Olive-sided Flycatchers are most often associated with openings or edges in coniferous forests, especially those with tall treed or snags for perching. Bog margins, river valleys and slow-moving streams are all frequently used feeding habitats. The occurrence of Olive-sided Flycatchers in the Project area is not surprising, considering they are commonly found in commercially harvested forests throughout Nova Scotia during all bird work associated with development projects and environmental assessment baseline work.

The Common Nighthawk is currently listed as Threatened by SARA, COSEWIC, and the NSESA. According to the ACCDC, the Common Nighthawk has been observed within 3km of the Project area, and it is identified as a confirmed breeder in the Maritime Breeding Bird Atlas (Square 20PR25). Unlike many songbirds which are most vocal during the early morning hours, the Common Nighthawk is most easily observed in flight during dawn and dusk as they forage for insects over open woodlands. Three evening surveys were completed within the Project area (one each in May, June and July, when detection of Nighthawks is most likely). No Common Nighthawks were observed during the baseline assessments nor during follow up Spring migration surveys in 2013 or adverse weather surveys.

Figures 9-12 show all bird survey locations (Spring and Fall migration, breeding bird survey, and winter survey, as well as the location of the adverse weather surveys (MET tower/proposed turbine location). These Figures show the results of bird SOCI and SAR for each survey season.

Code	Common_Name
BOCH	Boreal Chickadee
COLO	Common Loon
EAWP	Eastern Wood Pewee
GCKI	Golden-crowned Kinglet
GRAJ	Gray Jay
KILL	Killdeer
NOGO	Northern Goshawk
OSFL	Olive-sided Flycatcher
RCKI	Ruby-crowned Kinglet



CELTIC CURRENT

Mulgrave Community Wind Project

Figure 9

Spring Migration Survey Locations and Results

Legend:

Bird Transects
- Point Count
- Transect
- COLO:1 RCKI:1 Species:Frequency

Habitat Type
- Softwood Forest
- Mixedwood Forest
- Hardwood Forest
- Recent Harvest
- Treed Bog
- Alders
- Railway ROW
- Gravel Pit

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

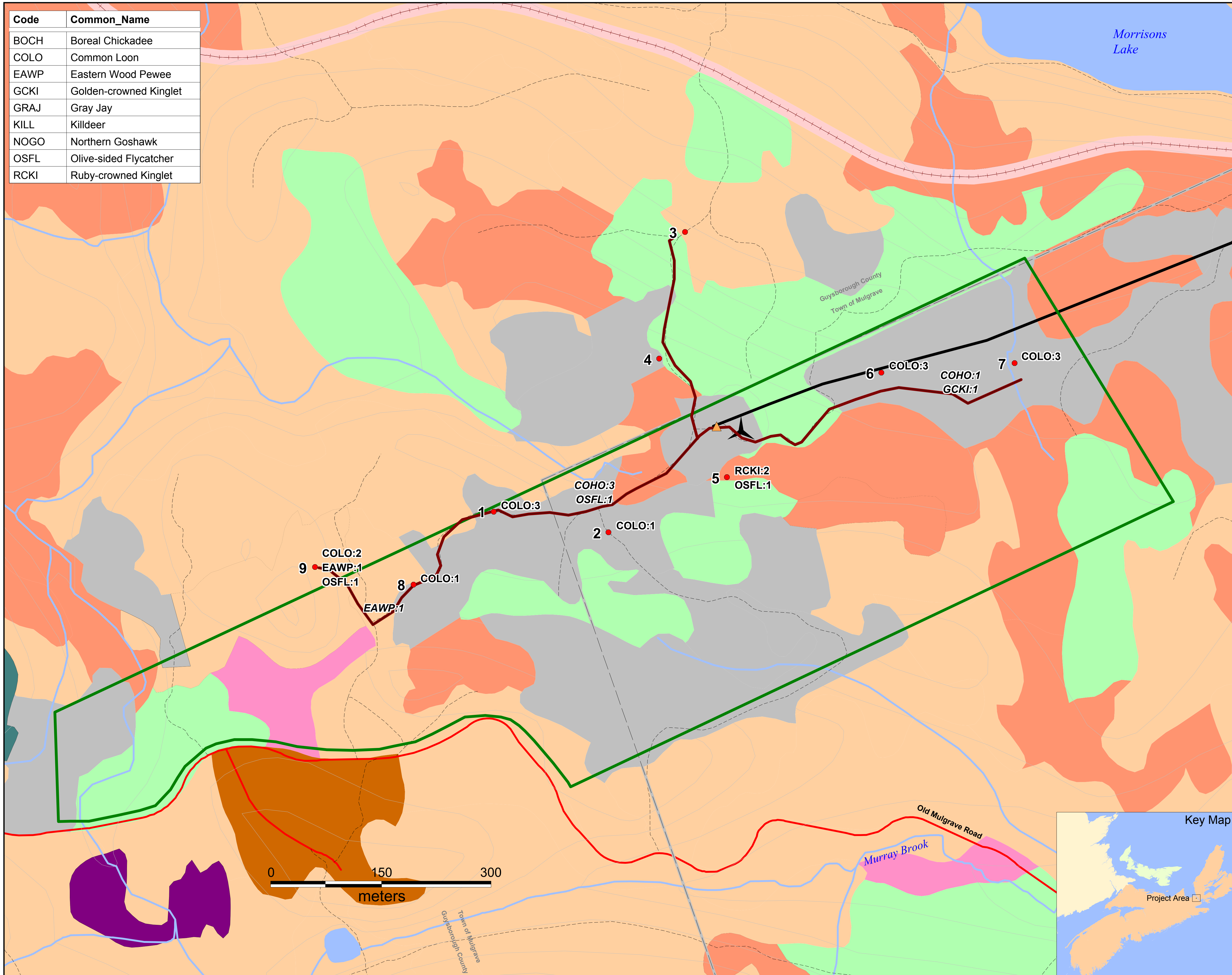
TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB)

Nov 25, 2013 | Coordinate System: NAD 1983 UTM Zone 20N | Version: 1.2

GIS By: Nortek Resource Solutions Inc.



Code	Common_Name
BOCH	Boreal Chickadee
COLO	Common Loon
EAWP	Eastern Wood Pewee
GCKI	Golden-crowned Kinglet
GRAJ	Gray Jay
KILL	Killdeer
NOGO	Northern Goshawk
OSFL	Olive-sided Flycatcher
RCKI	Ruby-crowned Kinglet

CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT

Mulgrave Community Wind Project

Figure 10
Summer Breeding Bird Survey Locations and Results

Legend:

Bird Transects
- Point Count
- Transect
- COLO:1 RCKI:1 Species:Frequency

Habitat Type
- Softwood Forest
- Mixedwood Forest
- Hardwood Forest
- Recent Harvest
- Treed Bog
- Alders
- Railway ROW
- Gravel Pit

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

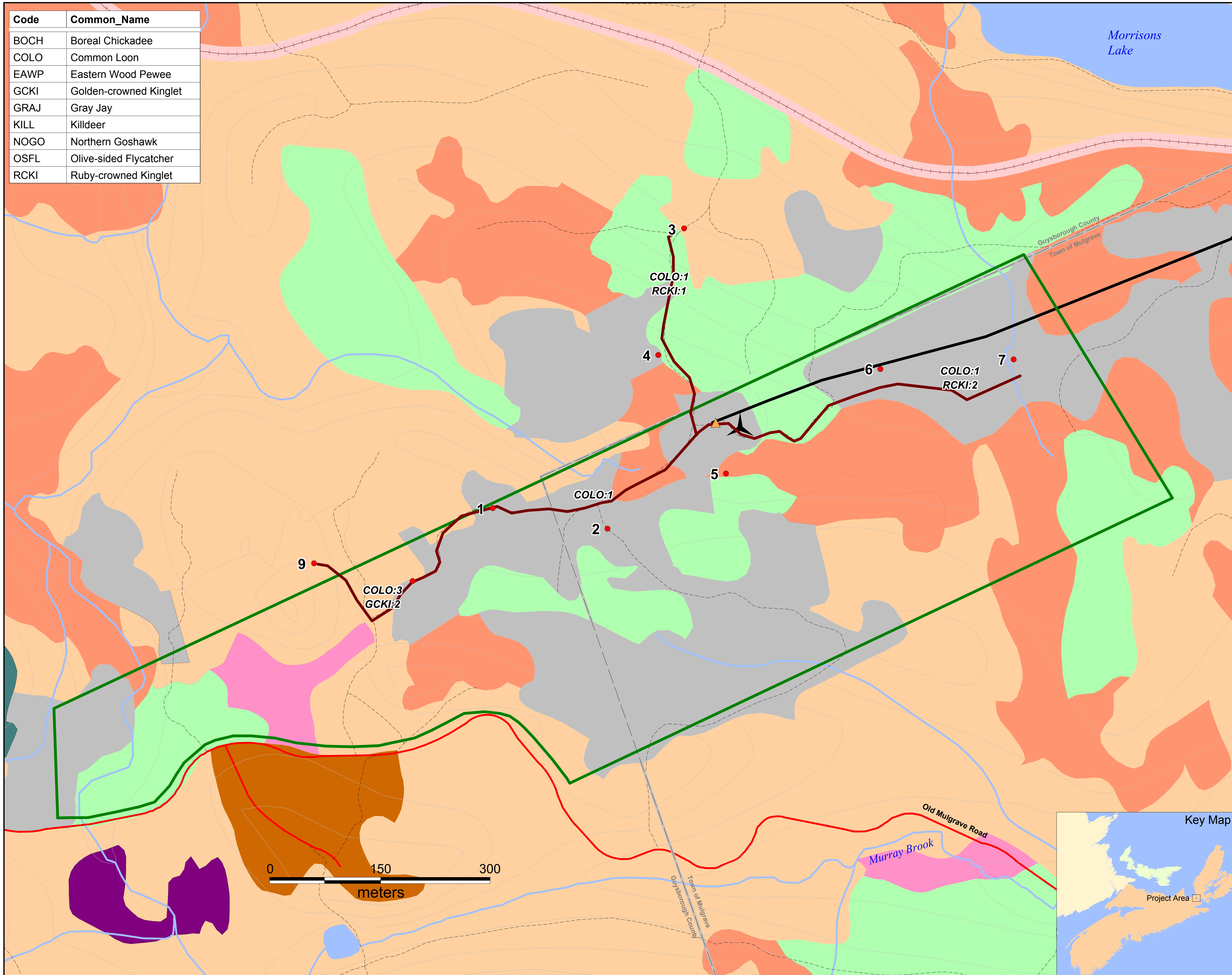
TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB)

Nov 25, 2013 | Coordinate System: NAD 1983 UTM Zone 20N | Version: 1.2

GIS By: Nortek Resource Solutions Inc.



Code	Common_Name
BOCH	Boreal Chickadee
COLO	Common Loon
EAWP	Eastern Wood Pewee
GCKI	Golden-crowned Kinglet
GRAJ	Gray Jay
KILL	Killdeer
NOGO	Northern Goshawk
OSFL	Olive-sided Flycatcher
RCKI	Ruby-crowned Kinglet

CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT

Mulgrave Community Wind Project

Figure 11
Fall Migration Survey Locations and Results

Legend:

Bird Transects
- Point Count
- Transect
- COLO:1 RCKI:1 Species:Frequency

Habitat Type
- Softwood Forest
- Mixedwood Forest
- Hardwood Forest
- Recent Harvest
- Treed Bog
- Alders
- Railway ROW
- Gravel Pit

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB)

Nov 25, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

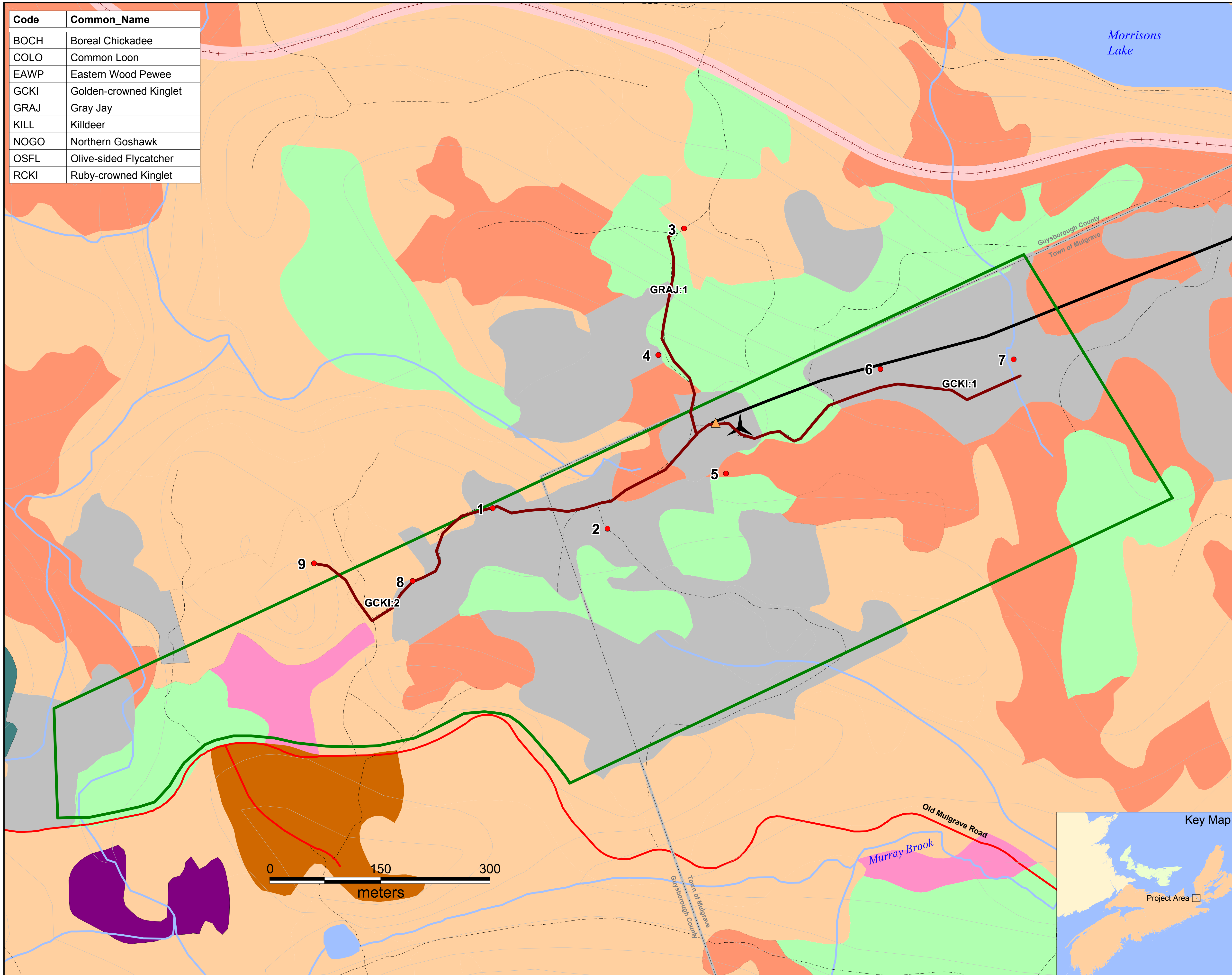
GIS By: Nortek Resource Solutions Inc.

Mulgrave Community Wind Project

CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT

Figure 12
Winter Bird Survey Locations and Results

Code	Common_Name
BOCH	Boreal Chickadee
COLO	Common Loon
EAWP	Eastern Wood Pewee
GCKI	Golden-crowned Kinglet
GRAJ	Gray Jay
KILL	Killdeer
NOGO	Northern Goshawk
OSFL	Olive-sided Flycatcher
RCKI	Ruby-crowned Kinglet



Legend:

Bird Transects
- Point Count
- Transect
- COLO:1 RCKI:1 Species:Frequency

Habitat Type
- Softwood Forest
- Mixedwood Forest
- Hardwood Forest
- Recent Harvest
- Treed Bog
- Alders
- Railway ROW
- Gravel Pit

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB)

Nov 25, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.

5.4.5 Bat Use

An assessment of bat species composition and activity for the Mulgrave Community Wind Project was completed by McCallum Environmental Ltd. and Boreal Environmental Ltd. in August and September 2013.

