Appendix 1 COMFIT Approval Documentation

NOVA SCOTIA
Energy
Office of the Minister

Suite 400, 5151 George Street, PO Box 2664, Halifax, Nova Scotia, Canada B3J 3P7 • Telephone 902 424-7793 Fax 902 424-3265 • www.gov.ns.ca/energy

January 29, 2013

Paul Pynn
Watts Wind Energy Inc.
300 Prince Albert Road
Dartmouth, N.S. B2Y 4J2

Dear Watts Wind Energy Inc.:

Re: Community Feed-In Tariff Approval

On behalf of the Nova Scotia Department of Energy, I am pleased to present you with your Community Feed-In Tariff (COMFIT) approval for your 3.2 MW large-wind project in Porter's Lake, NS (COMFIT application #247). Attached to this letter is a certificate indicating your approval.

In order to maintain your COMFIT approval, you must comply with the conditions set by Nova Scotia Power Incorporated, the Renewable Electricity Regulations made under Section 5 of the *Electricity Act* and all program Directives. You will also be expected to comply with the terms and conditions of the project as outlined in your COMFIT application submitted October 19, 2011. Any alterations to this submission (technology type, partnership structure etc.) must be submitted in writing and approved by the Department.

As a condition of approval, your project will be expected to complete:

- Community Consultation: Two public information sessions must be held prior to the construction of the project. Results of the information session must be submitted to the Department of Energy, outlining any community concerns. Additionally, the project must comply with additional information submitted with reference to consultations, mail outs, etc.

- Project Time Line and Milestones: A detailed project schedule including timelines and key milestones must be submitted to the Department of Energy within 60 days. You will be required to report regularly on the progress of the project, as outlined in the submission.

- Evidence of Ownership: Please provide final details regarding the project's ownership structure and any partnership details and agreements relating to the project.

- An Environmental Assessment.

- Wind Energy Mapping: The Department of Energy and Department of Natural Resources are endeavoring to map wind development within the province. All approved projects are required to submit the appropriate geographic information system data, and work collaboratively to address any recommendations emerging from an assessment of the cumulative impact of wind energy in the province. More information is provided in the guidance note.

- Archaeological Resource Impact Assessment: The Nova Scotia Department of Communities, Culture and Heritage recommends that an Archaeological Resource Impact Assessment be conducted.

These conditions are not an exhaustive list of the permits and approvals needed for your project. COMFIT approval does not supersede any additional regulations, permits or approval required by other government authorities as your project unfolds. Projects must still comply with all other conditions and milestones as set by government entities and Nova Scotia Power Inc. Failure to meet additional requirements may result in revocation of your COMFIT approval, even though they may not be an explicit condition at this time.

A COMFIT guidance note is attached with information pertaining to the implementation of your project. The guidance note is not a condition of approval, but information that may be useful to you as you implement your project. As per Directive 004: Annual Progress reports, the Department looks forward to receiving your annual reports on how COMFIT proceeds have assisted in meeting community sustainability goals.

Please note that you are also required to submit a report to the Department of Energy within 30 days of your project's connection to the distribution grid as identified in Section 34 of the Renewable Electricity Regulations. Failure to do so may result in revocation of your COMFIT approval.

If you have any questions about your approval, or if we can be of further assistance to you, please call COMFIT Clerk at (902) 424-5293 and a representative will be happy to assist you.

Yours sincerely,

Charlie Parker

Charlie Parker
Minister

Enclosure

№. Project 247

Community Feed-In Tariff Approval

This certifies that the *Watts Wind Energy Inc.* has received Community Feed-In Tariff Approval by the Nova Scotia Department of Energy for a 3.2 MW large-wind project in Porter's Lake, NS. Approval may be revoked should a project not meet the requirements of the Community Feed-In Tariff program or deviate from details specified in its Community Feed-In Tariff application.

NOVA SCOTIA
Department of Energy

Charlie Parker

Minister

№. Project 247

Community Feed-In Tariff Approval

This certifies that the *Watts Wind Energy Inc.* has received Community Feed-In Tariff Approval by the Nova Scotia Department of Energy for a 3.2 MW large-wind project in Porter's Lake, NS. Approval may be revoked should a project not meet the requirements of the Community Feed-In Tariff program or deviate from details specified in its Community Feed-In Tariff application.

NOVA SCOTIA
Department of Energy

Charlie Parker

Minister

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Energy

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Paul Pynn
Watts Wind Energy Inc.
300 Prince Albert Road
Dartmouth, N.S. B2Y 4J2

Re: COMFIT Guidance Note

Dear Watts Wind Energy Inc.:

A substantive review of your COMFIT application has been completed by the Department of Energy, in consultation with relevant government departments. During this review, factors have been identified that you should be aware of as your project proceeds. These are **not** conditions of approval, but guidance to assist you in the successful implementation of your COMFIT project.

Nova Scotia Environment has noted that there is presently a joint federal-provincial-territorial initiative to develop national guidelines for wind turbine noise. The guidelines are currently in draft format and may be adopted provincially. The guidelines are expected to pertain to:

1. large land-based (hub height of 60 meters or higher, blades larger than 30 meters and electrical output greater than one megawatt) and
2. land-based commercial scale turbines with a name plate capacity of greater than or equal to 50 kilowatts and a maximum sound power level of greater than or equal to 102 A-weighted decibels (dBA).

In terms of sound level limits, the proposed guidelines recommend limits ranging from 40 - 45 dBA (based on wind speed) for all classes of wind turbine facilities. In terms of setback distances, the proposed guidelines recommend that wind turbines with a name-plate capacity of greater than or equal to 50 kW and a sound power level of greater than or equal to 102 dBA be constructed, installed or expanded at least 550 metres from the nearest noise receptor. Please contact the Environmental Assessment Branch of the Department of Environment for any updates to these proposed Guidelines.

All approved COMFIT projects are required to submit geographic information system data in the form of a shape file. Furthermore, the Department of Energy and the Department of Natural Resources are currently endeavoring to map all wind energy development within the province. The aim of this exercise is to assess the potential cumulative impact of wind development on various wildlife, in particular migratory species. The results of this study may have potential impacts on the siting of projects, however this will be determined as the results of the study progress and impacts discussed in collaboration with applicants.

If you have any questions about your approval, or if we can be of further assistance to you, please call COMFIT Clerk at (902) 424-5293 and a representative will be happy to assist you.

Sincerely,

_____

Krystal Therien
COMFIT Program Manager
Nova Scotia Department of Energy

Appendix 2 Federal Approvals

November 16, 2014

Your file
080 Porters Lake
Our file
14-2369

Mr. Trent MacDonald
Watts Wind Energy Inc.
300 Prince Albert Road
Dartmouth, NS
B2Y 4J2

RE: Wind Farm: 2 Wind Turbines - Porters Lake, NS
Geo Centre (N44° 43' 37.53" W63° 21' 10.90" / 492.126' AGL / 675.853' AMSL)

Mr. MacDonald,

We have evaluated the captioned proposal and NAV CANADA has no objection to the project as submitted.

The nature and magnitude of electronic interference to NAV CANADA ground-based navigation aids, including RADAR, due to wind turbines depends on the location, configuration, number, and size of turbines; all turbines must be considered together for analysis. The interference of wind turbines to certain navigation aids is cumulative and while initial turbines may be approved, continued development may not always be possible.