Consistent with the requirements as set out by the Nova Scotia Department of Environment (Nova Scotia Environment, 2007, updated 2012) the following four objectives were established for the proposed Mulgrave Community Wind Project:

(1) To review of the potential impacts of wind turbine developments on bats;
(2) To provide a summary of the ecology of the bat species that are likely to be present in the area that is relevant to the proposed development;
(3) To assess whether there are any known bat hibernacula within 25 km of the proposed development site; and,
(4) To conduct a survey to count local species richness and assess the level of bat activity levels at the site (as bat passes/night).

In Nova Scotia there are occurrence records for seven bat species, and each have been documented to have experienced fatalities at wind turbine sites (Arnett et al. 2008). Nova Scotia is at, or near the periphery of the current known range for each of these species, except the northern long-eared bat and the little brown bat (van Zyll De Jong, 1985). These two species, as well as the tri-colored bat, appear to be the only bat species with significant populations in Nova Scotia (Broders et al., 2003; Farrow and Broders 2011). Little brown bats and northern long-eared bats have been known to exist across Nova Scotia but the population of tri-colored bats appear to be restricted to southwestern region (Broders et al., 2003; Farrow and Broders 2011; Rockwell, 2005). The low number of echolocation recordings of migratory species (i.e., red, hoary and silver-haired bats; 15 out of 30 000 echolocation sequences) by Broders (2003) and other unpublished work suggests there are no significant populations or migratory movements of these species in southwest Nova Scotia. As for big brown bats, there is only one unconfirmed observation of 2 individuals of this species hibernating at Hayes Caves, there are no other confirmed records (Moseley, 2007; Taylor, 1997).

In July 2013, the three resident species of bat in Nova Scotia (Little brown bat, Northern long-eared bat, and Tri-colored bat), were listed as endangered species under the Nova Scotia Endangered Species Act (NSESA) as a result of a major outbreak of the disease known as White Nose Syndrome (WNS), which is caused by the fungus, *Geomyces destructans*.

Little brown bat, which was once the most common bat in Nova Scotia is now endangered as a result of WNS. The disease has killed nearly 7 million bats in eastern North America in the past 8 years and estimates of a 90% percent decline in Nova Scotia have taken place in just 3 years since the disease was first recorded (NSDNR 2013). There is no known cure for the disease which is lethal and affects all bat species that congregate in caves and abandoned mines used for hibernation through the winter (NSDNR 2013). The Northern long-eared bat is Nova Scotia's second most common bat. It usually hibernates in association with the Little Brown Bat in caves and abandoned mines and at other times of the year is a true forest bat. Northern Myotis are also endangered by White-nose-Syndrome (NSDNR 2013).

The Tri-colored Bat, or Eastern Pipistrelle is the rarest of three congregatory bats that occur in the province. The Nova Scotia population is thought to be geographically isolated (disjunct) from others in eastern North America. Little is known about the ecology of tri-colored bats in the province, but research shows that it uses rivers and streams for feeding. Although white-nose syndrome has not been confirmed in this species in Nova Scotia (likely because the bat was always rare), evidence in the north east US indicates the species has been seriously impacted (NSDNR 2013).

Table 12. Bat species previously recorded in Nova Scotia

Species	Overwintering Strategy	Documented fatalities at wind farms?	Global ranking[2]	Federal, Provincial or ACCDC Ranking
Little brown bat	Resident hibernator (NS and NB)	Yes	G5	NSESA (endangered)
Northern long-eared bat	Resident hibernator (NS and NB)	Yes	G4	NSESA (endangered)
Tri-colored bat	Resident hibernator (NS and NB)	Yes	G5	NSESA (endangered)
Big brown bat	Resident hibernator (NB)	Yes	G5	N/A
Hoary bat	Migratory	Yes	G5	S2
Silver-haired bat	Migratory	Yes	G5	S1
Eastern red bat	Migratory	Yes	G5	S2

1 Bat species documented in fatality events from carcass surveys conducted at wind energy development sites in N.A.
2Global ranking based on the NatureServe Explorer, G5= **Secure**—Common; widespread and abundant: G4= **Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
3Atlantic Canada Conservation Data Centre ranking, based on occurrence records from NB and NS; S1= **Extremely rare**--May be especially vulnerable to extirpation (typically 5 or fewer occurrences or very few individuals; S2= **Rare**--May be vulnerable to extirpation due to rarity or other factors (6 to 20 occurrences or few remaining individuals); S4= **Usually widespread**-- fairly common and apparently secure with many occurrences; (?) qualified as inexact or uncertain.
NSESA ranking: http://novascotia.ca/natr/wildlife/biodiversity/species-list.asp

Potential for hibernacula in Project area

The guide to wind development prepared by the Nova Scotia Department of Environment and Labour (NSDEL, 2007, updated January 2012) states that wind farm sites within 25 km of a known bat hibernaculum have a 'very high' site sensitivity.

There is only one site mentioned by Moseley (2007) as a potential hibernaculum near the Project Area. This site (Hirschfield Galena Prospect) is an abandoned mine adit with a surveyed length of 215 m that is located approximately 65 km southwest of the Mulgrave Community Wind Power Project location. Moseley described this location as a significant hibernaculum with 200-300+bats. The species composition was not confirmed, but probably was mostly *M. lucifugus*.

There are ≥20 government records of abandoned mine openings within 25 kms of the proposed development site, and four of these have original depth records >50 m. To the knowledge of the project team, none have been surveyed for bats.

Acoustic Detection Results

In total, there were 47 files recorded of which 32 files were determined to be bat generated ultrasound. All remaining files were determined to be extraneous noise. Extraneous noise detection was very low and can be caused by gusts of wind, rustling vegetation, or the effect of moisture on electronic detection equipment. Historical weather data from both the Sydney Airport and Stanfield International Airport indicate that it was foggy and winds were light on the night of August 26th and August 27th when the majority of 'noisy" files were recorded. These relatively calm weather conditions were unlikely to interfere with the detection equipment making the source of recorded noise difficult to identify.

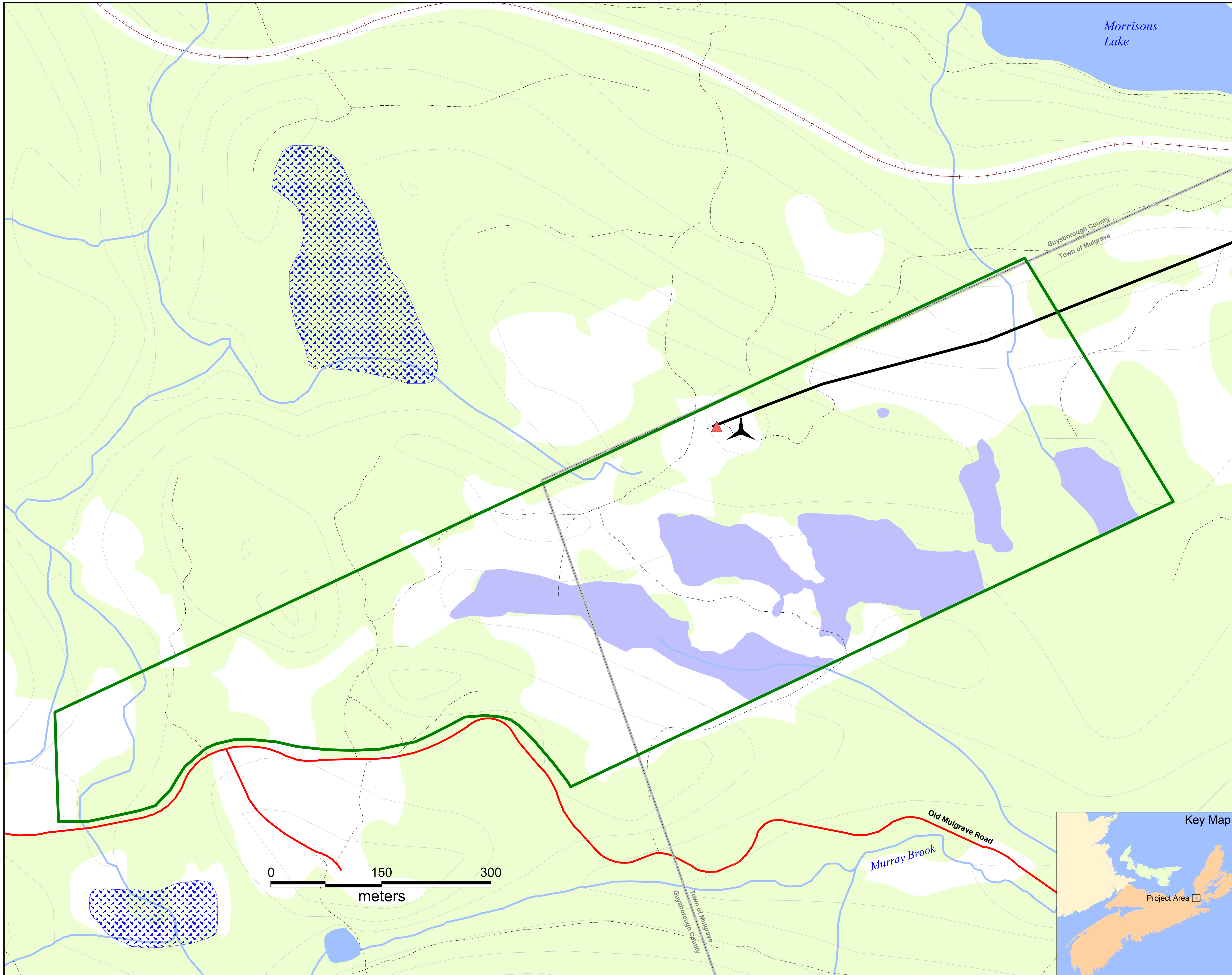
All calls detected at the Mulgrave study location were recorded on the evenings of August 26th and August 27th, 2013. All calls were associated with Myotis species bats (i.e., little brown bat (Myotis lucifugus) and northern long-eared bat (M. septentrionalis)). The highest level of activity occurred on the night of August 27th with 26 calls recorded. The remaining six calls were detected on August 26th. No attempt was made to identify each of the Myotis species calls to species level because of the difficulty in achieving defensible identifications (Broders 2011). Despite this, there were echolocation calls with characteristics consistent with both northern long-eared and little brown bat.

Increased activity on the night of August 27th, 2013 may not be an indication of bat abundance, but rather the presence of one Myotis species bat foraging in close proximity to the echolocation detector. There is simply no method to determine whether bat abundance is high at this site without direct observation; however, inferences can be made about the quality of the habitat with regards to prey abundance, roosting sites, etc. Overall the level of activity at the Mulgrave study location was low with no recorded activity on most survey nights.

Anabat log files were scrutinized to determine if the Anabat echolocation detector functioned over the duration of the study. Typically, this level of scrutiny is not required; however, there were many nights over the duration of the study where no ultrasound files (e.g., extraneous noise or bat calls) were recorded which is unusual. Log files contain information that allows one to determine if the detection equipment turned "on" and "off" at pre-programmed intervals and whether or not ultrasound files were recorded for each night. Between September 1st and 4th the detection equipment appears to have turned-on at the pre-program time which was 18:00 hours but promptly turn-off after a short period of time. Depleted batteries were determined to be the cause of the malfunction and promptly corrected once noticed. The detection equipment functioned properly for all other nights during the survey.

Discussion

There was no acoustic evidence of a movement or concentration of bats at the study sites during the late summer and fall migration season. Acoustic evidence of bats was limited to one evening in late August at the location of the MET tower. There were no echolocation sequences that were attributable to the tri-colored bat. This species is only abundant in southwest Nova Scotia and the proposed development area is outside the species distribution (Broders et al., 2003; Farrow and Broders 2011). Also, there were no echolocation sequences that were attributable to either hoary bat, red bat, silver-haired bat, or big brown bat. Current data would suggest that these species do not occur in the area in large numbers.



CELTIC CURRENT
COMMUNITY WIND DEVELOPMENT

Mulgrave Community Wind Project

Figure 13
Anabat Deployment Location

Legend:

Bat Monitoring

Bat Detector

Project Features

Project Area
Existing Access Road
Proposed E92 Turbine

Existing Features

Road
Trail
Abandoned Rail Road
Stream
Contour
Water
Swamp
Wetland
Forest

McCallum Environmental Ltd.

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

TN

Scale: 1: 5,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB

Nov 28, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.

5.4.6 Wildlife Habitat

Habitat across the Project Area is described in detail in previous sections above. Large tracts of the Project Area have been clear-cut, and are in early stages of regeneration. These areas generally lack tree cover, and are dominated by early colonizing species such as Red Maple and Balsam Fir, along with Speckled Alder, White Meadowsweet, and Red Raspberry. Mature softwood stands are dominated by White Spruce and Balsam Fir, with relatively sparse understory and ground cover vegetation. Immature deciduous stands are also present throughout the Project Area. These stands contain a mixture of early colonizers such as Red Maple and White Birch, along with Yellow Birch, Striped Maple and the occasional Sugar Maple. The forested habitats support the thermal, cover and security requirements for wildlife species listed in previous sections.

Habitat within the Project area is currently somewhat fragmented by small logging roads and ATV trails, and forestry operations. An access road was built in order to access the MET tower location. This road will be maintained and upgraded as necessary as the main access road into the project for the installation of the turbines. The majority of the Project area has been logged a number of times. The wetland system present to the south of the turbine locations has not been harvested, and is in good condition with little human interference.

As noted in Table 6, 89% of the Project Area is forested, and 40% has been recently harvested.

5.4.7 Aquatic Habitats/Fisheries

There are no lakes or areas of open water in the Project area. Two mapped watercourses are present within the Project Area. A watercourse is present on the eastern edge of the Project Area draining north towards Morrison Lake. This watercourse drains from a headwater wetland identified in the southeast corner of the Project Area. The watercourse is approximately 60cm wide and 15cm deep on average. While this watercourse generally lacks coarse woody debris, some in-stream vegetative cover is present and overhanging vegetative cover is provided by the shrub understorey. The substrate is a combination of muck, sand and gravel. This watercourse flows under the existing access road to the MET tower through a concrete culvert. Fish habitat potential within this watercourse is very low.

A second watercourse was identified within the southwestern section of the Project Area. This watercourse is located with wetland habitat and drains south outside of the Project Area and then east towards the Old Mulgrave Road. This watercourse commences near the north end of associated wetland habitat and at this location is 10-15 cm deep, 40-50 cm wide, with muck and gravel substrate and low to moderate flow. Further downstream, the watercourse widens and deepens as it gets closer to a series of small beaver impoundments located south of the Project Area. The watercourse reaches an average width of approximately 2m, and 0.6m deep.
The substrate is primarily muck and sand. Coarse woody debris provides in-stream cover, and a thick shrub layer provides overhanging vegetative cover. Fish habitat potential within this

watercourse is moderate, but potentially limited by presence of beaver activity downstream.

During constraints mapping, known watercourses and/or wetlands were mapped and a 30 metre setback imposed as a buffer.

Figure 14 shows all watercourses identified within the Project Area, as well as mapped watercourses outside the Project Area.

The watercourse crossing at the access road has already been constructed. Any additional new installations or upgrades will be completed in accordance with the Nova Scotia Environment Watercourse Alteration approval process, and all appropriate applications for alteration will be sought prior to construction or upgrading as required.

5.4.8 Wetlands

Wetlands are defined as "a swamp, marsh, bog, fen or other land that is covered by water during at least three consecutive months of the year." Wetland functions are the natural processes associated with wetlands and include water storage, pollutant removal, sediment retention and provision of nesting/breeding habitat. Functions may also include values and benefits associated with these natural processes and include aesthetics/recreation, cultural values, and subsistence production (Environment Canada, 2000). The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec 1997) or with the Nova Scotia methods for wetland delineation.

The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec 1997) or with the Nova Scotia Environment approved methods for wetland delineation.

<u>Desktop Review: Results</u>

The NSDNR Significant Species and Habitats Database (SSHD, 2010) was consulted and, based on the information in this database, no wetlands are identified from that source within the Project Area.

During the field survey, a system of wetland habitat was observed south of the proposed turbine location. The boundaries of this wetland system were delineated in the field to confirm wetland edges across the Project Area. A total of five wetlands were identified within the Project Area and these wetlands are shown on Figure 14. The southern-most boundary of Wetland 3 was not fully delineated as it will not be affected by the Project.

A minimum setback of 30 meters will be maintained from all wetland habitat for the construction of the turbine pad, access road and other miscellaneous infrastructure associated with the Mulgrave Community Wind Project.

Table 13. Field identified wetlands within the Project Area

Wet-land	Wetland Type	Approximate Area (ha)	Description
1	Freshwater Marsh	1.174	Wetland 1 is a Cattail dominated freshwater marsh, in a headwater position. It collects drainage from adjacent upland, and flows south through a small watercourse into Wetland 2. Wetland 1 is dominated by Broad-leaved Cattail, but it also contains American Burreed, Speckled Alder, and several sedges and grasses. Wetland 1 is has standing water within the cattails, but no open water is present. This organic soil indicates a histosol soil type. Some evidence of an old logging road exists near the southern portion of the wetland, and a potential trail along the western edge.
2	Shrub Swamp	8.395	Wetland 2 is a mixed wood shrub swamp, with Red Maple, Balsam Fir and Yellow Birch dominating the canopy cover. The shrub and sapling layer include saplings of these same species, along with Mountain Holly, Speckled Alder and Wild Raisin. Herbaceous vegetation within Wetland 2 includes a variety of ferns such as Cinnamon Fern, Sensitive Fern, Crested Shield Fern and Long Beech Fern. The wetland is generally in a headwater position, even though a small watercourse collects surface flow from Wetland 1, and it is connected to Wetland 3 via another small watercourse. Wetland 1 drains generally towards the southeast. Thick organic soil indicates a histosol soil type, and although the amount of standing water is negligible, wetland hydrology is present as indicated by saturation of the soil and a high water table.
3	Mixed wood treed swamp	6.155	Wetland 3 is a mixed wood treed swamp, with very similar vegetative diversity and structure to the community found in Wetland 2. Wetland 3 collects some surface flow from Wetland 2 via a small watercourse, although it is generally in a headwater position. Thick organic soil indicates a histosol soil type, and the presence of standing water to a depth of approximately 30 cm (along with saturated soil and high water table) confirm wetland hydrology is present. Wetland 3 is generally undisturbed, with the exception of a small trail which runs across the northern portion of the Wetland. A watercourse is present draining south through the central reaches of this wetland habitat. This watercourse has moderate fish habitat potential; however, this habitat may have been altered by the presence of downstream beaver dams.
4	Herbaceous Swamp	0.036	Wetland 4 is an isolated, open herbaceous swamp. A rapid assessment for wetland vegetation was completed within Wetland 4. This Wetland lacks tree, sapling and shrub cover. The herbaceous vegetation is dominated by Sensitive Fern, Bluejoint Reed Grass and Soft Rush. The water table is present at surface, and the organic soil is saturated.
5	Coniferous Treed Swamp	1.665	Wetland 5 is a coniferous treed swamp. A rapid assessment for wetland vegetation was completed in Wetland 5. It is dominated by Black Spruce, emerging from a sphagnum dominated ground cover. The northern tip of Wetland 5 is dominated by Broad-leaved Cat-tail,

Wet-land	Wetland Type	Approximate Area (ha)	Description
			with occasional Sensitive Fern. Organic soil is saturated at the surface, and the water table is high throughout the Wetland. Wetland 5 has a watercourse outlet which flows north towards Morrison Lake.

All wetlands identified within the Project Area are in a terrene landscape position, meaning they are located high in a watershed and serve as part of the headwater system. Field assessment suggests that the wetlands are typically formed in areas where rain and minimal surface flow collects in shallow depressions with bedrock located a short depth below the soil layers, creating a "perched" water table. The water source for most of the wetlands is seasonal channels or surface sheet flow that results from rainfall.

Wetlands at the Project area are all similar in that they have limited to no open water areas, are generally treed with minimal sapling/shrub understory, and have some depth of peat layer. Wetland 1 is a freshwater marsh habitat. Wetland 3 does have a watercourse present within its habitat draining south and outside the Project Area.

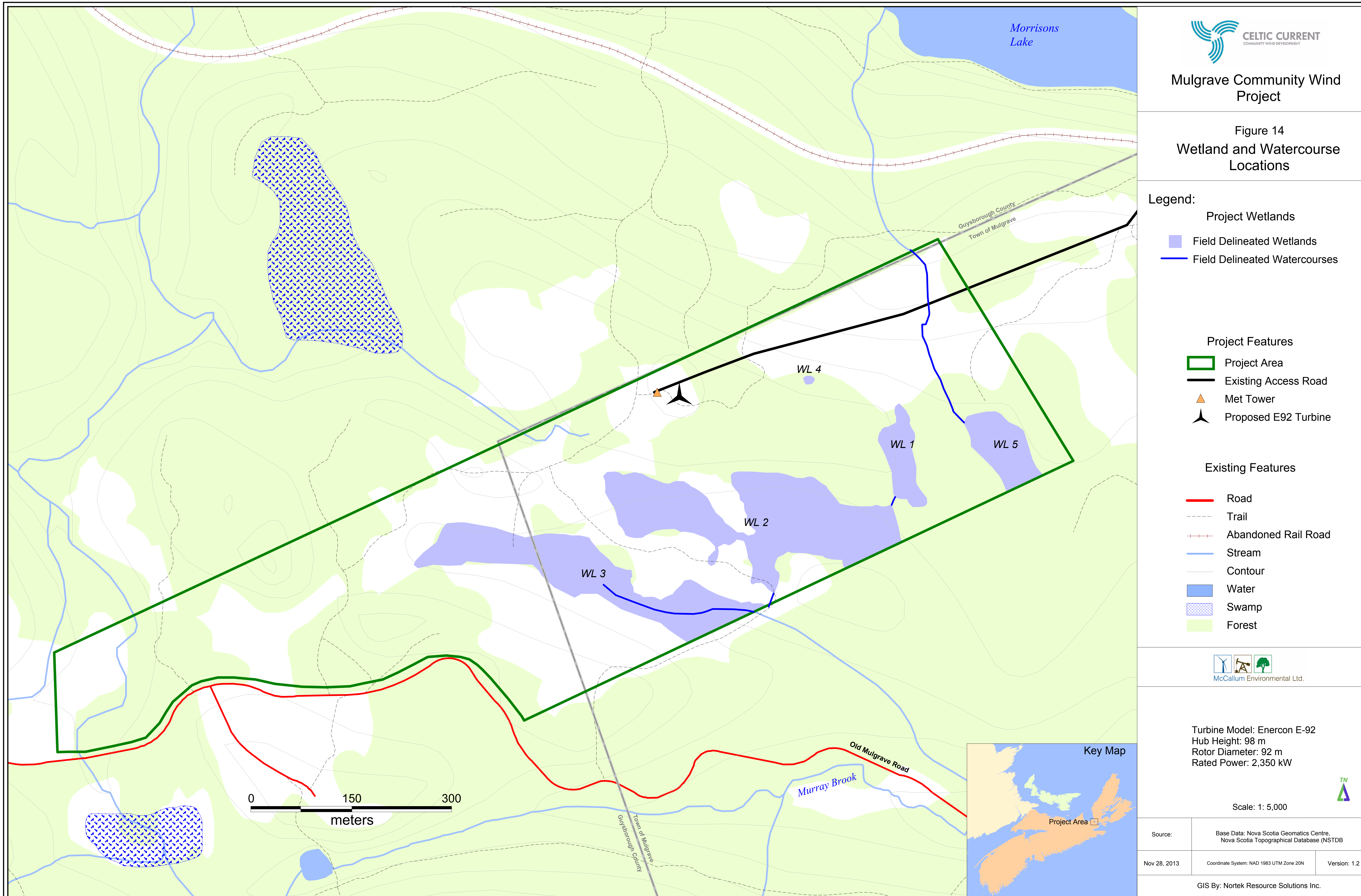
Photo 12. Graminoid swamp wetland typical of the Project Area.

The characteristics of the wetland systems encountered within the Project boundaries were similar in the following respects:

- Soils display evidence of either periodic or sustained saturation;
- It is expected that the recharge wetlands within the Project boundaries, the surrounding lands watershed complex, and the surface topography contribute to the aquifer quality

throughout the region. None of the encountered wetland areas are expected to contribute to aquifer water quality to a greater extent than surrounding areas;

- No water supplies are withdrawn from the wetlands;
- The quality and quantity of vegetation surrounding the wetlands (generally speaking) provide limitations to erosion potential of surrounding lands into the watershed system. Encountered wetlands do not appear to provide erosion control as a function;
- The quantity of vegetation, the low slopes surrounding the wetlands, and the lack of distinguishable flow channels which directly influence water levels suggests that sediment flow to the wetlands are limited and sediment flow stabilization is not a significant characteristic of the wetlands encountered;
- During periods of low precipitation, the wetlands provide nutrient supplies to dependent wildlife. Wildlife indicators around assessed wetlands (i.e. tracks, browse utilization, visible sightings) suggest that the habitat is an integral requirement of species in the area. Vegetation is consistent with neighbouring wetland areas and as such the wetlands do not appear to provide regionally or locally unique habitat;
- Based upon the results of the public consultation and field assessments, there is no evidence to suggest that any social/commercial/or cultural values are influenced by the wetlands encountered.


Morrisons Lake
Guysborough County
Town of Mulgrave
WL 4
WL 1
WL 5
WL 2
WL 3
Old Mulgrave Road
Murray Brook
0
150
300
meters
Key Map
Project Area
CELTIC CURRENT
Mulgrave Community Wind Project
Figure 14
Wetland and Watercourse Locations
Legend:
Project Wetlands
Field Delineated Wetlands
Field Delineated Watercourses
Project Features
Project Area
Existing Access Road
Met Tower
Proposed E92 Turbine
Existing Features
Road
Trail
Abandoned Rail Road
Stream
Contour
Water
Swamp
Forest
McCallum Environmental Ltd.
Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW
TN
Scale: 1: 5,000
Source:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB
Nov 28, 2013
Coordinate System: NAD 1983 UTM Zone 20N
Version: 1.2
GIS By: Nortek Resource Solutions Inc.

6 SOCIO-ECONOMIC CONDITIONS

The Project is located in Guysborough County, Nova Scotia, near the Canso Causeway which divides the Nova Scotia mainland from Cape Breton Island. Although the project is within the Town of Mulgrave in Guysborough County, there could be employment and other socioeconomic effects that accrue to the rest of the county and neighbouring counties. Background on the area and populations of the town and county are summarized below.

6.1 Population and Demographics – Cape Breton County

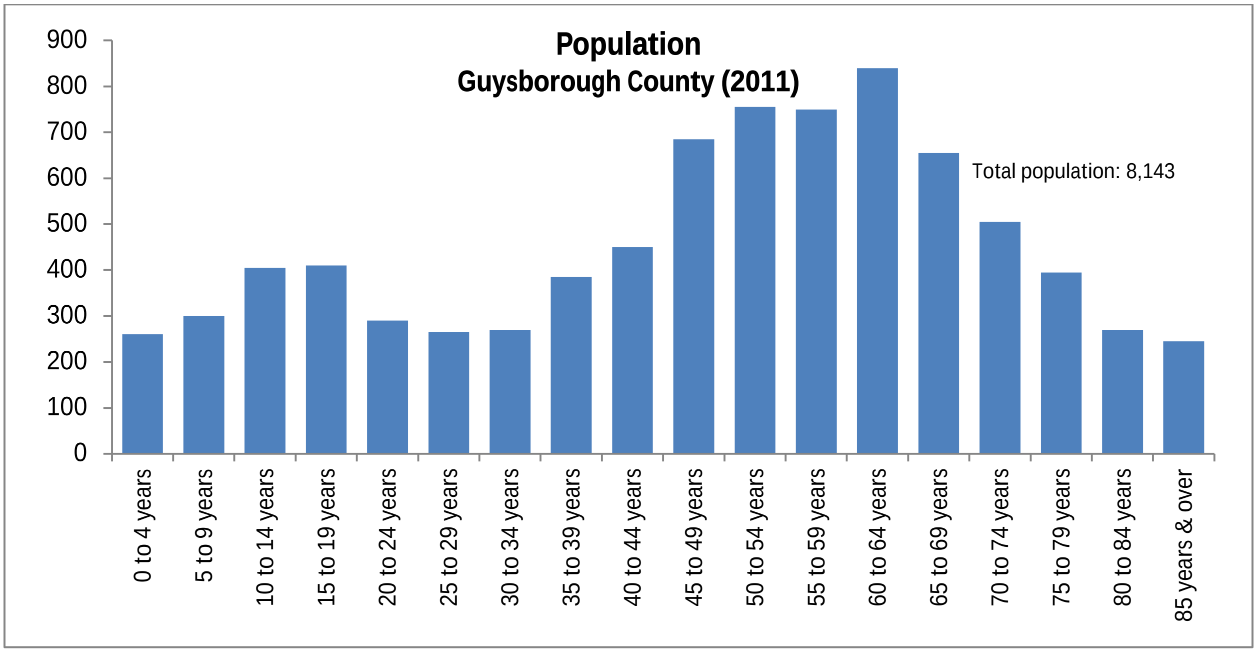
Guysbourough County, the 2nd least populous county in Nova Scotia, had a total census population of 8,143 in the year 2011, approximately 0.9% of the Provincial population. Over the past five years, the population of the county has declined 10.1% while the population for the Province increased by 0.9%. The Town of Mulgrave (Census subdivision) had a population in 2011 of 790 (415 male, 375 female). Mulgrave is losing population; the town had a population of 879 in 2006.

Table 14. Population and Demographics

	Guysborough County	**Nova Scotia**
Population in 2011	8,143	921,727
Population in 2006	9,058	913,462
2006-2011 Population Change (%)	-10.1	0.9
Total private dwellings (2011)	3,686	442,155
Total number of households (2011)	3,685	390,280
Population density per square km (2011)	2.0	17.4
Land area (square km) (2011)	4,044.2	52,939.4
Median Age of the Population (2011)	52.3	43.7

The population of Guysborough County has a median age of 52.3 years, considerably older than that of the province as a whole, which has a median age of 43.7.

Figure 15: Population by Age Cohort, Guysborough County



Source: Statistics Canada 2011 Census of Population Community Profiles

Median income in Guysborough County (2011) for persons 15 years and older with income was $21,421, of which 57.6 percent of income came from earnings, while 30.8 percent came from Government Transfers.

6.2 Health, Industry and Employment

The Mulgrave area is served by the Guysborough Antigonish Strait Health Authority (GASHA). The Guysborough Antigonish Strait Health Authority is served by St. Martha's Regional Hospital, the Strait Richmond Hospital, Guysborough Memorial Hospital, St. Mary's Memorial Hospital, and the Eastern Memorial Hospital. Not all of these facilities are on the Cape Breton side of the Canso Causeway. This health authority covers nine municipal units in its catchment area, including the Town of Port Hawkesbury, the Municipality of the County of Richmond, and the Municipality of the County of Inverness. The health authority employs over 1,000 individuals.

Table 15. Labour Force by Industry, Guysborough County

Industry	Total	Male	Female
Total labour force population aged 15 years and over by industry - North American Industry Classification System (NAICS) 2007	3,675	1,975	1,700

Industry	Total	Male	Female
Agriculture; forestry; fishing and hunting	675	595	85
Mining; quarrying; and oil and gas extraction	80	60	15
Utilities	20	25	0
Construction	395	340	60
Manufacturing	250	140	105
Wholesale trade	30	25	0
Retail trade	360	95	265
Transportation and warehousing	140	110	30
Information and cultural industries	20	0	10
Finance and insurance	55	0	55
Real estate and rental and leasing	50	20	30
Professional; scientific and technical services	50	0	45
Management of companies and enterprises	0	0	0
Administrative and support; waste management and remediation services	130	50	75
Educational services	255	90	160
Health care and social assistance	420	45	380
Arts; entertainment and recreation	135	65	65
Accommodation and food services	175	35	140
Other services (except public administration)	160	125	35
Public administration	290	145	145

Source: Statistics Canada 2011 National Household Survey

About 54 percent of the experienced labour force in Guysborough County is male. In 2011, the majority of the labour force worked in the service producing industries. Health care and social assistance (11.4%), retail trade (9.8%), and educational services (6.9%) are the largest employers. Accommodation and food services and other services would be included in the tourism sector, which would also be supported by the Wholesale and Retail trade industries. Nearly 18 percent of the labour force in the county worked in the construction and manufacturing industry combined.