In the interest of aviation safety, it is incumbent on NAV CANADA to maintain up-to-date aeronautical publications and issue NOTAM as required. To assist us in that end, we ask that you notify us at least 10 business days prior to the start of construction. This notification requirement can be satisfactorily met by returning a completed, signed copy of the attached form and spreadsheet confirming turbine data by e-mail at landuse@navcanada.ca or fax at 613-248-4094. In the event that you should decide not to proceed with this project or if the structure is dismantled, please advise us accordingly so that we may formally close the file.

If you have any questions, contact the Land Use Department by telephone at 1-866-577-0247 or e-mail at landuse@navcanada.ca.

NAV CANADA's land use evaluation is valid for a period of 12 months. Our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations; it neither constitutes nor replaces any approvals or permits required by Transport Canada, Industry Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required. Industry Canada addresses any spectrum management issues that may arise from your proposal and consults with NAV CANADA engineering as deemed necessary.

Yours truly,

David Legault
Manager, Data Collection
Aeronautical Information Services

cc ATLR - Atlantic Region, Transport Canada
CCF4 - PORTERS LAKE
CDD2 - PORTERS LAKE (WATER)

Transport Canada / Transports Canada

Print

TC File No/Ref No: 2014 - 172

Applicant File No/Ref No:

AERONAUTICAL ASSESSMENT FORM FOR OBSTRUCTION MARKING AND LIGHTING

General Information

1. Owner's Name: Watts Wind Energy Inc.
Contact Person: Trent MacDonald
Address: 300 Prince Albert Road
City: Dartmouth
Province: Nova Scotia
Postal Code: B2G 2L1
Telephone No.: 1-902-482-8687
Fax No.: 1-866-314-5349
Email Address: tmacdonald@eonwind.com

2. Applicant's Name: See Above
Contact Person:
Address:
City:
Province:
Postal Code:
Telephone No.:
Fax No.:
Email Address:

3. Description of Proposal (or as attached)
- 2 Turbine Wind Energy Facility in Porters Lake, Nova Scotia
- See attached file for coordinates and turbine height

4. Geographic Coordinates ☑ NAD83 ☐ NAD27 ☐ WGS84
N Latitude deg _____ min _____ sec _____ W Latitude deg _____ min _____ sec _____

5. Nearest
Community: Porters Lake
Province: Nova Scotia

6. Nearest Aerodrome:

7. Have you contacted the aerodrome?
◯ Yes ◯ No

8. Notice of
◉ New Construction ◯ Change to existing structure

9. Duration
◉ Permanent ◯ Temporary

10. Proposed Construction Date Beginning (yyyy-mm-dd)
July 1, 2015

11. Temporary Structure
From (yyyy-mm-dd) _____ To (yyyy-mm-dd) _____

Canada

TC File No/Ref No

12. Marking and Lighting Proposed (refer to Standard 621)

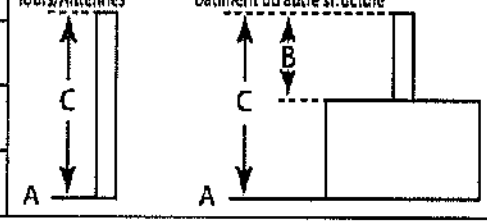
- ☐ Red lights and paint
- ☐ Red and M.I. white lights
- ☐ White M.I. lights
- ☐ Red and H.I. white lights
- ☐ White H.I. lights
- ☐ No painting
- ☐ No lighting
- ☐ Paint marking only
- ☐ Other (provide description)

13. Monitoring to Standard 621, article 4.7 — ☐ Visual inspection per 24 hours — ☐ Automatic remote monitoring

14. Catenary/Cable Crossing

- ☐ Paint supporting structures
- ☐ Cable marker spheres
- ☐ Shore markers
- ☐ Support structure lighting
- ☐ Cable marker lights

			Feet	Metres
15.	A	Ground Elevation (AMSL)		varies
16.	B	Height of an addition to an existing structure		
17.	C	Total structure height including #15 (AGL)		varies
18.		Overall height (#14 plus #16) (AMSL)		varies



19. Does the proposal comply with *Airport Zoning Regulations*? ○ Yes ○ No ○ N/A

I hereby certify that all the above statements made by me are true, complete and correct to the best of my knowledge. Also, I agree to mark and/or light and maintain the structure with established marking and lighting standards as necessary.

Date (yyyy-mm-dd)	Name of person filing notice	Signature
2014-07-22	Trent MacDonald	

Transport Canada Assessment

Marking and/or lighting as per Standard 621:

☑ Lighting Required ☑ Paint Required ☐ Temporary Lighting Required ☐ No Lighting or Painting required

Comments (Transport Canada use Only)

Civil Aviation Inspector	Signature	Date (yyyy-mm-dd)
C. Allaun		2014-09-29

Note 1: This assessment is only valid for one year from the date of assessment and applicable to the proposal as submitted.

Note 2: If there is a change to the intended installation, a new submittal is required.

Wind Turbine Submission Form

Turbine Information						
Turbine Number	Latitude	Longitude	Ground Elevation (m)	Nacelle Height (m)	Rotor Diameter (m)	Total Height (m)
1	44°43'37.13"N	63°21'24.32"W	56	100	100	206
2	44°43'38.39"N	63°20'57.50"W	50	100	100	200

Trent MacDonald <tmacdonald@eonwind.com>

Interference Assessment - 080 Porters Lake Wind Farm

Weather Radars Contact,National Radar Program [Ontario] <weatherradars@ec.gc.ca> Wed, Jul 30, 2014 at 12:25 PM
To: Trent MacDonald <tmacdonald@eonwind.com>
Cc: "Deaudelin,Gaetan [Montreal]" <Gaetan.Deaudelin@ec.gc.ca>, "Weather Radars Contact,National Radar Program [Ontario]" <weatherradars@ec.gc.ca>

Dear Trent MacDonald,

Thank you for contacting the Meteorological Service of Canada, a branch of Environment Canada, regarding your wind energy intentions.

Our preliminary assessment of the information provided to us via e-mail on July 22nd, 2014 indicates that any potential interference that may be created by the Porters Lake

Wind Farm near Gore Radar will not be severe. Although we would prefer our radar view to be interference free, this is not always reasonable. As a consequence, we do not have strong objections to the current proposal.

If your plans are modified in any manner (e.g. number of turbines, height, placement or materials) this analysis would no longer be valid. An updated analysis must be conducted.

Please contact us at: weatherradars@ec.gc.ca.

Thank you for your ongoing cooperation and we wish you success.

Best Regards,

Jim M.C. Young
Environment Canada Environnement Canada

National Radar Program | Programme national de radars
Meteorological Service of Canada | Service météorologique du Canada
Environment Canada | Environnement Canada
4905 Dufferin Street | 4905, rue Dufferin
Toronto, Ontario M3H 5T4 | Toronto (Ontario) M3H 5T4
Email | Courriel : Jim.Young@ec.gc.ca
Phone | Téléphone : +1-416-514-2643

Trent MacDonald <tmacdonald@eonwind.com>

Interference Assessment - 080 Porters Lake Wind Farm

XNCR, Windfarm Coordinator <Windfarm.Coordinator@dfo-mpo.gc.ca> Tue, Jul 22, 2014 at 1:28 PM
To: Trent MacDonald <tmacdonald@eonwind.com>

Hello,

The proposed wind farm (Porters Lake) is located 21 km away from the Shannon Hill radar site and 19 km away from the Georges Island radar site.

Even though it is located within the 60 km consultation zone, it is located beyond the areas covered by the radars. Therefore no interference issues are anticipated.

Regards,

Martin Grégoire, P. Eng

Canadian Coast Guard

From: Trent MacDonald [mailto:tmacdonald@eonwind.com]
Sent: July 22, 2014 11:50 AM
To: XNCR, Windfarm Coordinator
Subject: Interference Assessment - 080 Porters Lake Wind Farm

[Quoted text hidden]

Trent MacDonald <tmacdonald@eonwind.com>

Fwd: Detailed Analysis Results - Porter's Lake Wind Project - Porter's Lake, NS - WTA-2043

Andrew Arbuckle <aarbuckle@eonwind.com> Tue, Aug 5, 2014 at 12:16 PM
To: Trent MacDonald <tmacdonald@eonwind.com>

Andrew Arbuckle
Eon WindElectric
+1-902-401-1076

------ Forwarded message ------
From: <ADIN.SWITZER@forces.gc.ca>
Date: Jun 18, 2012 9:41 AM
Subject: Detailed Analysis Results - Porter's Lake Wind Project - Porter's Lake, NS - WTA-2043
To: <aarbuckle@eonwind.com>
Cc: <JOCELYN.BELAND@forces.gc.ca>

Andrew,

We have completed the detailed analysis of your proposed site, Porter's Lake Wind Project, located near Porter's Lake, NS (WTA-2043). The results of our detailed analysis have shown that there is likely to be minimal interference with DND radar and flight operations.
Therefore, as a result of these findings we have no objections with your project as submitted (attached).
If however, the layout were to change/move, please re-submit that proposal for another assessment using the assigned WTA number listed above. The concurrence for this site is valid for 24 months from date of this email.
If the project should be cancelled or delayed during this timeframe please advise this office accordingly.
It should be noted that our office looks at each submission on a case by case basis and as such, concurrence on this submission in no way constitutes a concurrence for similar projects in the same area, nor does it indicate that similar concurrence might be offered in another region.
Finally, the concurrence offered in this email extends only to the subject projects and current proponent. Should the project or any part of it be altered, or be sold to another developer, this office must be notified and we reserve the right to reassess the project.
Thank you for your patience on this matter and for considering DND radar and airport facilities in your project development process.
If you have any questions feel free to contact me.
Thank you.
Porters Lake Turbine 1 44 43 37.53 63 21 19.56 54.00 99.00 101 204

Adin Switzer
Capt
AEC Liaison Officer
CCISF/ESICC
ATESS/ESTTMA
Défense nationale | National Defence
8 Wing Trenton, Astra, ON K0K 3W0
TEL: 613 392-2811 Ext4834 (CSN: 827-4834)
FAX: 613 965-3200
Gouvernement du Canada | Government of Canada
ü Please consider the environment before printing this email | S'il vous plaît pensez à l'environnement a

Trent MacDonald <tmacdonald@eonwind.com>

Operational Impact Assessment - 080 Porters Lake Wind Farm

+WindTurbines@forces.gc.ca <+WindTurbines@forces.gc.ca> Thu, Jul 31, 2014 at 9:02 AM
To: tmacdonald@eonwind.com

Trent,

Due to the proximity of the proposed site to Shearwater, we will need to do a more detailed analysis to assess any possible impact the wind farm may have. I will update you again as soon as I can. Thank you very much for your patience.

Kayla Bowser
Capt
AEC Liaison Officer/C2SSO
CCISF/ESICC
ATESS/ESTTMA
Défense nationale | National Defence
8 Wing Trenton, Astra, ON K0K 3W0
TEL: 613 392-2811 Ext4834 (CSN: 827-4834)
FAX: 613 965-3200
Gouvernement du Canada | Government of Canada

From: Trent MacDonald [mailto:tmacdonald@eonwind.com]
Sent: July-22-14 11:58 AM
To: +WindTurbines@ATESS@TRENTON
Subject: Operational Impact Assessment - 080 Porters Lake Wind Farm

Dear Sir or Madam,

The purpose of this email is to inform you of a proposed 2-turbine wind farm in Porters Lake, Nova Scotia. The details of the turbine heights and locations are included in the attached file.

We are asking you to complete an interference assessment on the proposed site. If you have any questions or require additional information, please contact me at your earliest convenience.

Appendix 3 Environmental Protection Plan

Porters Lake Wind Farm (3.2MW)

Environmental Protection Plan

Porters Lake Wind Project
3660 Highway 7, Lake Echo
Lake Echo, Nova Scotia

Table of Contents

Section A – Introduction

1.0 General

The Porters Lake Wind Farm (Project; PLWF) is proposed as a 3.2 megawatt (MW) wind energy installation 3 kilometres (km) west of the Town of Porters Lake in Halifax Regional Municipality. The site is located on crown land between Nova Scotia Trunk 7 (NS-7) and Highway 107 and is a section of land decimated by the Porters Lake fire of 2008.

Figures of the site can be found in Appendix A. Watercourses have been identified on the Project site, as shown in Appendix A; generally the site considered to be in a lowland region. Small treed swamps and bogs have been delineated through field studies. No watercourse alteration will occur at the PLWF; the Proponent will following the approach of avoidance, mitigation and compensation with respect to wetland alterations..

2.0 Environmental Protection Plan

This Environmental Protection Plan (EPP) describes protection measures that will limit the environmental effects associated with construction and operation of the Project. The EPP identifies Project mitigation measures to support Project planning, construction and operation.

The EPP is a guide for contractors, sub-contractors and site personnel associated with the Project. It includes commitments made in the Nova Scotia Environmental Assessment (EA) Registration Document. The guide should be adhered to accordingly.

3.0 Objective

The purpose of the EPP is to provide guidelines and protocol regarding environmental protection measures relating to the Project. The EPP will also provide emergency information in the event of an incident on site. It is intended to direct the work completed by the contractors, sub-contractors and site personnel to ensure environmental protection.

4.0 Training

The Project Manger is responsible for ensuring that all personnel on site have a level of training that is commensurate with their responsibilities.

Section B – Erosion and Sediment Control

1.0 General

Construction and large scale earth-moving projects have the potential to speed up erosion when large areas of soil are exposed to rain and storm water runoff. The runoff must be properly handled to avoid siltation in nearby watercourses.

The Proponent and its contractors are responsible for erosion and sediment control specific to their activities within the Project site. This section details protocols and procedures for effective sediment and erosion control measures in accordance with the Erosion and Sediment Control Handbook for Construction Sites, 1988 (ESCH).

The Project footprint was delineated with input from the results of wetland identification and botanical surveys. No alteration to watercourses is expected; wetlands will be avoided when feasible however, the final EPP will detail any required alterations and requirements of regulatory approvals. Control measures during wetland alteration periods will be in place prior to any construction activities in or around wetland areas.

The limits of work was designed in part to minimize potential of sedimentation of wetlands; however, as with an earth work activity, there remains some potential for sedimentation if erosion and sediment control measures are not well managed during or after heavy storm events. Hence erosion and sedimentation control is essential to this Project. Sediment and erosion control measures will be implemented during the construction of the PLWF.