The participation rate (the percentage of working age population in the labour force) in 2011 for the county was 53.2 percent, lower than the provincial average of 63.1 percent. The unemployment rate for Guysborough County in 2011 was 15.3 percent, substantially higher than the provincial average of 10.0 percent.

6.3 Industry and Tourism

The Strait Region and nearby Cape Breton have a long history of natural resource and manufacturing based industries. From hundreds of years of coal mining in industrial Cape Breton to a long tradition of pulp and paper industry in the Strait Region, the primary and manufacturing sectors have helped shape the regions.

Today, there is still primary industry in forestry and fishing, and less in mineral resources. Recent developments in the Strait region have caused the paper producing industry to change hands. A newly re-started paper mill in Port Hawkesbury now employs just over half the workforce that it did in recent years. The ice free port at the Strait of Canso is an asset for shipping mined materials, and the Mulgrave area is home to new business in manufacturing food supplements and the Mulgrave Marine Industrial Park, in the Strait of Canso Superport.

Nova Scotia markets itself as a tourism destination, with a tourism industry that contributes more than $722 million to provincial GDP (2010), and with direct and spinoff employment of 34,400.

The tourism industry is important to the area, and tourists are drawn to nearby Cape Breton, with vast wild areas, the scenic Bras d'Or lakes, and Cabot Trail that skirts the top of Cape Breton Island and the Cape Breton Highlands National Park. Provincial parks in the area include Dundee, Burnt Island, Port Michaud beach, Battery, and the Isle Madame parks (Lennox Passage and Pondville Beach).

Within Guysborough County, there are nearby provincial parks at Boylston and Salsman, and day use parks with beach and picnic sites at Port Shoreham, Tor Bay, and Black Duck Cove.

In 2002, MORI (Market & Opinion Research International) completed an independent research study on the "Economic Impacts of wind farms on Scottish tourism" for the British Wind Energy Association (BWEA) and the Scottish Renewables Forum. (Market & Opinion Research International, March 2008) MORI interviewed 400 tourists visiting Argyll and Bute, Scotland, an area chosen because, at the time, had the greatest concentration of wind farms in Scotland. In addition the tourism industry in the region has a strong reliance on the area's high landscape value (the study indicates that 48% of the respondents who came to the area reporting doing so for the scenery). (Market & Opinion Research International, March 2008)

The MORI study indicates that forty (40%) percent of tourists interviewed were aware of the existence of wind farms in the area and when asked whether this presence had a positive or negative effect, 43% indicated that it had a positive effect, while a similar proportion (43%) felt it made no difference. 8% felt that it had a negative effect.

In comparison, a 2003 study was completed for the Wales Tourist Board (NFO World Group, 2003) in response to an inquiry from the Welsh Assembly to "assess the effects of renewable energy, and particularly wind farms, on tourism." (NFO World Group, 2003) This study used a 266 person sample size and found that overall 78% of respondents were positive or neutral towards wind farms, with 21% negative, and 1% with no opinion.

6.4 Property Values

There were 3,690 private dwellings in Guysborough County in 2011, with an average value of $129,412 (35.9% lower than the Provincial average). About 88 percent of dwellings in Guysborough County were owned, and the majority (82.5%) of dwellings was constructed prior to 1990.

The concern that property values will be adversely affected by the Project is a concern raised at other wind power projects throughout North America. In 2009, the most comprehensive study known (at that time) was commissioned by the U.S. Department of Energy to determine if this impact does in fact exist. (Hoen, Wiser, Cappers, Thayer, & Sethi, 2009) The study collected data on almost 7,500 sales of single family homes situated within 10 miles of 24 existing wind facilities in nine different U.S. states. (Hoen, Wiser, Cappers , Thayer, & Sethi, 2009) In addition, the study reviewed a number of data sources and published material. Although that reviewed information addressed concerns about the possible impact of wind energy facilities on the property values of nearby homes, Hoen et al. found that "the available literature that has sought to quantify the impacts of wind projects on residential property values has a number of shortcomings". The list of shortcomings identified in that study (Hoen, Wiser, Cappers , Thayer, & Sethi, 2009) are as follows:

1. Studies relied on surveys of homeowners or real estate professionals, rather than trying to quantify real price impacts based on market data;
2. Studies relied on simple statistical techniques that have limitations and that can be dramatically influenced by small numbers of sales transactions or survey respondents;
3. Studies used small datasets that are concentrated in only one wind project study area, making it difficult to reliably identify impacts that might apply in a variety of areas;
4. Many studies had no reported measurements of the statistical significance of their results;
5. Many studies have concentrated on an investigation of the existence of Area Stigma, and have ignored Scenic Vista and/or Nuisance Stigma;
6. Only a few studies included field visits to homes to determine wind turbine visibility and collect other important information about the home (e.g., the quality of the scenic vista); and,
7. Only two studies have been published in peer-reviewed academic journals.

Ultimately, the Hoen et al. study indicated that "none of the models uncovers conclusive evidence of the existence of any widespread property value impacts that might be present in communities surrounding wind energy facilities. Specifically, neither the view of the wind facilities nor the distance of the home to those facilities is found to have any consistent, measurable, and statistically significant effect on home sales prices. Although the analysis cannot dismiss the possibility that individual homes or small numbers of homes have been or could be negatively impacted, it finds that if these impacts do exist, they are either too small and/or too infrequent to result in any widespread, statistically observable impact." (Hoen, Wiser, Cappers , Thayer, & Sethi, 2009)

Critiques have been developed in response to the Hoen report, notably by Wayne Gulden at Wind Farm Realities (2010) and Albert Wilson in 2010. These both outline concerns with methodology in the Hoen report including the conclusion that the analytical methods can not be shown to be reliable or accurate (Gulden 2010 and Wilson 2010). Another study completed by Gardner Appraisal Group Inc. in Texas, USA (Gardner 2009) states that “ market data and common sense tell us property values are negatively impacted by the presense of wind turbines.” (Gardner 2009). This study was completed for a conference in February 2009.

As a follow up to the Hoen et al. study completed in 2009, a recent study published in August 2013 was conducted to address these apparent gaps in data. This study, completed by Berkeley National Laboratory, involved the collection of data from 51,276 homes across 27 counties and nine states in the USA relating to 67 different wind facilities (Hoen et al, 2013). All homes included in the study were within a 10 mile radius of a wind power project and 1,198 homes were within a 1 mile (1.6 km) radius of a wind power project.

The results of the study revealed no statistical evidence that home values near turbines were affected in the post-construction or post-announcement/pre-construction periods. Therefore, the authors conclude that if effects do exist, either the average impacts are relatively small (within the margin of error in the models) and/or sporadic (impacting only a small subset of homes) (Hoen et al. 2013).

Further review of available literature did not find significant additional studies to aid in determining effect of wind projects on surrounding property values.

6.5 Recreation

Land use is dominated by active timber harvesting and there is only limited hiking, birding and general human activity within the Project Area. There are no public trails within the Project Area, but small ATV and hiking trails do exist, most likely along old logging trails. All-Terrain Vehicles (ATV) use is present within the Project area along these old logging trails. No other public recreational lands exist within the Project boundaries.

The closest Provincial Park to the Project Area is Boylston Provincial Park located 21 km south of the Project Area in Boylston, Nova Scotia. This park is a camping and picnic location. Bayfield Beach, located along the north shore of Nova Scotia, is located 23 km northwest of the Project Area near the community of Afton Station.

7 ARCHAEOLOGICAL RESOURCES

Two phases of the archaeological resource impact assessment were completed for the Mulgrave Community Wind Project. The first, Phase I, was a historical assessment of the potential for archaeological resources to be present inside the Project Area. The second, Phase II, was the field reconnaissance program and was completed for the proposed three turbine layout of this project. . The results described below are taken directly from the assessment completed by Davis McIntyre & Associates.

7.1 Phase I

The Maritime Archaeological Resource Inventory was accessed on May 9th, 2013 in order to determine if known archaeological sites of resources exist within or near the study area.

Seventeen archaeological sites were identified by DM&A around the Mulgrave Community Wind Project area in 2013 (Permit A2013NS030). Most date to the 19th and early 20th centuries. Among the sites are house foundations, field clearing stone piles, stone walls and terraces, and sites with unknown functions and dates. None of these sites fall within study area for the proposed wind power project.

There is no strong evidence of prolonged settlement in the study area from the 18th to 20th century. James and Alexander Legertwood received the earliest land grants in the area when they were each awarded 500 acres on August 10th, 1811. The Legertwood's land stretched from the edge of Grant's Lake to the shores of the Straight of Canso, abutting the northern boundary of land granted to Alexander Cumming (Figure 3.2.2-1). Of Scottish descent, Cumming was granted 240 acres in 1785 as part of the regimental grant, and was given double the acreage typically awarded to privates. Official documentation of the size of these grants differs from the Crown Land Map which shows Alexander Cumming with a parcel of 500 acres while Alexander Legertwood holds a grant of 207 acres. The reason for this discrepancy is not known.

James and Alexander Legertwood do not feature prominently in written history. It is not known whether they eventually settled and worked the land they were granted. The general study area does contain a portion of the old rail bed from the Inter-Colonial Railway to Mulgrave, built in 1882. An 1884 Geological Survey of Canada map shows settlement east of the northern tip of Grant's Lake but outside of the study area. A mill is depicted to the west, close to the railway, again outside of the study area

It was recommended that an archaeological reconnaissance be conducted once the locations of the turbines, access roads, and other necessary infrastructure were known, and before any ground disturbance (Phase II).

7.2 Phase II

An archaeological field reconnaissance was conducted on May 7th, 2013 directed by Stephen Davis. The reconnaissance included an access road that had been built of granite gravel prior to reconnaissance as well as a meteorological (MET) tower and its cleared pad at the termination of the road.

No evidence of past cultural use, with the exception of logging, was found at the site, which had already been disturbed prior to reconnaissance. The primary resource of this area, timber, continues to attract forestry activity to the present, but the area offered little incentive to historic settlement. A lack of navigable or bountiful waterways makes First Nations occupation unlikely, especially with several more appealing areas close-by. However it is acknowledged the hill and surrounding forests may have been used for hunting and gathering. Archaeological evidence of this activity is unlikely to exist.

A second archaeological field reconnaissance was conducted on May 31st directed by Stephen Davis. This work was facilitated by handheld GPS, project maps of the area and detailed field notes and photographs were taken. The purpose of the reconnaissance was to survey the candidate site for Turbine 1 and also survey the candidate sites for Turbine 2 and Turbine 3. No additional changes had been made to the access road, the MET tower pad, or the surrounding area since the original assessment on May 7th, 2013 by DM&A.

The proposed site for Turbine 1 was located about 40m east of the edge of the MET tower pad. It was accessed by an old bulldozed logging road. Moss-covered stumps in the area and the young growth of mixed hardwood attests to forestry being conducted sometime in the recent past. Multiple smaller trails break off from the old road, providing further evidence that this area has been disturbed by logging activity.

The second turbine site was southwest of the MET tower pad and was again accessed off of an old logging road. The surrounding area was of mixed hardwood, and the understory had some berry bushes beginning to grow. Modern dumping of plastic and rusting metal was noted in the area. Evidence of clear cutting was present.

The site for Turbine 3 is located further southwest from the site for Turbine 2. It was accessed by hiking in south from the old logging road, down a slope inclined at about 40 degrees. Glacial erratics dotted the hillside and level area of the turbine site. The area showed clear evidence of past disturbance from logging. Push-out from bulldozing was present in the area, as well as cut-stumps and new growth. The forest was new growth of mixed wood.

No evidence of Pre-Contact or historic activity with the exception of logging was found in at any of the three sites. The proposed sites for the turbines would appear to offer little incentive to settlement, timber being the main resource attracting cultural activity. As noted in the earlier field reconnaissance, First Nations occupation is unlikely though the surrounding hills and forests may have been used for hunting and gathering. Archaeological evidence of this activity is unlikely to exist.

The report in its entirety can be found in Appendix V.

8 OTHER CONSIDERATIONS

8.1 Sound

Wind turbines generate sound from two primary sources: the mechanical equipment (gearbox and generator), and the aerodynamic sound from the interaction of the air with the turbine parts, primarily the blades (NRC 2007). In modern turbine designs, much of the mechanical sound is mitigated through the use of noise insulating materials.

Aerodynamic noise, produced by the flow of air over blades, is created by blades interacting with eddies created by atmospheric inflow turbulence and is thus an unavoidable aspect of wind power operations (NRC 2007). The propagation of sound from the turbine source to a receptor, such as a residential dwelling, is influenced not only by the sound power level emitted from the turbine, but also by local factors such as distance to the receptor, topography, and weather conditions (Hau 2006). For example, increases in wind speed result in increases in ambient, natural noise (from vegetation movement) that can mask the sounds emitted from the turbine(s) (NRC 2007).

Nova Scotia has no specific sound regulations for wind projects. Through the environmental assessment process, NSE requires that predicted noise levels at identified residential receptors (as well as camps/cottages, daycares, hospitals and schools) not exceed 40 dBA. As this guideline is intended to be protective of human sleep disturbance, 40 dBA does not apply to commercial or vacant lot receptors. This guideline was used in the current sound assessment for the Mulgrave Community Wind Project.

Construction and decommissioning activities will generate noise from the use of heavy machinery and vehicles, and potential blasting if necessary during the construction period and decommissioning phase. These impacts will occur during normal working hours, be short in duration, and given the rural and industrial location of the Project (adjacent to several quarries), are not expected to be a significant impact on the surrounding communities.

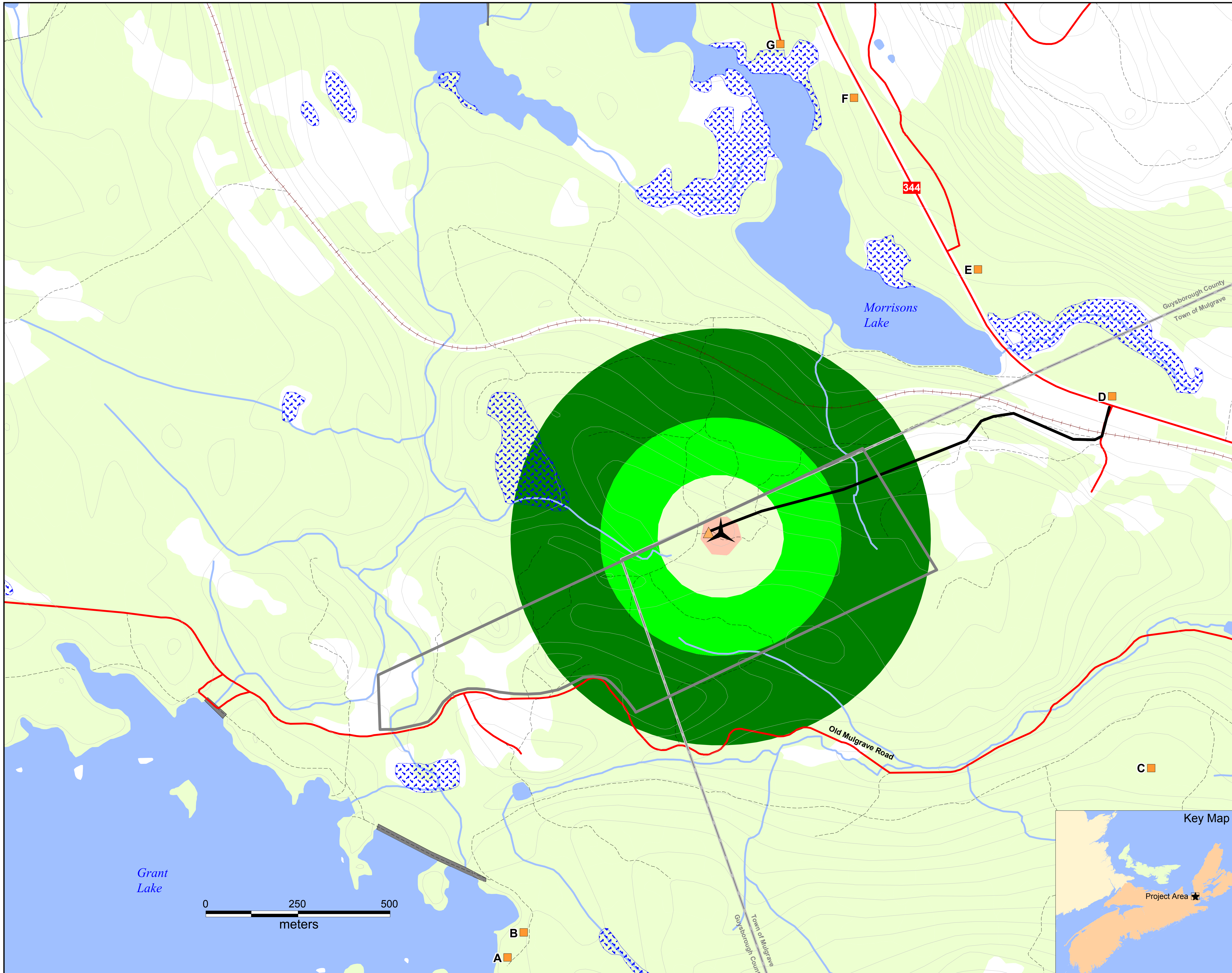
A Sound Impact Assessment (SIA) has been completed for this Project by AL-PRO Wind Energy Consulting Canada Inc. (AL-PRO). This report can be found in Appendix VI.

No sensitive receptors (hospitals, schools, elderly care facilities, daycares) are present within a 2 km radius from the Project Area. All residential receptors present within a 1500 m radius of the Project area were identified during field assessments in 2013. A total of seven receptors were identified within 1500 m (3 residential, and 4 seasonal/camps/cottages).Characteristics of each residence (i.e. number of stories, permanent residence, seasonal, hunting camp) were recorded.

The closest distance between the Mulgrave Community wind turbine and a Point of Reception is 1008 m (receptor E). This receptor is located northeast of the Project Area on the east side of Highway 344. This receptor is expected to receive a combined sound pressure of 34.4 dBA from the Mulgrave Community Wind Project.

The second closest receptor is located 1135 m from the turbine and is identified as Point of Reception D. This receptor is located directly east of the Project Area on the east side of Highway 344. This receptor is expected to receive a combined sound pressure of 33.06 dBA from the Mulgrave Community Wind Project.

The noise level at each Point of Reception within 1500 m of the turbine proposed for the Mulgrave Community Wind Project was calculated (see attached report). The results show that the Mulgrave Community Wind Project complies with the applicable environmental sound threshold of 40 dBA. The SIA was modelled for the single turbine. However, AL-PRO did complete a second model run with the proposed small 50 kW turbine to determine if the small turbines would contribute to overall sound output at each receptor. The results of this model run indicated that the two smaller turbines will not contribute to an increase in sound output at the receptors. Should these turbines be considered in the future, the results of this SIA will be confirmed and provided to NSE. A sound iso-contour map illustrating the contribution of the all wind turbines is shown in the following Figure 16.



CELTIC CURRENT

Mulgrave Community Wind Project

Figure 16
Predicted Sound Pressure Levels at 8 m/s

Legend:

Sound Pressure (dBA)
- 40
- 45
- 50
- 55

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water
- Swamp
- Wetland
- Forest
- 2 Receptor with ID

McCallum Environmental Ltd.

Modeled using:
DIN ISO 9613-2
Acoustics - Attenuation of sound during propogation outdoors

Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW

Scale: 1: 10,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB	
Nov 28, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.

8.2 Visual

Any loss of aesthetic value associated with the Project may be as a result from the physical presence of new turbines, trails, increased traffic, and changes in vegetation and wildlife communities. The greatest impact will be associated with the physical presence of the turbine.

Currently, no data is available which indicates how wind power project visual thresholds are defined or exceeded. Therefore it is assumed that much of the aesthetic value is perceived by residents and visitors to the area. In order for the public and regulatory personnel to effectively estimate the visual effect of the Project, the following was completed:

1. A visual representation of the Project from 4 vantage points surrounding the Project Area. The visual representations were provided in poster board format to the public during an Open House on October 22, 2013 at the Town of Mulgrave Fire Hall. They are found in Appendix VII.

2. Visual zone of influence analysis. This study uses line of site analysis and incorporates a Digital elevation Model (DEM) obtained from the Nova Scotia Topographic database (1:10,000), the Nova Scotia Forest Inventory database, turbine specific characteristics (hub height, rotor diameter) to create a model that defines the areas from which the tip heights of the turbines can be seen. The incorporation of mean stand height from the forest database provides a realistic viewshed which assumes the observer has an eye height of 1.5 m a.g.l. and that all forests above 1.5 obscure the line of site (Summer conditions). The resultant model identifies whether the turbine will be seen from a geographic area (within which a specific receptor may be located). This map is included in Appendix VII.

In addition to visual impacts and aesthetics experienced by residents, the Project will affect the visual characteristics and, therefore, opinions of visitors to the region. Nova Scotia markets itself as a natural, coastal destination. From a tourism perspective, the question of how the Project will impact the visitor experience from the local scenic perspective is unknown, as that experience highly subjective.

8.3 Shadow Flicker

The objectives of this analysis are to determine (through computer modeling) the possible visual effects of the designed wind project on the surrounding, local residences.

Shadow flicker caused by wind turbines is defined as alternating changes in light intensity due to the moving blade shadows cast on the ground and objects (including through windows of residences). The effects of shadow flicker are more prevalent when the sun is low in the sky at either sunrise or sunset. The shadow flicker footprint is largest during the winter solstice (December 21st) and is smallest during the summer solstice (June 21) when the suns arc through the sky is higher.

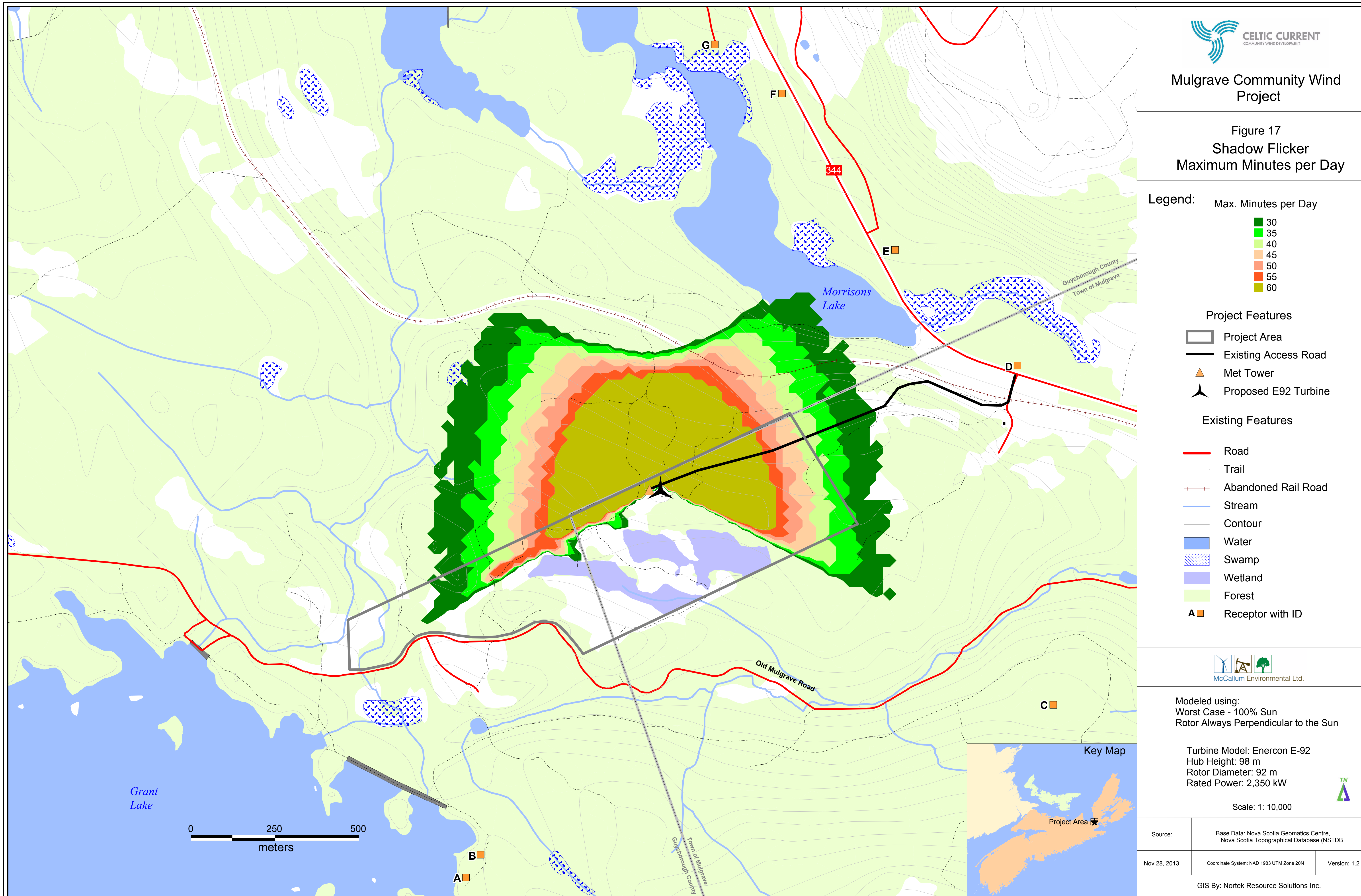
There are no municipal, provincial, or federal regulations related to shadow flicker, but many jurisdictions (including NSE) have adopted the standard of no more than 30 hours of shadow flicker per year, or no more than 30 minutes of shadow flicker on the worst day of the year at receptor locations (e.g., dwellings, cottages/camps, hospitals, schools, and daycares). These guidelines were developed in Germany and are now included under that country's Federal Emission Control Act (as cited in Haugen 2011).

The shadow flicker assessment was completed by AL-PRO and is attached to this document as Appendix VIII. A modeling exercise was completed utilizing the turbine specifications for the Mulgrave Community Wind Project to determine potential shadow flicker associated with the Project. The potential shadow flicker at multiple Points of Reception surrounding the Project Area was also calculated (see attached report).

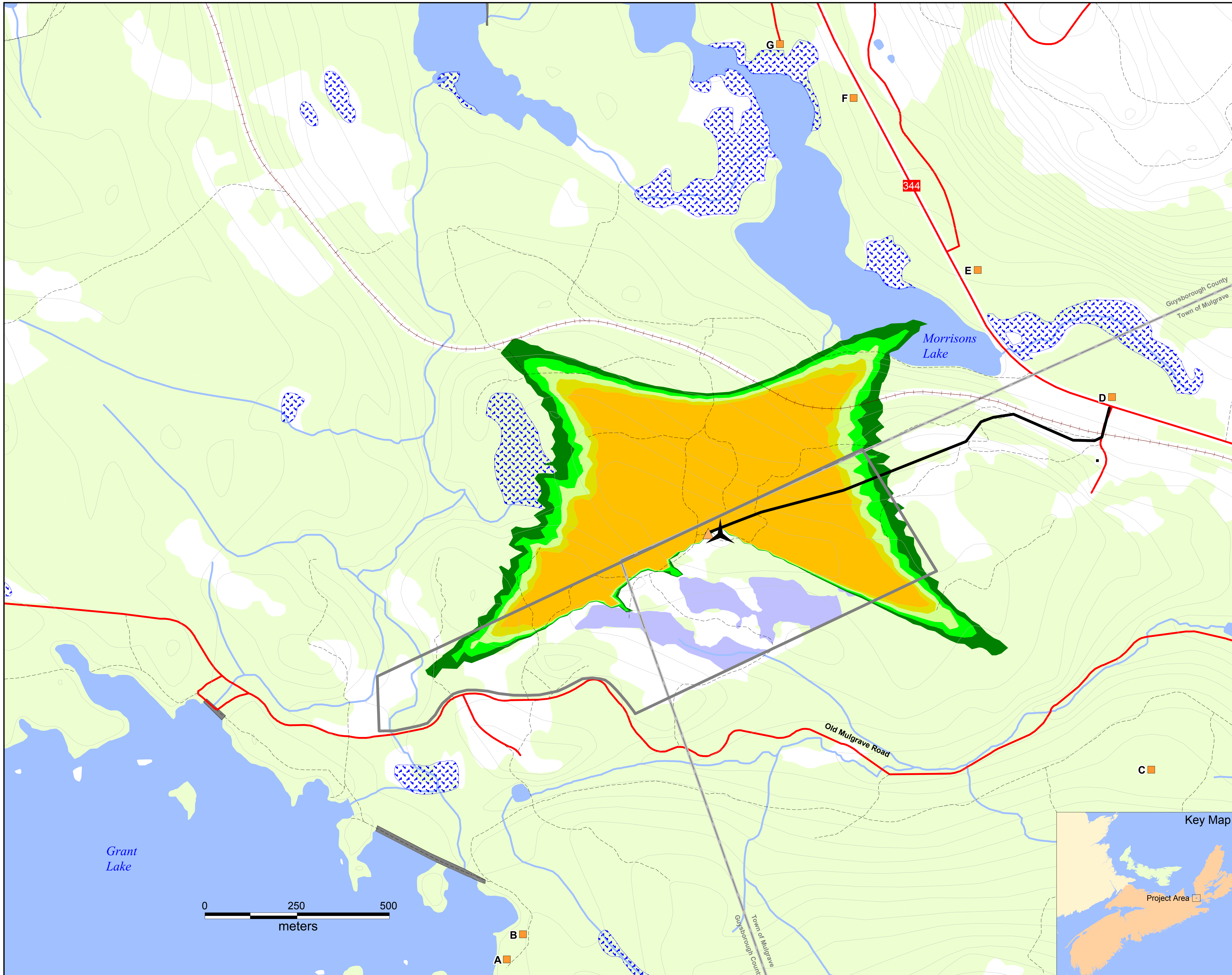
The closest distance between the Mulgrave Community wind turbine and a Point of Reception is 1008 m between receptor E. This receptor is located northeast of the Project Area on the east side of Highway 344. This receptor is expected to receive a maximum of 24 minutes/day and 20hr 29 minutes/year from the Mulgrave Community Wind Project under a worst case scenario (No cloud cover, turbine is always spinning and is always perpendicular to the sun).

The second closest receptor is located 1135 m from the turbine and is identified as Point of Reception D. This receptor is located directly east of the Project Area on the east side of Highway 344. In a worst case scenario (described above), this receptor is expected to receive a maximum of 19 minutes/day and 6hrs 3 minutes/year from the Mulgrave Community Wind Project.

The results show that the Mulgrave Community Wind Project is expected to comply with the shadow flicker thresholds of 30 minutes/day and 30 hours/year. Two figures illustrating the extent of shadow flicker from the Project (30 minutes/day and 30 hours/year) are shown in the following Figures 17 and 18.



CELTIC CURRENT
Mulgrave Community Wind Project
Figure 17
Shadow Flicker
Maximum Minutes per Day
Legend:
Max. Minutes per Day
30
35
40
45
50
55
60
Project Features
Project Area
Existing Access Road
Met Tower
Proposed E92 Turbine
Existing Features
Road
Trail
Abandoned Rail Road
Stream
Contour
Water
Swamp
Wetland
Forest
A Receptor with ID
McCallum Environmental Ltd.
Modeled using:
Worst Case - 100% Sun
Rotor Always Perpendicular to the Sun
Turbine Model: Enercon E-92
Hub Height: 98 m
Rotor Diameter: 92 m
Rated Power: 2,350 kW
TN
Scale: 1: 10,000
Source:
Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB
Nov 28, 2013
Coordinate System: NAD 1983 UTM Zone 20N
Version: 1.2
GIS By: Nortek Resource Solutions Inc.
Key Map
Project Area
Morrisons Lake
Grant Lake
Old Mulgrave Road
344
Guysborough County
Town of Mulgrave
A
B
C
D
E
F
G
0
250
500
meters



CELTIC CURRENT

Mulgrave Community Wind Project

Figure 18
Shadow Flicker Hours per Year

Legend:

Hour per Year
- 30
- 35
- 40
- 45
- 50

Project Features
- Project Area
- Existing Access Road
- Met Tower
- Proposed E92 Turbine

Existing Features
- Road
- Trail
- Abandoned Rail Road
- Stream
- Contour
- Water
- Swamp
- Wetland
- Forest
- A Receptor with ID

McCallum Environmental Ltd.