2.0 Protocol

a) The Contractor must prepare a site specific Environmental Construction Plan and establish erosion and sediment control measures prior to construction activities to ensure the Project footprint is minimized and no sedimentation occurs.

b) Earth works should be avoided during heavy rainfalls or periods of high runoff. Where extreme events are forecast, the site shall be temporarily stabilized where possible.

c) The Contractor will avoid areas subject to flooding, including defined wetlands as indicated on construction drawings and as marked in the field. The lay down areas must be selected to avoid natural drainage and preserve existing runoff channels, e.g., ditching. Any work in wetlands is clearly defined on the drawings and in this EPP; no work shall occur without regulatory approvals.

d) Sedimentation fencing and vegetative filters (e.g., hay bales) will be installed as needed, i.e., downgradient of exposed soil areas. Detail on proper installation of such measures can be found in the ESCH, e.g., keying in of sedimentation fencing.

e) Extent and duration of exposed soil will be minimized as much as possible, i.e., expose the smallest feasible area and only areas that are being actively developed.

f) Care will be taken to minimize tracking of sediment from vehicles on Highway 7 from the access road. This area will be checked daily by the Contractor and swept as needed.

g) After grading is completed, the Contractor will stabilize exposed soils as soon as reasonably possible, including placing gravels and establishing permanent vegetation.

h) Sediment and erosion control measures will be monitored daily during active construction by the Project Manager or designate. Monitoring will continue post construction after excessive precipitation events until the site is stabilized.

Section C – Wetlands and Watercourses

1.0 General

It is imperative that all contractors and on-site personal understand the importance of avoiding wetlands unless their alteration has been identified in the construction package. Delineation of wetlands has been completed; alteration to a maximum of 3500m^2 has been identified as unavoidable by the Proponent.

The site drains southeast generally and several low flow or pot wetlands (primarily shrub and trees bogs) will be bisected by the access road and reside in the designed WTG laydown areas. There will be a need to install culverts as part of access road design. All necessary alteration to wetlands will be identified and mitigations clearly stipulated in the final EPP.

The culvert installations will be done in accordance with NSE and NSDNR requirements and during the summer low flow period and in compliance with the Nova Scotia Watercourse Alteration Specification (2006). Accordingly no effect on fish or fish habitat is expected from the Project.

As the Project avoids fresh water fish habitat and marine environs, the Department of Fisheries and Oceans (DFO) does not have a direct interest in this Project; however, should the Contractor not follow the site plan and this EPP and negatively impact fish or fish habitat, the Fisheries Act could be invoked by DFO. Accordingly, the Contractor must conduct on-site operations in a manner that causes minimal disturbance to receiving waters, e.g., no releases of heavily sediment laden water or hazardous materials, e.g., fuel.

Work will be completed in accordance with the Nova Scotia Wetland Conservation Policy, and appropriate approvals will be sought, if necessary, from NSE under the Activity Designation Regulations, including wetland compensation if required.

This EPP will be updated accordingly pending additional work and final design in spring of 2015.

2.0 Protocol

a) No work will occur in watercourses; work occurring in wetlands will only proceed after obtaining necessary approvals from NSE. This will be the responsibility of the Project Manager.

b) There is a need to upgrade the existing woods road and construct a new access road; this work may require up to 5 culverts and will be completed between June 1 and September 30 in accordance with NSE and NSDNR regulatory requirements. Work will be in compliance with the Nova Scotia Watercourse Alteration Specification (2006). NSDNR and NSE will be consulted; specific mitigations for this work will be included in the final EPP.

c) The Project Manager will define the limits of site work as it relates to wetlands by flagging boundaries and defining appropriate buffers. The Proponent will clearly define its limits of work to ensure maximum wetland alteration is 3500m^2. All on-site personal will be informed of these sensitive areas as identified on mapping in Appendix A. This mapping will be updated pending additional wetland field work.

d) The disposal of any substance into a watercourse, directly or indirectly, is strictly prohibited during all phases of the Project.

e) Erosion and sediment control measures must be accurately followed to preserve the highest degree of water quality protection.

f) All refueling activities must take place with a 50m setback from all watercourses and wetland areas (see Section E for additional detail on hazardous materials).

g) All on-site equipment must be mechanically sound. No fuel or hydraulic leaks are permitted; accordingly, equipment must be inspected daily (see Section F for additional detail on equipment maintenance).

Section D – Wildlife

1.0 General

The Project Manager is responsible for ensuring all contractors and on-site personnel are provided with appropriate information and protocols in the event of a wildlife encounter and potential to encounter species at risk or of concern. Wildlife sightings should be reported to the Project Manager. All reasonable action will be taken to avoid disruption and injury to any wildlife encountered.

2.0 Protocol for Wildlife Encounters

a) Harassing wildlife in any manner is strictly prohibited on site.

b) There will be no interaction or feeding of wildlife on site.

c) To minimize the potential for attracting wildlife, all on-site personnel must use the garbage disposal units provided.

d) Equipment and vehicles will yield to wildlife.

e) Injured or deceased wildlife should be reported to the Project Manager who will then contact a Provincial Wildlife Officer to aid or remove the animal. Personnel are prohibited from making direct contact with the animal.

f) Any unlawful or accidental killing of wildlife must be reported to the Project Manager as soon as reasonably possible.

g) The possession or use of firearms on site is strictly prohibited.

3.0 Protocol for Nesting Birds

a) Site clearing is scheduled to take place during the late winter season. No impact to nesting birds is expected to occur.

b) If nesting birds are encountered during construction, the Contractor will not disturb the nest. The sighting must be reported to the Project Manager immediately for direction.

c) If the Project Manager requires advice in avoiding the nest, a Regional Biologist at the NSDNR and the CWS may be contacted. The nest will not be disturbed until the fledglings have left the nest.

4.0 Monitoring for Bird and Bat Carcasses

a) As per the requirements of CWS and Environment Canada (EC), follow up and monitoring plan will be developed for the site and implemented once approved by CWS and EC. This work will be in accordance with the two, 2007 guidance documents from EC: Wind Turbines and Birds: A Guidance Document for Environmental Assessment and Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds. Results will be communicated in an annual report to NSE, CWS and EC.

b) The Project Manager will be notified of any bird or bat carcasses that are found on the site during regular maintenance checks, e.g., within the area of the turbine pad.

c) The Project Manager will log the discovery of a bird or bat carcass found during routine inspections. The information logged should include: species; date and time the carcass; state of decomposition; estimated number of days the bird has been deceased; and injury sustained (if identifiable). The Project Manager will contact CWS for advice on subsequent actions, such as potentially freezing the carcass to send to CWS. Any discovery outside of the formal carcass surveys will be included in the formal annual report.

5.0 Protecting Species at Risk and of Concern

a) Two separate rare plant surveys did not reveal any plant species at risk.

b) There is low-moderate potential for Wood Turtle to be present in the local area of the Project site. The Wood Turtle is a provincially and federally listed species, i.e., Threatened (Canada) & Threatened (NS) respectively.

    a. There is potential for Wood Turtles to nest in stream beds or in road shoulder, i.e., sandy/graveling substrate, during late May - early July. Accordingly the site personnel will be educated by the Project Manager on the potential presence of the Wood Turtle.

    b. NSDNR education materials will support this training.

    c. If any site personnel identify a Wood Turtle or the potential of a nest, the Project Manager will be notified immediately. The Project Manager will contact NSDNR with any questions and to share findings.

c) Surveys have been completed for Mainland Moose; no evidence was found of Mainland Moose in the local area based on the survey.

a. Should the any personnel observe a Moose in the Project area or immediate environs of the Project, they will notify the Project Manager immediately. The Project Manager will notify DNR of these findings.

Section E – Hazardous Waste Management Including Spills

1.0 General

In the event of an accidental spill or hazardous waste incident, the primary concern is preventing the spill from entering a watercourse or wetland. Responding to the incident as quickly as possible will ensure a minimized risk of adverse environmental impact. At all times when hazardous materials are on-site, there must be operational personnel on site that are trained to handle, store, and dispose of hazardous materials.

2.0 Protocol

a) Spills or releases that are contained within the site will be the responsibility of the Project Manger; further assistance will be needed to respond to larger or more serious spills. See Appendix B for emergency contact table.

b) For a spill of greater than 100L of fuel, oil, paints or sealants, the Project Manager will report to Nova Scotia Environment (1-800-565-1633) and the Operator (902-755-2237).

c) If the spill has, or may enter, any watercourse or wetland, or the spill cannot be removed safely, the 24-hour spill reporting number (1-800-565-1633) will be called regardless of the estimated size of the spill.

d) The Contractor will be equipped with an emergency spill containment kit that will adequately control the loss of fuel or lubricant.

e) Only personnel with specific training in spill containment may attempt to respond to a release of a hazardous material.

f) A common method for controlling and containing spills is through the use of absorbents. Common materials used are: sand, dirt, gravel and wood chips. If used, the contaminated absorbent must be collected and placed in appropriate containers with proper labeling.

g) Fuel, fuel storage, lubrication and equipment maintenance will be done at a designated site away from watercourses or wetlands. The area must be on level terrain, and ideally have an impermeable surface and containment system. The area must not be within 50m of the ordinary high water mark of a body of water.

h) All dangerous goods must be transported in accordance with federal and provincial legislation.

i) All hazardous material must stored in an approved container in accordance with federal and provincial legislation.

j) All hazardous materials must be disposed of at an approved facility in accordance with provincial and federal legislation.

k) Products must be properly labeled and handled only by trained on-site personnel.

l) A Material Safety Data Sheet (MSDS) will be kept on site to record all hazardous material inventory stored on site. The MSDS will be kept on file for emergency response teams in the event of a fire or explosion.

Section F – Use and Maintenance of Equipment and Vehicles

1.0 General

The Contractor is responsible for appropriate use and maintenance of equipment such that safety is considered at all times. Air emissions and noise will be minimized, as will be the potential for leaks and spills.

2.0 Protocol

a) All on-site personnel must comply with provincial and federal restrictions as it relates to transportation and vehicle management.

b) All drivers will obey local traffic laws, including speed limits, and practice safe, defensive driving.

c) The Project Manager will coordinate with the RCMP and Nova Scotia Transportation and Infrastructure Renewal (NSTIR) to ensure proper permitting and safe transport of wide or heavy loads.

d) All construction equipment and vehicles must be suitably clear or debris and cleaned / pressure washed if necessary before being brought to the site to reduce transport of invasive species.

e) Equipment must undergo routine maintenance to minimize noise impacts. See Section I, 3.0 for a discussion on noise.

Section G – Waste Management

1.0 General

Wastes created during construction of the Project are the responsibility of the Contractor completing the construction activities. In terms of operation, wastes again are responsibility of the party completing the activity, e.g., regularly scheduled turbine maintenance. Hazardous waste management was addressed in Section E.

2.0 Protocol

a) Recycle and re-use solid and liquid (e.g., fuel, oil, solvents) waste, where possible; dispose of all remaining waste as per provincial and federal guidelines.

b) Sewage and grey wastewater collected on site should be disposed of according to provincial standards.

c) Proper garbage disposal units must be provided on site. All litter and site waste should be collected daily and disposed of at an approved facility.

d) Burning any products is strictly prohibited.

e) Merchantable timber shall be cut into lengths for salvage at discretion of Contractor with non-merchantable timber chipped and disposed of according to provincial standards

Section H – Contingency and Emergency Response

1.0 General

All reasonable precautions will be taken by the Project Manger and on-site personnel to avoid an accident or injury. In the event of an accident or injury, preparation and quick response is crucial in minimizing adverse effects to on-site personnel and the environment. This section outlines plans and protocols for reasonably conceivable emergencies that could take place on site. The Emergency Reponses Table is Appendix B with relevant contact information beyond calling 911.

2.0 Explosion or Fire

Explosion or fire may occur on site as a result of many different factors, some of which include: vehicle accidents, combustion of spilled material, negligent handling of flammable materials or vandalism.

The Project Manager is responsible for having appropriate firefighting equipment (i.e., fire extinguisher) on site and available to respond to minor fires, if it is safe to do so. There must personnel on site at all times that are trained to use this fire protective equipment, such as fire extinguishers.

In the event of a fire:

a) Contact 911 Emergency Services for assistance.

b) If the fire is minor and it is safe and feasible to do so, a trained member of staff may attempt to extinguish the fire. Only individuals trained in the proper use of fire extinguishers may attempt to extinguish the fire.

c) Personal protective equipment will be used by all responding personnel to ensure protection from the fire and other hazardous materials potentially emitted in the process.

d) The area will be carefully monitored to ensure the fire has been completely extinguished.

As a preventative measure against fire, smoking is allowed in designated smoking areas only as defined by the Project Manager. These areas must be greater than 50m away from all flammable or hazardous materials.

3.0 Personal Injury or Fatality

If an accident or fatality does occur on site, the following actions will be taken immediately:

a) All personal injuries and accidents will be responded to immediately. Appropriate first aid measures will be employed provided the measures will not further aggravate the victim.

b) Only individuals with current First Aid Certification will perform the first aid. The severity of the injury should be assessed; 911 Emergency Services will be contacted if additional medical attention is required.

c) In the event of a fatality, contact 911 immediately and respond as further directed.

d) In the event of injury or fatality, the Project Manager will be informed as soon as possible.

4.0 Discovery of Human Remains

In the event suspected human remains are encountered on site, the following action will be taken:

a) Cease all work related activities and secure the site to avoid further disturbance.

b) Contact 911 services for further assessment of the remains.

c) If it is determined that the remains are human, representatives of the Nova Scotia Department of Communities, Culture and Heritage will be contact as soon as reasonably possible. If the remains or artifacts discovered are potentially of Mi'kmaq significance, KMK will also be notified.

5.0 Cultural Artifacts

If a suspected cultural artifact is found:

a) The Project Manger will stop all work in the vicinity of the artifact and secure the site to avoid further disturbance.

b) The Department of Communities, Culture and Heritage and the KMK will be contacted for advice and further assessment as appropriate.

6.0 Emergency Response Table

In the event of any emergency where police (Halifax RCMP Office), fire (Lake Echo) or ambulance is required for response as soon as possible, call 911. Otherwise, the emergency response table in Appendix B has additional contacts related to the Project.