Modeled using:
Worst Case - 100% Sun
Rotor Always Perpendicular to the Sun

Turbine Model: Enercon E-92
Hub Height: 98 m
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Rated Power: 2,350 kW

TN

Scale: 1: 10,000

Source:	Base Data: Nova Scotia Geomatics Centre, Nova Scotia Topographical Database (NSTDB	
Nov 28, 2013	Coordinate System: NAD 1983 UTM Zone 20N	Version: 1.2

GIS By: Nortek Resource Solutions Inc.

8.4 Electromagnetic Interference

Due to their large size, wind turbines can interfere with radio waves emitted from telecommunication and radar systems. In response to these potential conflicts, the Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) have issued a set of guidelines which describe the methodology for assessing magnetic interference (EMI).

EMI created by a wind turbine can be classified in two categories:

1. Obstruction - occurs when a wind turbine is placed between a receiver and a transmitter, creating an area where the signal is weakened and/or blocked; and,
2. Reflection - caused by the distortion between a signal and a reflection of the signal from an object. Included within reflection is a sub-category called Scatter. Scatter is a result of rotor blade movement.

The specific characteristics of a wind turbine will influence the type and magnitude of the interference. Furthermore, wind turbines affect different types of signals in various ways as some telecommunication signals are more robust to interference than others.

A preliminary investigation of the potential conflict between the proposed Project and communication systems has been completed. Potential stakeholders relating to the Mulgrave Community Wind Power project and EMI have been contacted. The complete EMI report and consultation responses to date are included as Appendix IX. The results of the investigation are summarized as follows:

Table 16. EMI Systems and Proximity to the Project Area

System	Result
Point-to-Point Systems above 890 MHz	There are no radio link transmitters or receivers that are within 1.0 km of the proposed wind farm. Additionally, there are no links that pass within the recommended consultation zone.
Broadcast Transmitters	No AM transmitters within the 5 km omnidirectional antennae consultation zone. No FM Transmitters located within the 2.0 km consultation zone. No TV Transmitters within the 2.0 km consultation zone.
Over-the-Air Reception	A number of potential receivers are located within the 10 km consultation zone recommended by the RABC for digital Television transmitters. **A Broadcast Reception Study will be initiated.**
Cellular Type Networks	No cellular networks located within the 1.0 km

	consultation zone.
Land Mobile Radio Networks and Point-to-point Systems below 890 MHz	Non within the 1.0 km consultation zone
Satellite Systems	No ground satellite stations located within 500 m of the proposed wind farm. No dwellings or buildings located within the projected consultation cone.
Air Defence Radars, Vessel Traffic Radars, Air Traffic Control Radars and Weather Radars	DND Contacted – No Issues perceived Nav Canada Contacted – No radar sites within the recommended consultation zones. Vessel Traffic Systems – No Issues Weather Radar – Environment Canada contacted – No Issues **Port Hawkesbury Airfield located within the 10 km consultation zone. The airfield operator will be contacted.**
CBC Preliminary Report	**One CBC FM Transmitter within 5 km of proposed wind farm.** CBC has been contacted in regard to the proposed wind project. No digital TV Transmitters within 89 km of the site
VOR	There are no VOR sites located within the 15 km consultation zone.

9 PUBLIC ENGAGMENT SUMMARY

9.1 Public Consultation

Celtic Current believes that open, honest and transparent relationships are essential to their success. Celtic Current also believes that communities have a right to know about its activities in those communities. To this end, Celtic Current attempts to structure its community involvement program to:

- Ensure all stakeholders have the opportunity to learn about operations, and Projects, and are able to provide input;
- Create a positive relationship with stakeholders through community involvement and community investment;
- Work within the Project timeline;
- Resolve issues in a timely, friendly manner; and
- Do the right thing and be seen doing the right thing.

Community involvement at the Mulgrave Community Wind Project has been on-going since the commencement of the planning process for this community wind project in 2011.

- Celtic Current representatives have met with the Mayor (Marney Simmons) and Chief Administrative Officer (Hugh Landry) from the Town of Mulgrave on several occasions. The Town has offered its total support of the Celtic Current project.

- Celtic Current has also met with the Town of Port Hawkesbury Mayor (Billy Joe MacLean and received their verbal and written support of the Project.

- Celtic Current has received investment commitments for the Project from dozens of people who are from the Town of Mulgrave.

- In advance of the open house completed for the Mulgrave Community Wind Project, over 800 flyers were distributed by Canada Post to properties in the surrounding communities. These flyers announced the open house dates and location, as well as opened the line of communication directly with the Celtic Current project team if people had questions, comments or concerns, by providing each household with local contact information for Celtic Current.

- On October 22, 2013, Celtic Current hosted an open house at the Town of Mulgrave Fire Fall (6-8 pm). This provided residents and other interested parties an opportunity to view and discuss with Celtic Current representatives (2 in attendance) information on the Project and wind power in general. The Project was introduced to the community through a series of poster boards describing the Project, the environmental assessment process, bird and bat studies, and proposed and expected timelines for construction of the Project.

- 5 people attended the Open House (signatures on the sign in sheet provided at the front door);
- Attendees were encouraged to fill out comment cards. 1 comment card was received. This comment card was in support of the Project.

Photo 13. Public Open House on October 22, 2013

At the time of submission of the environmental assessment registration document, no concerns have been expressed by the public to either Celtic Current or McCallum Environmental.

9.2 Mi'kmaq Consultation & Traditional Use

Project details were submitted to the Kwilmu'kw Maw-klusuaqn Negotiation Office and the NS Office of Aboriginal Affairs on December 2, 2013. Details included a Project map, description of the work undertaken to date, and invitation to comment.

10 DISCUSSION OF IMPACTS

10.1 Valued Ecosystem Component Selection

The scope, methodology and baseline environmental conditions for the Mulgrave Community Wind Project have been described in detail in Sections 3 through 9 in this registration document. Each Valued Ecosystem Component (VEC), as identified and defined in the NSE *Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document*, May 2007 (updated January 2012), has been described and baseline environmental work has been completed to evaluate the site specific conditions relating to each VEC for the Mulgrave Community Wind Project.

Based on the environmental baseline work completed for each VEC over the course of an eighteen month period, and the expertise of the various members of the EA Project Team, evaluation of each VEC has been completed to determine which VEC could have potential residual effects once planned mitigation (Appendix I Environmental Protection Plan EPP) has been applied. This evaluation is described in Table 17. VECs with identified potential residual effects are carried forward (in Section 10.2) for further discussion of significance of potential effects.

Table 17.Valued Ecosystem Component (VEC) Evaluation of Potential Residual Effects

VEC Category	Valued Ecosystem Components (VECs)	Description of Impacts	Mitigation	Residual Effects (Section 10.2)	Applicable Section of Report
Atmospheric Environment	**Weather and Climate** **Air Quality**	Potential impacts to localized air quality conditions: · Increase in air emissions due to increased usage of equipment and vehicles during construction and operation; and, · Generation of dust during construction activities.	Project-related air emissions and dust are expected to be temporary and localized in nature. Mitigation for these effects is provided in Environmental Protection Plan (EPP)	No	Description of VEC Section 5.2 Mitigation Recommendations Appendix I EPP
Geophysical Environment	**Physiography and Topography** **Surficial Geology** **Bedrock Geology** **Hydrogeology and Groundwater**	Potential impacts include Localized disturbance of surficial soils and shallow bedrock; · Potential for Acid Rock Drainage (ARD); and, · Damage from blasting activities to potable groundwater supplies.	Geotechnical investigations are necessary and the need for blasting has not yet been identified. The need for mitigative measures or monitoring programs relating to potable water resource will be determined post-geotechnical evaluation and determination of blasting needs The likelihood of ARD occurring on site is considered low but will be fully determined once geotechnical assessment has been completed. Project-related effects to the geophysical environment are expected to be temporary and localized. Mitigation for effects is provided in the EPP.	No	Description of VEC Section 5.3 Mitigation Recommendations Appendix I EPP

Terrestrial Environment	**Vegetation** **Herpetofaunal species** **Mammals**	Potential terrestrial impacts to flora and fauna. Please note, species of conservation interest and species at risk, birds and bats have been considered as separate VECs for the purpose of this assessment. Impacts to flora and fauna include: · Temporary loss of vegetation due to clearing activities for project infrastructure; · Habitat fragmentation; · Introduction of invasive species; and, · Mortality of fauna species due to clearing and construction activities.	Cleared areas will be re-vegetated and clearing will be limited to areas needed for construction of access roads and turbine pads. The project size is small (1 turbine) and therefore the effects associated with habitat fragmentation are considered to be minimal. Clearing and grubbing best management practices are described in the EPP. Mortality of fauna is considered to be minimal due to the small overall size of the project.	No	Description of VEC Section 5.4.1, 5.4.2, and 5.4.3 Mitigation Recommendations Appendix I EPP
Terrestrial Environment	**Birds (Avifauna)**	Potential concerns associated with birds include: · Mortality resulting from direct collision with turbine blades; · Habitat alteration; and, · Sensory disturbance.	Due to the potential residual effects of wind turbines on birds once mitigation efforts are employed, this VEC has been considered for further assessment. Detailed effects and mitigation measures are discussed in Section 10.2.	Yes	Description of VEC Section 5.4.4 Effects Assessment and Mitigation Section 10.2
Terrestrial Environment	**Bats**	Potential concerns associated with birds include: · Mortality resulting from direct collision with turbine blades; · Mortality resulting from barotrauma; · Habitat alteration; and, · Sensory disturbance.	Due to the potential residual effects of wind turbines on birds once mitigation efforts are employed, this VEC has been considered for further assessment. Detailed effects and mitigation measures are discussed in Section 10.2.	Yes	Description of VEC Section 5.4.5 Effects Assessment and Mitigation Section 10.2
Terrestrial Environment	**Wetlands**	Potential concerns associated with wetlands include: · Direct impact of roads, turbines or other project infrastructure with wetland habitat; and, · Indirect impact of wetland habitat through construction in upland buffer area, or impacts to surface water systems that indirectly could affect wetland habitat.	Wetland habitat has been delineated and a 30 meter upland buffer has been identified across the Project Area. All project infrastructures (roads, laydown areas, turbine pads) have been located outside of the wetland habitat and its associated buffer.	No	Description of VEC Section 5.4.8 Mitigation Recommendations Appendix I EPP

Terrestrial Environment	**Species of Conservation Interest (SOCI) and Species at Risk (SAR)**	With the exception of bird species SOCI/SAR (assessed separately in this assessment), one fauna species SAR (Mainland Moose) has the potential to be found within the Project Area. Potential concerns to the Mainland Moose include: · Sensory disturbance resulting in area avoidance or behaviour changes; and, · Alteration or loss of habitat/habitat fragmentation.	Due to the potential residual effects of wind turbines on moose once mitigation efforts are employed, this VEC has been considered for further assessment. Detailed effects and mitigation measures are discussed in Section 10.2.	Yes	Description of VEC Section 5.4 Effects Assessment and Mitigation Section 10.2
Freshwater Environment	**Watercourses** **Fish Habitat**	There are two watercourses identified within the Project Area. Potential concerns with the freshwater component include: · Decreased water quality; · Loss or damage to fish habitat; and, · Mortality of aquatic species.	Watercourses located within and between wetland habitat with the Project Area will not be affected by the construction of the Project. A 30 meter buffer has been established and will be maintained around all watercourses (and wetlands).	No	Description of VEC Section 5.4.7 Mitigation Recommendations Appendix I EPP
Socio-Economic Environment	**Land Use/Property Values** **Recreation** **Tourism**	The Mulgrave Community Wind Project is a small project proposed on a privately owned single parcel of land. Therefore, impacts to the tourism in the surrounding community are expected to be low. The project lands are privately owned and do not support public recreation areas. The Project will likely create more local jobs and increase tax revenues to the Town of Mulgrave and the Municipality of Guysborough, and provide a community dividend, resulting in a positive change for the local economy.	A minimum of 1000 meter setback is present from the proposed turbine to all residential properties surrounding the Project Area. Celtic Current will employ, whenever possible, local contractors to complete Project tasks.	No	Description of VEC Section 6.1-6.4

	Local Economy				
Other Considerations	**Sound**	Sound during construction and decommissioning phases will be temporary and localized. As directed by Nova Scotia Environment and its associated Proponent Guide to Wind Power Projects (NSE 2007), operational sound has been modelled to meet 40 dBA at all receptors.	Post construction, at the request of NSE, Celtic Current will complete sound monitoring to confirm model predictions.	No	Description of VEC Section 8.1
Other Considerations	**Electromagnetic Interference (EMI)**	Wind turbines can interfere with various types of electromagnetic signals that are emitted from radar and telecommunication systems. An EMI study was completed by the Project Team and consultation with relevant stakeholders has determined that there are no objections regarding EMI effects associated with the Project. provided to date.	No mitigation required at this time.	No	Description of VEC Section 8.4
Other Considerations	**Shadow Flicker**	Shadow flicker can occur when rotating blades cast flickering light and shadows during times of direct sunlight. As directed by Nova Scotia Environment and its associated Proponent Guide to Wind Power Projects (NSE 2007), shadow flicker has been modelled to meet 30 min/day and 30 hours/year at all receptors.	Post construction, at the request of NSE, Celtic Current will complete flicker monitoring at individual receptors.	No	Description of VEC Section 8.3
Other Considerations	**Visual**	Wind Projects produce a change in the visual landscape. Predicted view plans from four vantage points have been provided in this registration document and were provided to the public during the public consultation process. No objections were provided or are known at this time	Turbine colors and marking schemes will comply with provincial or municipal requirements.	No	Description of VEC Section 8.2

As indicated in Table 17, three VECs have been carried forward for detailed effects assessment in the following section:

- SOCI;
- Birds; and,
- Bats.

10.2 Effects Assessment

Effects assessment involves the following steps:

1. Identification of potential negative effects of the Project on selected VEC;
2. Description of recommended mitigation;
3. Identification of expected residual effects (post mitigation);
4. Evaluation of significance of residual effects; and,
5. Description of recommended follow up and monitoring.

Significance of residual effects was then determined using four levels of significance identified in the Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the Canadian Environmental Assessment Act (CEAA) (NRCan, 2003).

Level	Definition
High	Potential impact could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered.
Medium	Potential impact could result in a decline in resource to lower-than-baseline but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required.
Low	Potential impact may result in a slight decline in resource in study area during the life of the project. Research, monitoring and/or recovery initiatives would not normally be required.
Minimal	Potential impact may result in a slight decline in resource in study area during construction phase, but the resource should return to baseline levels.

Potential effects to each identified VEC are discussed and evaluated in the following sections to determine specific mitigation requirements, expected significance of residual effects, and any monitoring and follow up requirements.

10.2.1 Avifauna (Birds)

Potential concerns associated with birds at the Mulgrave Community Wind Project include:

- Mortality resulting from direct collision with turbine blades or during construction of project infrastructure and decommissioning;
- Habitat alteration; and,
- Sensory disturbance.

Table 18 provides a summary of the potential environmental effects resulting from the potential Project-VEC interactions. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions, by Project phase.

Most potential interactions associated with the construction phase will be limited, based on the infrastructure currently present on the subject site and the small size of the overall project. The access road and basic turbine pad are present.

Table 18: Project- VEC Interactions by Project Phase on Avifauna

Project Activities and Physical Works	Potential Environmental Effect		
	Habitat Alteration	Sensory Disturbance	Direct Mortality
Construction			
Site preparation	√	√	√
Roadbed construction			
Watercourse crossing structures			
Turbine pad- levelling and grading	√	√	√
Temporary storage pads/areas	√	√	√
Operation and Maintenance			
Project presence			√
Infrastructure maintenance		√	
Winter maintenance		√	
Vegetation management	√		√
Decommissioning			
Turbine dismantling and removal		√	
Turbine pad and road reclamation	√	√	
Accidents, Malfunctions and Unplanned Events			
Erosion and sediment control failure	√		
Fire			

10.2.1.1 Construction

Wildlife habitat directly within any necessary further alterations to the existing access road layout and turbine pad area will be eliminated during Construction. Clearing and grubbing for site preparation will remove vegetation, reducing the quantity of terrestrial habitat, and will affect the quality of already marginal habitat. The Project will result in a slight increase in edge area, which may act as a barrier for some animal movements and could increase predation on birds and small mammals, but also has potential benefits related to habitat creation (edge nesting birds), and food availability (grass and browse near edge and ditches).