Section I – Site Management

1.0 General

During the Project construction and operations phases, the Project Manager is responsible for appropriate site management. In addition to the various aspects of site management already addressed in the EPP, site access and signage, noise and light management, and monitoring are key to minimizing impact on the environment and human receptors, such as neighbours.

Associated requirements for community liaison and resolution in the event of complaints are addressed in Section J.

2.0 Site Access and Signage

a) Public access to the Project site is prohibited. "Restricted Access" signs will be posted at the entrance to the access road.

b) A gate will be installed at the entrance road to the Project site to prevent unauthorized site access.

c) Appropriate signs will be placed on site during operation indicating the danger of falling ice, e.g., ice throw potential from the turbine blades or flying debris.

d) As defined in Section J, signage will contain contact information of the Proponent.

e) Following an icing event, the following procedures will be followed:

    a. Two representatives from the service company will visit the site, remaining in their vehicle to assess the level of icing, and ice melt/throw from the blades.

    b. When the site has been deemed safe by the technicians, first a call to remote operations will be made to request a remote restart. If the control center cannot restart the turbines remotely, a manual restart will be done.

3.0 Noise

During construction, noise will be generated from vehicles and equipment and related activities. The closest residence is greater than 1000m from the Project site; it is anticipated that any inconvenience caused by construction is a temporary, short term nuisance. Should any public annoyance result from construction of the Project, it is

expected to be very low and will be mitigated via the Contractor measures as noted below and community liaison as per Section J of this EPP.

To mitigate construction noise, the following will be adhered to by the Contractor.

a) Ensure that all vehicles are maintained properly and have appropriate noise suppression equipment.

b) Where possible, use rubber tire equipment.

c) Reduce idling, where practical.

d) Minimizing noise by training of employees on management practices such as avoiding use of loud radios, shouting excessively, slamming of equipment doors, etc.

Blasting may be required as part of this work; if so, a protocol will be included in the final EPP. Work will be in accordance with regulatory requirements.

If noise complaints are made by community residents, a complaint resolution procedure is followed. Where possible, the Project Manger will alter the construction planning to accommodate concerns (see Section J).

The Project will use commercially reasonable efforts to limit construction activities to the daytime. Should the Project Manager require work to be completed during nighttime hours, the Project Manager will use the community liaison protocols outlined in Section J.

During operation of the wind turbine, there will be turbine noises that may be audible in terms of low-level continuous or intermittent swooshing, as well as low level frequencies. While noise is expected to be at very low levels at these distances from the turbines (greater than 1000m from closest residence), it is important that neighbours are informed that some increase to baseline sound pressure level is expected though it is expected to be inaudible under most conditions. Further, the community has been provided with contact information to share any questions or concerns with the Proponent. Community consultation and complaint resolution is discussed in Section J.

While no follow up monitoring of noise is proposed for this Project, it may be an outcome of the complaint resolution procedure (Section J) if concerns exist.

4.0 Lighting

Lighting can impact birds as well as neighbours. Like noise, consultation and complaint resolution should address issues respecting lighting with neighbours (see Section J).

Primary aspects in lighting as applied to this Project are:

a) Lighting on the turbines is required to comply with aviation legislation (Transport Canada).

b) Preparation of a lighting plan in consultation with Canadian Wildlife Service and Transport Canada.

c) Proponent will review use of LED lighting that has a definite on/off setting as recommended by Environment Canada.

d) Any required lighting on ancillary buildings will be shielded to shine down.

5.0 Project Monitoring Requirements

a) During active construction, ongoing monitoring will occur by the Contractor. Primarily this will involve erosion, site stabilization, and equipment maintenance including checking for leaks. The Project Manager will perform intermittent inspection of the Contractor's activities respecting compliance with Contract documents including this EPP.

b) Operation and maintenance will be coordinated by the Project Manager. The staff and contractors will report issues to the Project Manager as identified in this EPP, including but not limited to destabilized surfaces (i.e., exposed soil), bird or bat carcass discovery, as well as vandalism and other issues.

c) Malfunctions and parts replacement will be assessed on an ongoing basis during operation and are subject to calendar maintenance and regular inspection schedules.

d) As defined in Section D, 4.0, ongoing inspections during maintenance visits will include a review of area around wind turbine pad for bird / bat carcasses with notification of the Project Manager if any are found. Post construction requirements as per CWS and the Department mandates will also be followed, including design, implementation and annual reporting of the bird and bat follow up program.

e) Given the scope of this Project, no noise monitoring is required; however, noise monitoring will be considered in the event of public complaints (see Section J).

Section J – Community Liaison

1.0 General

The Project Manager will ensure that the community is updated on project planning, construction activities and commissioning of the wind turbine. As this is a community energy project, liaison with the community is integral in the planning. This also ensures that any neighbours or other interested community members with questions or concerns will have Proponent contact information such that their questions or concerns can be promptly addressed.

In the event of public complaints, the Project Manager will ensure that the complaints are addressed via respectful communication, including joint fact finding, and review and implementation of mitigation measures as appropriate.

2.0 Communication and Notification

a) The Project Manager will provide advance notice to neighbours concerning construction and operational phases via mail outs. Information will include construction schedule, defined activities that are expected to create noise and their expected duration, mitigation measures that are being used and noise respite periods, i.e., quiet times. Expectations in terms of potential noise and lighting during operation of the turbine will also be conveyed in the information prior to commissioning.

b) A website is constructed for communication with stakeholders, including neighbours (http://wattswind.com). This will be updated with construction schedule and other announcements.

c) Site information signage will be present at gated entry to site with Proponent contact details for stakeholders to gather more information.

d) Both signage and mail outs will have Proponent contact information such that all comments or complaints will be forward to the Proponent contact for review. See Appendix B for contact information; this list will be updated as appropriate.

e) The Proponent contact information and copies of the Environmental Assessment should be made available via the Lake Echo Community Center and the Cole Harbour Public Library, as well as on the Department's website.

3.0 Complaint Resultion Protocol

a) Complaints or comments will be reviewed by the Project Manger or designate.

b) Within a maximum of one week from receiving the communication, the Project Manager or designate will provide an initial response to the question or concern.

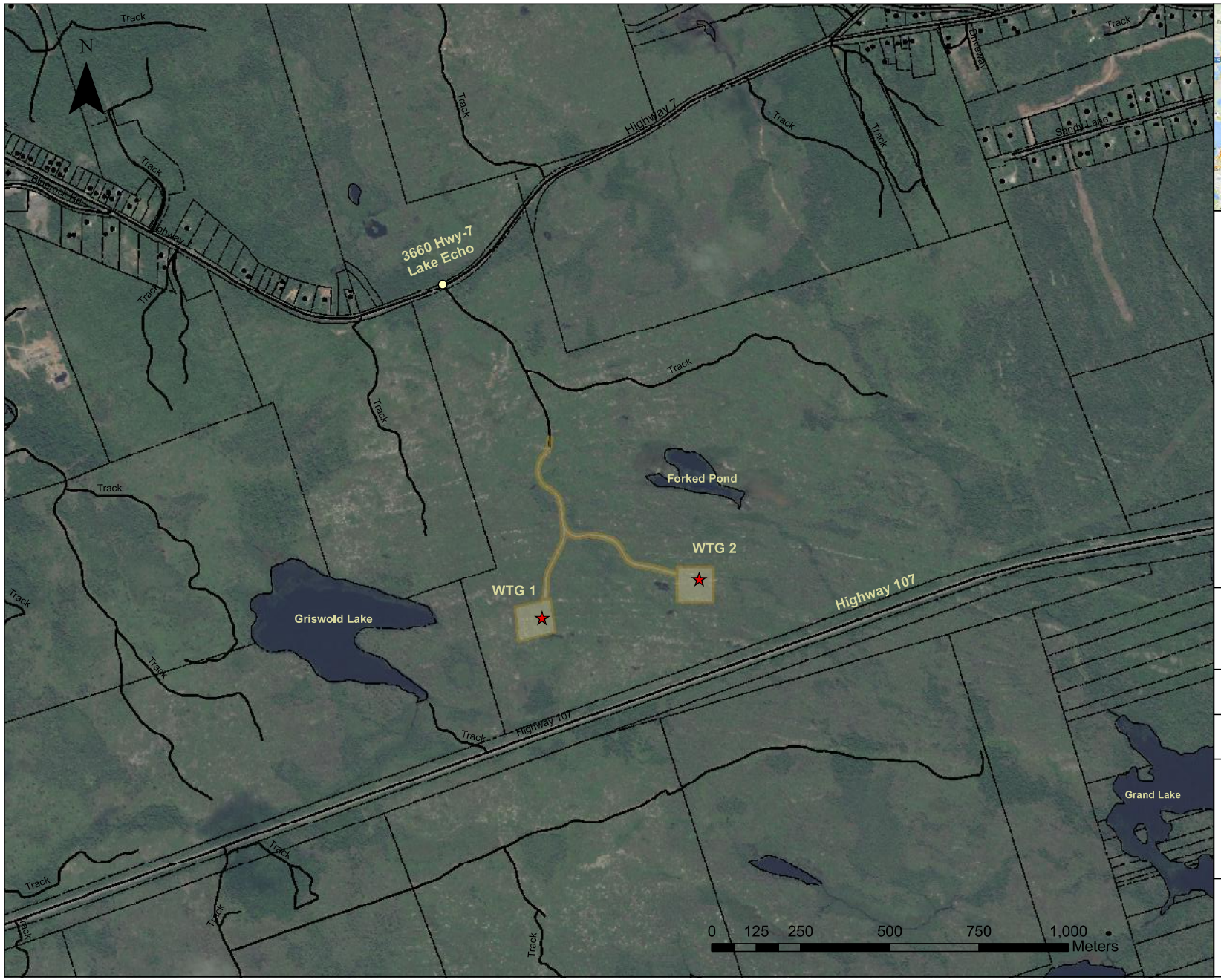
c) Where a member of public expresses a concern, the Proponent will seek to better understand the perspective of the community member and the specifics of the complaint. The Proponent and community member will embark on joint fact finding to identify the source of the complaint and possible mitigative measures.

d) The Project Manager will review possible mitigations available in consultation with the Proponent management team. These options will be discussed openly with the community member.

e) Appropriate and reasonable action will be taken to mitigate impacts caused by the Project, including noise monitoring, landscaping, etc.

f) In the unlikely event that complaints cannot be resolved directly with the community member, the Proponent will seek review options in a form of alternate dispute resolution as defined under the *Nova Scotia Environment Act*, including but not limited to conciliation, negotiation, mediation or arbitration. It is expected that most if not all concerns can be addressed directly with the resident or other stakeholder.

Appendix A - Site Plan



Legend

- WTG Location
- Residential Building
- Roads
- Project Footprint
- Municipal Bounds

Appendix A

Environmental Protection Plan

Drawn by: TAM	Date: 2014/10/30
Project #: 080	Scale @ 11"x17"

EON WindElectric

Coord. System: NAD83 CSRS UTM Z20N
Projection: Transverse Mercator
Units: Meters

Appendix B – Emergency and Project Contact Information

Organization	***Contact Name/ Service***	***Address***	***Phone Number***
Lake Echo and District Fire Department		3035 Highway 7, Lake Echo, NS B3E 1A6	1 (902) 829-3105
Halifax RCMP Detachment		1975 Gottingen Street, Halifax, NS B3J 2H1	1 (902) 490-6883
Poison Control	NS Poison Information Centre		1 (800) 565-8161
CANUTEC	Dangerous Goods Emergencies		1 (613) 996-6666 (collect) *666 (cellular)
Regional Spill Reporting Number	24 hour Emergency and Environmental Response		1 (800) 565-1633 or 1 (902) 426 –6030
Hospital	Dartmouth General Hospital	325 Pleasant St. Dartmouth, NS	1 (902) 465-8300
Nova Scotia Power Inc.	Report Power Interruption		1 (877) 428-6004
Watts Wind Energy Inc.	Stan Mason, President	4 MacDonald Avenue Dartmouth, NS	1 (902) 482-8687
Eon WindElectric Inc.	Paul Pynn, President	4 MacDonald Avenue Dartmouth, NS	1 (902) 482-8687
Eon WindElectric Inc.	Trent MacDonald, Project Engineer-In-Training	4 MacDonald Avenue Dartmouth, NS	1 (902) 482-8687
Nova Scotia Department of Labour	Occupation Health & Safety Division		1 (800) 952-2687
Nova Scotia Department of Transportation & Public Works	24 Hour Service		1 (902) 742-4612
Kwilmu'kw Maw-klusuaqn Negotiation Office	Twila Gaudet	851 Willow Street, Truro, NS B2N 6N8	1 (902) 843-3880
Indian Brook First Nation	Jennifer Copage, Sipekne'katik Consultation Coordinator	118 Sesame St. Micmac, NS B0N 1W0	1 (902) 758-3372
Department of Natural		1701 Hollis St.	1 (902) 424-5935

Organization	***Contact Name/ Service***	***Address***	***Phone Number***
Resources		Halifax, NS B3J 2T9	
Nova Scotia Environment	Glen Warner, District Manager	30 Damascus Road, Bedford NS B4A 0C1	1 (902) 424-3856

Appendix 4 Municipal Development Permit

THIS IS NOT A BUILDING PERMIT

THIS PERMIT DOES NOT AUTHORIZE ANY CONSTRUCTION ACTIVITY

THIS PERMIT CERTIFIES COMPLIANCE WITH LAND USE BYLAW REQUIREMENTS ONLY, AND NO REVIEW WAS COMPLETED BY DEVELOPMENT ENGINEERING, THE HALIFAX REGIONAL WATER COMMISSION, THE BUILDING INSPECTOR, OR ANY OTHER AUTHORITY HAVING JURISDICTION.

PRIOR TO UNDERTAKING ANY CONSTRUCTION ACTIVITY, A BUILDING PERMIT IS REQUIRED TO CERTIFY COMPLIANCE WITH THE TECHNICAL REQUIREMENTS OF THE APPLICABLE BUILDING CODE REGULATIONS AND REQUIREMENTS OF THE ABOVE NOTED REVIEW AGENCIES.

DEVELOPMENT PERMIT — HRM File Number 141439

GRANTED TO

WATTS WIND ENERGY INC.