Very little clearing additional is necessary for this Project, as the majority of necessary lands associated with the access road and turbine pad have already been cleared.

Wildlife, that currently live within the direct area of the turbine pad or expanded access road or laydown area be permanently displaced during the initial stages of construction, potentially causing direct mortality of bird species that are unable to relocate to suitable habitat. During construction, birds may be affected by disturbance and noise related to construction activities (i.e. blasting, and forest removal). Birds affected may temporarily move out of the range of disturbance throughout the construction period. Similar habitat to that identified within the Project footprint is present surrounding this area to the west, south and north and wildlife and birds would be able to relocate into these adjacent habitats during construction.

Construction, in particular site preparation, during the breeding season for birds has the potential to cause direct mortality to the birds, abandonment of nests, and/or the destruction of nest contents, including losses of species with Species at Risk or Species of Conservation Interest. If adjacent suitable habitat is not available, birds that have been displaced will not likely nest until nearby habitat becomes available, as most birds return to the same general area from year to year. This may result in a higher non-breeding population. Nesting habitat has not been identified within the footprint of construction. Nesting habitat is probable south of the access road and turbine pad location within the southern adjacent wetland system.

Construction of temporary ancillary elements has the potential to interact with birds and/or bird habitat in a similar fashion to those of site preparation activities, though on a smaller scale.

The additional area required for clearing is expected to be minimal and will be as narrow as practical to reduce the amount of lost habitat. As there is no unique habitat within the Project Area, displaced animals should be able, and are expected, to move to similar habitat patches within and adjacent to the Project Area.

The environmental effects of clearing and grubbing are most severe when these activities are conducted during the period when most bird species are breeding (May to September). Clearing and grubbing at this time could result in the Direct Mortality of eggs and unfledged nestlings. The killing of birds or the destruction of their nests, eggs, or young is an offence under the Migratory Birds Convention Act.

Change in wildlife habitat quality includes the potential fragmentation of habitat during construction. Habitat fragmentation can adversely affect local populations of wildlife, , living adjacent to the Project Area. This would be a result of specific species unwilling to reduce their security cover that is currently provided by contiguous habitat. As such, the species do not enter cleared areas, which results in a reduction in available habitat to a specific species. Habitat fragmentation may adversely affect local populations of birds living adjacent to the access road and project infrastructure. However the size of this project (one access road and a single turbine) suggests that the significance of this impact would be low.

Wildlife including birds may be temporarily displaced from areas adjacent to the Project as a result of Construction-related noise. This potential environmental effect would be temporary, and for a short duration (i.e., during active Construction).

Based on consideration of the potential environmental effects of the activities required for Construction, the proposed mitigation (e.g., avoidance, and limiting area of disturbance), and the residual environmental effects significance ratings criteria, the environmental effects of Construction on birds and bird habitat are rated minimal and not significant.

10.2.1.2 Operation and Maintenance

The most likely potential effect of the Project on birds is direct mortality resulting from collision with project infrastructure, namely turbine blades, during the operational phase.

A recent study, as part of a special feature on Quantifying Human-related Mortality of Birds in Canada (Zimmerling et al., 2013) estimated collision mortality using data from carcass searches for 43 wind farms, incorporating correction factors for scavenger removal, searcher efficiency, and carcasses that fell beyond the area searched. On average, 8.2 ± 1.4 birds (95% C.I.) were killed per turbine per year at these sites, although the numbers at individual wind farms varied from 0 - 26.9 birds per turbine per year (Zimmerling et al, 2013).

Despite concerns about the impacts of biased correction factors on the accuracy of mortality estimates, these values are likely much lower than those from collisions with some other anthropogenic sources such as windows, vehicles, or towers, or habitat loss due to many other forms of development. Species composition data suggest that < 0.2% of the population of any species is currently affected by mortality or displacement from wind turbine development (Zimmerling et al, 2013).

Flying Areas used by large numbers of foraging or roosting birds are at risk from collision with turbines, or those areas considered as important migratory flyways (Drewitt and Langston 2006). According to a recent evaluation of operational wind projects in Canada, bird fatalities are dominated by passerines with relatively low numbers of raptors and waterbirds. (EC et al. 2012).

No significant migratory flyways or features that attract large numbers of migrant passerines were detected during pre-construction avian surveys at the Project site, and very few waterfowl and raptors were observed passing over the site during key migratory periods. Although isolated collisions will occur, it is very unlikely that collision mortality resulting from Project operations will have an effect at the population level given the low level of use by birds in this area.

The proposed turbine location is within a habitat type that is relatively common locally and at the landscape level, and has been designed to maintain a buffer from all identified wetlands. Sensitive species potentially breeding in wetland habitats, therefore, should not be disturbed by Project activities.

Based on consideration of the potential environmental effects of the activities during the Operation Phase, the proposed mitigation, and the residual environmental effects significance ratings criteria, the environmental effects of Operation on birds and bird habitat are rated low and not significant.

10.2.1.3 Decommissioning

Decommissioning of turbine components, the turbine pad and access road will result in a positive effect on the Project, involving the reclamation of land and re-establishment of vegetation across the Project Area.

10.2.1.4 Accidents, Malfunctions and Unplanned Events

Accidents, Malfunctions and Unplanned Events that may occur in association with the Project and could have adverse environmental effects on bird and bird habitat are listed below with a discussion of the potential environmental effects.

Erosion and sediment control measures could fail during precipitation events and release sediment, potentially affecting wetland or stream habitat used by wildlife species such as amphibians and reptiles. This type of effect is temporary and short-term, and is highly localized to the affected area.

Fire events during any phase of the Project could remove significant amounts of vegetation, thereby having an environmental effect on habitat for wildlife, and potentially result in their displacement or mortality, particularly during breeding season when the young are less mobile.

10.2.2 Species of Conservation Interest and Species at Risk – Mainland Moose

As discussed in Section 10.1, the only species of conservation interest or species at risk identified within or near the Project Area is the Mainland Moose (with the exception of bird species discussed separately in this report). Potential effects on moose from the Mulgrave Community Wind Project include:

- Sensory disturbance resulting in area avoidance or behaviour changes; and,
- Alteration or loss of habitat/habitat fragmentation.

Table 19 provides a summary of the potential environmental effects resulting from the potential Project-VEC interactions. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions, by Project phase.

Most potential interactions associated with the construction phase will be limited, based on the infrastructure currently present on the subject site and the small size of the overall project. The access road and basic turbine pad are present.

Table 19: Project- VEC Interactions by Project Phase on Mainland Moose

Project Activities and Physical Works	Potential Environmental Effect	
	Habitat Alteration	Sensory Disturbance
Construction		
Site preparation	√	√
Roadbed construction		
Watercourse crossing structures		
Turbine pad- levelling and grading	√	√
Temporary storage pads/areas	√	√
Operation and Maintenance		
Project presence		√
Infrastructure maintenance		√
Winter maintenance		√
Vegetation management	√	
Decommissioning		
Turbine dismantling and removal		√
Turbine pad and road reclamation	√	√
Accidents, Malfunctions and Unplanned Events		
Erosion and sediment control failure		
Fire		√

10.2.2.1 Construction

Project construction is not expected to significantly impact Mainland Moose that are present in the area. Construction will be limited to final work associated with the current access road, and erection of the turbine itself. The moose may be displaced due to noise and activity. However, this impact is temporary and of short duration

10.2.2.2 Operation and Maintenance

Moose are affected by a variety of disturbance types, and in a variety of ways. The removal of moose habitat to create linear disturbances can decrease foraging and cover habitat and decrease connectivity of the landscape (MEG Energy Corp. 2010). One such linear disturbance in moose habitat is roads. Much recent research, for example, has been dedicated to the issue of moose-vehicle collisions on highways (Seiler 2005; Dussault, Poulin, Courtois and Ouellet, 2006; Leblond, Dussault, Ouellet, Poulin, Courtois and Fortin, 2007a,b; Danks and Porter 2010). The presence of roads can affect moose behaviour and habitat usage as well. Laurian and colleagues (2008) observed that moose usually avoided approaching within 500m of highways and forest roads, although 20% of moose periodically browsed sodium-rich vegetation along road ways. This general avoidance of roads and surrounding areas by moose was interpreted by the authors as meaning that the moose perceived these areas as low-quality habitat. Neumann (2009) determined that moose rarely utilized habitats in close proximity to roads in Sweden. Rudd and Irwin (1985) found the mean distance of bedding and feeding sites from the nearest travelled road to be 1283m and 1101m, respectively, which appears to be in accordance to the findings of et al. (2008). Goldrup (2003) detected no such avoidance of roads or trails by moose in the Prince Albert National Park in Saskatchewan, finding moose to be indifferent to their presence. Similarly, Belant and colleagues (2006) determined that overall moose did not avoid the main park road in Denali National park and Preserve in Alaska. Thus, it appears that the response of moose to roads is highly variable and it most likely situation specific.

Dussault and colleagues (2007) determined that moose did not cross highways frequently, which may suggest that habitat may become fragmented into discontinuous units on opposite sides of the road. In Sweden, a major highway acted as a barrier to moose migration, causing moose to accumulate in habitats on one side of the highway while unable to access wintering ground near the coast (Seiler et al. 2003). In another Swedish study, Neumann (2009) observed that moose seldom crossed roads, but did increase their rates of crossing during migration. In Alaska, individual moose crossed a six lane highway up to 8 times per year (McDonald 1991), and Timmerman and Racey (1989) concluded that the presence of a highway running parallel to a lake did not limit moose access to this aquatic habitat. Moose in Québec were more likely to cross roads during the night when traffic level was at its lowest (Dussault, Ouellet, Laurian, Courtois, Poulin and Breton, 2007). Dussault and colleagues (2007) found that topography, vegetation, and the presence of brackish pools were the most influential characteristics determining the locations of crossing points where they did occur. Silverberg and colleagues (2003), when studying moose behaviour at roadside salt-licks, found that stimuli that decreased feeding and increased incidences of fleeing included trucks passing, suggesting that the noise generated by these vehicles generated a disturbance sufficient to elicit a response by the moose. This same pattern was observed by Rudd and Irwin (1985), who found that trucks caused the greatest escape distance, displaced the greatest percentage of moose, and caused the greatest level of disturbance to moose of the factors examined. These researchers determined that whether or not an access road was adjacent to a forest stand was a key factor in determining the presence/absence of moose in that stand, and went on to suggest that preferred moose habitat should be avoided when selecting the location of drilling rigs and access roads.

In an example of a more indirect effect, roads associated with forestry operations can increase hunter access to moose habitat, leading to higher mortality of the moose within the area (Timmerman and Gollat 1983; Ontario Ministry of Natural Resources 1988; Rempel, Elkie, Rodgers, and Gluck, 1997; Burrows 2001).

Not all road effects are negative however, as Van Ballenberghe and Peek (1971) suggested that the road system in their study area allowed moose to extend their movements into areas that would have been otherwise inaccessible. Numerous moose trails associated with old logging roads in Ontario were noted by Timmerman and Racey (1989), and these trails were all longer and better used than those not associated with old roads.

Beazley and colleagues (2002) discussed the impacts of roads on moose populations in Nova Scotia, and stated that moose avoid areas of high road density, and that road density affects moose habitat suitability. Furthermore, they associated the presence of Highway 101 with the isolation of the small moose population in southwestern Nova Scotia. These authors suggest that to properly manage moose populations in Nova Scotia, areas with no roads or low road densities containing suitable moose habitat should be maintained in such a state. Beazley and colleagues (2008) found a higher road density in southeastern Cape Breton, Nova Scotia, and suggested that this factor could be related to the absence of moose in the region.

Human Development and Activity

While moose are considered more tolerant of human presence than are other ungulates (AXYS 2001), they are nonetheless sensitive to human proximity (Neumann 2009). Geist (1963) reported that the sight of humans at close range caused all moose to flee, although the sounds of powersaws and gunshots had little effect of moose behaviour. A number of human activities intrude on moose habitat. Anderson and colleagues (1996) determined that human sources of disturbance, as opposed to mechanical sources, elicit flight responses from further away and result in longer periods of elevated heart rates in moose. In this study, skiers and hikers caused moose to flush from as far away as 400m, while F-16 jets flying 150m overhead did not elicit any behavioural or physiological response. Hiking (Neumann 2009) and backcountry skiing (Nuemann et al. 2010) activities were found to elicit short-lived but considerable responses in moose, including increased movement rates following the disturbance and displacement from the site of the disturbance. Cross-country skiing was found to influence the winter distribution of moose in Alberta, as they moved away from area with heavily used trails during the ski season (Ferguson and Keith 1982). Nuemann (2009) reported a similar response to snowmobile activity within moose habitat, and Colescott and Gillingham (1998) noted altered behaviour of moose within 150m of snowmobile traffic on trails. Behavioural responses to the snowmobiles in this study included moving gradually away from the trail, possibly displacing them temporarily from preferred habitat. Tomeo (2000) examined the physiological response of moose to snowmobiles, and found higher levels of stress hormones in the feces of moose from areas with snowmobile traffic than those from areas with no snowmobile traffic.

Wind Energy Development

There is little established literature pertaining to the response of moose to wind farm development. A wildlife monitoring report from the Searsburg wind project in Vermont reported that moose were using the area under a generating turbine (Multiple Resource Management Inc. 2006). A total of 23 images of moose were captured using a remote camera installed under the turbine, and of these, 61% occurred when the turbine was on and generating power. Observations of moose scat and of a single moose foraging were reported on the site of the Dokie Wind Energy Project in British Columbia (Jacques Whitford AXYS Ltd, UNBC 2008), meaning that moose continued to use the area after the wind farm was in operation.

A study of the response of elk, another ungulate, to wind-power development in Oklahoma was conducted by Walter et al. (2006). They determined that elk in the area were not adversely affected by the wind-power development, either through negative effects on diet or through changes in home range. The elk remained in the area throughout the construction and operation phases of the wind farm, and the access roads were no barrier to elk movement.

Based on consideration of the potential environmental effects of the activities required for Operation, the proposed mitigation (e.g.limiting area of disturbance and only a single access road), and the residual environmental effects significance ratings criteria, the environmental effects of Operation on Moose and Moose habitat are expected to below and therefore not significant.

10.2.2.3 Decommissioning

Decommissioning of turbine components, the turbine pad and access road will result in a positive effect on the Project, involving the reclamation of land and vegetation across the Project Area, and reduction in overall habitat fragmentation associated with the access road.

10.2.3.4 Accidents, Malfunctions and Unplanned Events

Accidents, Malfunctions and Unplanned Events that may occur in association with the Project and could have adverse environmental effects on the moose and moose habitat are listed below with a discussion of the potential environmental effects.

Erosion and sediment control measures could fail during precipitation events and release sediment, potentially affecting wetland or stream habitat used by wildlife species such as the Mainland Moose. This type of effect is temporary and short-term, and is highly localized to the affected area.

Fire events during any phase of the Project could remove significant amounts of vegetation, thereby having an environmental effect on habitat for wildlife, and potentially result in their displacement or mortality, particularly during breeding season when the young are less mobile.

10.2.3 Bats

Potential concerns associated with bats at the Mulgrave Community Wind Project include:

- Mortality resulting from direct collision with turbine blades;
- Mortality resulting from barotrauma;
- Habitat alteration; and,
- Sensory disturbance.

Table 20 provides a summary of the potential environmental effects resulting from the potential Project-VEC interactions. The table is divided according to each of the Project phases assessed (Construction, Operation and Maintenance, Decommissioning as well as Accidents, Malfunctions, and Unplanned Events). The discussion following the table provides an analysis of key Project-VEC interactions, by Project phase. Most potential interactions associated with the construction phase will be limited, based on the infrastructure currently present on the subject site and the small size of the overall project.

Table 20: Project- VEC Interactions by Project Phase: Bats

Project Activities and Physical Works	Potential Environmental Effect			
	Habitat Alteration	Sensory Disturbance	Direct Mortality	Indirect Mortality
Construction				
Site preparation	√	√		
Roadbed construction				
Watercourse crossing structures				
Turbine pad- levelling and grading	√	√		
Temporary storage pads/areas	√	√		
Operation and Maintenance				
Project presence			√	√
Infrastructure maintenance		√		
Winter maintenance		√		
Vegetation management	√			
Decommissioning				
Turbine dismantling and removal		√		
Turbine pad and road reclamation	√	√		
Accidents, Malfunctions and Unplanned Events				
Erosion and sediment control failure	√			
Fire		√		

10.2.3.1 Construction

Project construction is not expected to significantly impact bats that may be present in the area. Construction will be limited to final work associated with the current access road, and erection of the turbine itself. Furthermore, construction will occur during normal working (daylight) hours. Bats that are present in the area fly at night during hunting or migration and would therefore not be affected by construction operations. Finally, no hibernacula are going to be disturbed during the construction phase.

10.2.3.2 Operation and Maintenance

Mortality of bats is a known potential effect during the operational phase of wind energy projects throughout North America. The first large scale wind developments were located in western North America typically in agricultural and open prairie landscapes (reviewed in Johnson, 2005). Fatalities of these non-migratory species were largely absent from these sites. It is likely that this reflects the location of these wind development sites in open non-forested landscapes. These species may be under represented in the bat communities in these open areas due to an association with forested landscapes. More recently however, evidence of Myotis fatalities from wind turbines have been noted at sites in eastern North America (reviewed in Arnett et al., 2008; Jain et al., 2007b; Johnson, 2005). Therefore, although documented fatalities of Myotis are fewer than for migratory species there is still risk.

The prominent proximate causes of bat deaths at wind turbines are direct collision (i.e., blunt-force trauma) and barotrauma. It is difficult to attribute individual fatalities exclusively to either direct collision or barotrauma (Grodsky et al. 2011). Barotrauma involves tissue damage to air containing structures (i.e., lungs) caused by rapid or excessive air pressure change. In this case, it is believed that air pressure change at turbine blades (in movement) causes expansion of air in the lungs not accommodated by exhalation, therefore resulting in lung damage and internal hemorrhaging. Grodsky et al. (2011) used radiology to investigate causes of mortality and found that a majority of the bats (74%; 29 of 39) examined had bone fractures that are likely to have occurred during direct collision with turbines. Approximately one-half (52%; 12 of 23) of bats whose ears were examined had mild to severe hemorrhaging in the middle or inner ears (or both). The true nature of mortality resulting from turbine collision remains poorly understood.

Overall bat activity at the Project site was low during the traditional peak period in bat movements across the landscape. This may suggest that the Project site is not situated within an area of importance to local/regional bats moving to swarming/hibernation sites. However, white-nosed syndrome must also be considered which is resulting is generally low reported numbers of bats during all monitoring activities across Nova Scotia.

Based on consideration of the potential environmental effects of the activities required for Construction and Operation, the proposed mitigation (e.g., limiting area of disturbance and size of project (small)), and the residual environmental effects significance ratings criteria, the environmental effects of Operation on bats and bat habitat are rated low and not significant.

10.2.3.3 Decommissioning

Decommissioning of turbine components, the turbine pad and access road will result in a positive effect on the Project, involving the reclamation of land and vegetation across the Project Area, and reduction in overall habitat fragmentation associated with the access road.

10.2.3.4 Accidents, Malfunctions and Unplanned Events

Accidents, Malfunctions and Unplanned Events that may occur in association with the Project and could have adverse environmental effects on bats and bat habitat are listed below with a discussion of the potential environmental effects.

Erosion and sediment control measures could fail during precipitation events and release sediment, potentially affecting wetland or stream habitat used by wildlife species such as bats. This type of effect is temporary and short-term, and is highly localized to the affected area.

Fire events during any phase of the Project could remove significant amounts of vegetation, thereby having an environmental effect on habitat for wildlife, and potentially result in their displacement or mortality, particularly during breeding season when the young are less mobile.

10.3 Mitigation

10.3.1 Birds

To avoid destroying nesting or breeding species during breeding timeframes, clearing of remaining vegetation will occur prior to April 15, 2014.

A follow-up monitoring program will be implemented after construction and will be designed in accordance with Canadian Wildlife Service and/or NSDNR requirements. The purpose of the follow-up monitoring is to determine rates of mortalities occurring and, if so, to identify any possible mitigation measures.

If it appears that a high number of direct fatalities are occurring, attempts will be made to determine the nature of the fatalities, specific timing or seasonality, weather related effects at the time, so that mitigation such as modifications to turbine operations may be designed (i.e. change to cut-in wind speeds for turbine operation; change to lighting; other).

The Project is committed to use of limited lighting during construction and on turbines while still meeting all lighting requirements of Transport Canada. Furthermore, there will be no general lighting at the Project site (restricted to during times when technicians are on site only).

Project activities have worked and will work to avoid and/or minimize disturbance to potential Eastern Wood-Pewee nesting habitat, including areas of low canopy cover within large deciduous or mixed wood forest stands. Project activities will also work to avoid and/or minimize disturbance to potential Olive-sided Flycatcher nesting habitat, including tall trees or snags within clearings especially near wetlands or edges of mature coniferous forest stands.

10.3.2 Bats

The following mitigation is provided for minimizing bat effects at the Mulgrave Community Wind Project.

Minimize project footprint – Minimized the direct loss of bat habitat resources (e.g., wetlands, riparian areas, mature deciduous-dominated forest stands) and therefore minimized the extent of bat habitat affected. This Project consists of a single access road and turbine.

Follow up on effects and adaptive management – A post-construction monitoring program to quantify bat fatality rates is of utmost importance. These surveys need to be appropriately designed to account for searcher efficiency and scavenger rates and need to be conducted over an entire season (April to October), but especially during the fall migration season from mid-August to late-September. Should fatalities be found, these should be investigated with respect to spatial distribution of fatalities, turbine lighting, weather conditions and other site specific factors which can then be analyzed and operations adjusted in an adaptive management framework.

Celtic Current has the ability to alter the cut-in wind speeds of the Enercon turbine if bat mortality is shown to change during post construction monitoring.

11 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental factors that have the potential to have damaging effects on wind turbines include:

- Ice throw
- Hurricane
- Heavy snow
- Lightening
- Fire

11.1 Ice Throw

Wind turbines can accumulate ice under certain atmospheric conditions, such as temperatures near freezing (0°C) combined with humidity, freezing rain, or sleet. Since changing weather conditions may then cause this ice to be shed, there are safety concerns that must be considered during Project development and operation. However, the Enercon turbine blades are equipped with blade de-icing equipment which is engineering to remove any build up of ice prior to the ice being at risk of shedding.

Any ice that is accumulated may be shed from the turbine due to warmer temperatures, gravity and the mechanical forces of the rotating blades.

In the unlikely event of ice throw the motion of the fragment is governed by specific forces. The ice fragment has an initial velocity due to rotation, while in flight the motion is constrained by gravity and aerodynamic forces.

Due to certification requirements which outline load cases which must be used in the design of wind turbines (including iced blades) manufacturers incorporate ice build up on the blades as a load resulting in additional vibration caused by both mass and aerodynamic imbalance. (LeBlanc, 2007)

Leblanc (2007) used defined methodologies and analyses to determine the probability that an ice fragment will land on a certain target or in a particular area in the range of the turbines. The probability of impact is then multiplied by the probability of ice throw. The final result is the probability that a target fixed at a certain range from the turbine will be hit in one year. If targets are not fixed, such as cars on a roadway, then the probability must be multiplied again by the probability that the target will be in position. Mobile targets are discussed in the analyses.

The calculated probabilities results of this risk analysis are provided in terms of Individual Risk (IR), which is defined as the probability of being struck by ice fragment per year. (LeBlanc, 2007) The results of the Leblanc's (2007) are as follows:

1. Scenario A – Fixed Dwelling: Based upon a location of 300 metres from an individual turbine, calculated risk is 1 strike per 500,000 years;
2. Scenario B – Road: Based upon a road location 200 metres from a turbine, with a 100 vehicles travelling 60 km/h along a 600 metre section of road, during 5 days of icing events, calculated risk is 1 strike per 260,000 years;
3. Scenario C – Individuals: Based upon one ever-present individual within 300 metres of a turbine, who does not impinge within 50 metres of the turbine base, calculated risk is 1 strike per 137,500,000 years.

The calculated strike risk does not factor in the following characteristics at the Mulgrave Community Wind Project:

1. The presence of forest vegetation providing additional shelter; and,
2. Topographic variations.

All commercial wind turbines include vibration monitors, which will automatically shut the turbine down when vibrations exceed a pre-set level. This vibration safety shutdown feature is also effective when excessive ice builds up on the turbine blades thus further limiting the risk of ice throw. In addition, Celtic Current is committed to the installation of signs at a central access point warning of the potential for ice throw. Operation and maintenance staff and contractors will be made aware of the risk of ice accumulation, throw, or falling as a function of Celtic Current Safety Guidelines.

11.2 Hurricane, Heavy Snow, and Hail

All commercial wind turbines include vibration monitors, which will automatically shut the turbine down when vibrations exceed a pre-set level. This shut down will occur in inclement weather including high winds/hurricane, heavy snow or hail. In addition, Celtic Current is committed to the installation of signs at a central public access point identifying the presence of wind turbines.

11.3 Lightning

There is the potential for a lightning strike causing fire. Or, damage to the electrical systems within a turbine could also cause a localized fire. All commercial turbines are equipped with built-in grounding systems to avoid fire during a lightning strike.

12 CONCLUSIONS

Celtic Current LP (Celtic Current) intends to construct a 2.3 MW (nameplate capacity) single turbine on private land [PID 35124452] within the Town of Muglrave, Nova Scotia. This Project consists of a single access road and turbine pad, a system of above ground distribution lines and an Enercon E-92 2.3 MW turbine. The proposed schedule involves construction during Spring 2014 with a tentative operation date of late Summer 2014.

The field data, regulatory consultation, and subsequent conclusions of this assessment indicate there are no expected significant residual environmental effects resulting from the Mulgrave Community Wind Power Project once all appropriate mitigation and monitoring has been implemented and completed.

Standard construction mitigation methods will be implemented to ensure there are no significant impacts of the Project on Valued Ecosystem Components (VEC). These methods were included in the development of the Environmental Protection Plan (EPP) which is included as part of this assessment.

The proposed turbine location is adjacent to a large clearcut area. The turbine has been located at the same location as the existing MET tower and the Project will be able to use the access road constructed for the MET tower installation as the access road for the entire scope of the Project.

Natural areas remaining following Project construction will continue to include disturbed and undisturbed tracts of forests, wetlands, or stands of trees or other vegetation within the Project Area. These forested natural areas are continuous, and provide suitable habitat, travelling corridors, thermal and security cover for wildlife, and are representative of forest systems throughout the Project Area. Habitat fragmentation will be minimal, based on the size of the Project.

Species at risk inventories within the Project revealed that no flora species at risk were identified. It is expected that Mainland Moose use the Project Area. However, it continues to remain unknown how Mainland moose move through the area, at what times, or in what numbers. The small size of the Project and the construction of only a single access road results in low residual impact to the Mainland Moose.

Avian and bat species at risk were identified within or near the Project Area. The environmental assessment process has determined that residual environmental effects on birds and bats is low, post-mitigation, and Celtic Current is committed to completing follow up monitoring as recommended by CWS and NSDNR.

There are no areas of cultural significance identified during assessments of historical resources. As well there are no adverse effects anticipated on health and socio-economic conditions, physical and cultural heritage areas, traditional land use, and traditional structures or sites as a result of environmental changes from the Project.

Celtic Current has exceeded residential setbacks with the closest residence or other sensitive receptor being located 1008 metres from the turbine. Sound models indicate that the regulatory criterion of 40 dBA for sound at any identified receptors within 1500m is not expected to be exceeded.

Both McCallum Environmental Ltd. and Celtic Current are confident that the community-at-large support the development of this Project. Positive feedback received from the communities in proximity for the proposed Project, suggest that community support for this Project is positive. Celtic Current will continue to conduct public consultation on this Project.

The magnitude of disturbance and risk associated with the Project are all considered minimal given the size of the Project, abundance of similar VEC within the Project Area and the mitigation techniques and technologies currently available. Furthermore this assessment concludes there are no significant environmental concerns and no significant impacts expected that cannot be effectively mitigated through well established and acceptable practices, or ongoing monitoring and response. Residual environmental effects have been determined to be minimal or low for identified Valued Ecosystem Components.

13 LIMITATIONS

Constraints Analysis

- On some maps, land use or land cover is defined everywhere to form a complete mosaic of polygons. On topographic maps landuse/landcover is depicted only in certain areas. The source data in some cases may need to be conditioned to allow the second type of depiction if it is a mosaic, and certain constraints will operate differently in each case (Agent Consortium, 2001); and,
- Conflicts that might exist between objects in a database are typically of a logical nature, such as topological inconsistencies or duplicate identifiers. We attempted to ensure that our database has addressed any potential inconsistencies, however inconsistencies may still occur. In map generalization, the vast majority of conflicts are physical, spatial consequences of reducing map scale. The greater the degree of scale change, the more cluttered an un-generalized map will be, and this signals the extents of potential conflicts in presentation of the data.

Limitations incurred at the time of the assessment include:

- McCallum Environmental Ltd. has relied in good faith upon the evaluation and conclusions in all third party assessments. McCallum Environmental Ltd. relies upon these representations and information provided but can make no warranty as to accuracy of information provided;
- There are a potentially infinite number of methods in which human activity can influence wildlife behaviors and populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors;
- The environmental assessment provides an inventory based on acceptable industry methodologies. A single assessment may not define the absolute status of site conditions;
- Effects of impacts separated in time and space that may affect the areas in question, have not been not been included in this assessment.
- Regulatory standards and requirements for property value analysis have not been established or recommended by Nova Scotia Environment. Therefore, site and regional effects assessment of this VEC has not been completed as part of this environmental assessment.
- Regulatory standards and requirements for assessment of infrasound have not been established or recommended by Nova Scotia Environment. Therefore, effects assessment relating to this potential VEC has not been completed as part of this environmental assessment.

General Limitations incurred include:

- Classification and identification of soils, vegetation, wildlife, and general environmental characteristics (i.e. vegetation concentrations, and wildlife usage) have been based upon commonly accepted practices in environmental consulting. Classification and identification of these factors are judgmental and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may not identify all factors;

- All reasonable assessment programs will involve an inherent risk that some conditions will not be detected and all reports summarizing such investigations will be based on assumptions of what characteristics may exist between the sample points.

14 GLOSSARY

Balance of Plant (BOP): the infrastructure of a wind farm Project, in other words all elements of the wind farm, excluding the turbines. Includes civil works, SCADA and internal electrical system. It may also include elements of the grid connection.

System Interconnection Study (SIS): A study that evaluates the impact of new generation to the interconnected transmission system, to confirm that it will have no negative reliability impact.

Wake Loss: Wind turbines extract energy from the wind and downstream there is a wake from the wind turbine, where wind speed is reduced. As the flow proceeds downstream, there is a spreading of the wake and the wake recovers towards free stream conditions. The wake effect is the aggregated influence on the energy production of the wind farm, which results from the changes in wind speed caused by the impact of the turbines on each other.

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16 CERTIFICATION

This Report has considered relevant factors and influences pertinent within the scope of the assessment and has completed and provided relevant information in accordance with the methodologies described.

The undersigned has considered relevant factors and influences pertinent within the scope of the assessment and written, and combined and referenced the report accordingly.

Meghan Milloy,
Sr. Project Manager
McCallum Environmental Ltd.

I have reviewed the information as submitted and completed this report in conformity with the Code of Ethics and the Duties of Professional Biologists and good industry practice.

Respectfully submitted,

Robert McCallum, P.Biol
President
McCallum Environmental Ltd.

McCallum Environmental Ltd.

December 4, 2013

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Attention: **Steve Sanford**
Re: **Mulgrave Community Wind Project**

The Proponent for the Mulgrave Community Wind Project is Celtic Current LP. Contact information and authorized signature for this Project is provided.

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