Project Description

MISCELLANEOUS ACTIVITIES

Subject Property: PID #00497701 3660 HIGHWAY 7 , LAKE ECHO

Property owner(s): NS DEPARTMENT OF NATURAL RESOURCES
HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF

APPROVAL CONDITIONS

NOT AN HRM OWNED ROAD. INSTALLATION OR ALTERATION TO ACCESSES (IF APPLICABLE), MUST BE APPROVED BY NSTIR.
PROJECT APPROVED UNDER INFORMATION PROVIDED FOR PERMIT 138927.

This permit has been issued based on plans and specifications provided by the applicant. Any departure from the approved plans requires submission of revised plans and the approval of the Municipality in the form of a revised permit.

THIS DEVELOPMENT PERMIT EXPIRES 1 YEAR FROM THE DATE OF ISSUE.

HALIFAX

PO Box 1749, Halifax, Nova Scotia B3J 3A5
Website: https://www.halifax.ca/PermitsInspections

Halifax: Tel: 490-5650; Fax: 490-4645
Dartmouth: Tel: 490-4490; Fax: 490-4661

DATE OF ISSUANCE	Wednesday, November 12, 2014
ISSUED BY	ANDREW FAULKNER
SIGNATURE	

Appendix 5 Avian Bird Reporting

Pre-construction survey of autumn bird migration at the Porters Lake Wind Farm

Andrew G. Horn
for Eon WindElectric Inc

Summary

A two-turbine wind farm is planned for a site near Forked Pond, between Lake Echo and Porters Lake, Nova Scotia. As part of pre-construction assessment of the project, an autumn migration bird survey was undertaken, consisting of nine visits that combined transect, area search, and passage migration counts throughout September to early November, 2013. No species at risk or high concentrations of birds were found that would suggest the site has more than low sensitivity for birds during migration. The site does have potentially suitable habitat for breeding by several species of concern, however, so searches for these species during the breeding season are recommended.

Determining Site Sensitivity and Level of Concern

Background information

Pre-existing information on species found near the site (from sources suggested in EC 2007b) comes mainly from coverage by birders and others of nearby birding "hotspots", such as Conrad Beach and West Lawrencetown Marsh (Maybank 2005), which are on the coast with strikingly different habitat to the present site. The site is also well enough inland that it does not lie on a flight line between such coastal sites. Thus little of the pre-existing data is applicable to the present site.

The most applicable pre-existing data appears to be the pre-construction avian survey for the Gaetz Brook Community Wind Project (Strum Consulting 2013), which occupies the same relation to the coast as the present site, but is 6 km to the east. No significant risk factors were found at that site during migration (Table 1). Provincially ranked species were in small numbers, although several were year-round residents. Species with federal at-risk status included one Common Nighthawk passing south of the site and one pair of Canada Warblers that were probable breeders at that site (Table 1), although this species is unlikely to breed at the Porters Lake site, which was severely burned over in 2008.

Site sensitivity

In terms of its topography, the present site is not on a ridge, cliff, shoreline, or other topographical feature that would concentrate birds. It has little habitat that is particularly well suited to migration stopover, such as high dense vegetation, running water, or late fruiting bushes. Instead, the site, burned in one of Nova Scotia's worst wildfires, in 2008, mainly consists of a series of burnt-over rock outcrops that are partly covered with low shrubby vegetation, and are separated by narrow sedge-dominated seeps, with a few remnant patches of boggy spruce and/or tamarack. As noted above, the site is not on a flight path between sensitive areas (which in this landscape are all coastal, such as Conrad Beach and Lawrencetown Marsh).

Based on this information, it seems that the site has low sensitivity, but given the potential presence of species of concern (e.g., some of the provincially Yellow-ranked species in Table 1), it might be considered to be High Sensitivity. Combining that with the small size of the project (two turbines) yields a Level of Concern (from Table 3 of EC 2007b) of Category 2. Projects in this category call for "basic surveys spread over a one-year period", with future survey effort depending on the information gathered.

Methods

For fall surveys, EC protocols (2007a) recommend 8-10 visits spread through the main migration period for most bird species, using the methods of transects, area searches, and/or passage migration counts. For this project, the EC protocols were adjusted based on site-specific considerations. Specifically, transects were hard to complete, especially in the initial visits to the site, because of the observer's unfamiliarity with the terrain and the difficulty of traversing its alternating rock outcrops, wet fissures, and occasional sinkholes. Therefore, the length of transect was scaled back, to allow for safer passage, diversion to area searches when distinct habitat patches were encountered, and frequent scanning of the sky (< one 360 degree scan every 5 minutes) in lieu of passage migration counts. The goal of each visit was to complete one segment (either the north-south or west-east) of the line in Fig. 1, although on later visits, when the sparser late-fall vegetation made safe paths easier to see, both segments were completed.

Nine visits were made to the site from September to early November (Table 2). Each visit began with a search for carcasses under the communication tower near the north end of the site, and two of its three guy wires. Also, Forked Pond was scanned for waterfowl on each day, when that day's transect offered the clearest view (at least 50%) of the water's surface.

Results

The species list is in Table 3.

While large numbers of migrants were seen on some occasions (Table 3), these birds were seen in small flocks, whose locations were not noticeably concentrated in any particular area of the study site. Eight species of raptor were seen (Turkey Vulture, American Kestrel, Bald Eagle, Osprey, Sharp-shinned Hawk, Red-tailed Hawk, Broad-winged Hawk), but none in large numbers (Table 3).

The only priority species found were one Common Loon (one individual flying c. 150m high, 250 m west of the west turbine site), one Golden-crowned Kinglet (a likely migrant along the entry road), Gray Jay (two individuals seen together, just southwest of the east turbine site).

No carcasses were found under the communications tower, and no waterfowl were seen on Forked Pond.

Discussion

Overall, these results suggest that, in terms of fall migrants, the site has Low Sensitivity under the criteria of EC 2007b. The same conclusion would likely result from spring migration surveys, as movements of spring migrants in Nova Scotia are generally less numerous and diverse than in fall. Nonetheless, the site has potentially suitable breeding habitat for several species of concern, notably Olive-sided Flycatcher, Gray Jay, and Rusty Blackbird, and should be checked thoroughly for these species in the breeding season (April-July 2014).

References

Environment Canada, Canadian Wildlife Service (EC). 2007a. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.

Environment Canada, Canadian Wildlife Service (EC). 2007b. Wind Turbines and Birds, A Guidance Document for Environmental Assessment.

Maybank, B. 2005. Birding Sites of Nova Scotia. Nimbus, Halifax (Nova Scotia).

Strum Consulting. 2013. Baseline Avifauna Surveys Final Report Gaetz Brook Community Wind Project. Unpublished report for Natural Forces Technology, Inc.

Table 1. Priority species found in each season, with status, detected at the Gaetz Brook Community Wind Project, as given in Strum Consulting 2013. Species in **bold** ranked by COSEWIC as Threatened.

Species	**Season**	**Provincial status** (as reported in source)
Common Loon	Spring, Summer, Autumn	Red
Willet	Summer	Red
Common Snipe	Summer	Yellow
Common Nighthawk	Autumn	Red
Yellow-bellied Flycatcher	Spring, Summer	Yellow
Tree Swallow	Summer	Yellow
Gray Jay	Autumn, Winter	Yellow
Boreal Chickadee	Spring, Autumn, Winter	Yellow
Golden-crowned Kinglet	Spring, Summer, Autumn, Winter	Yellow
Ruby-crowned Kinglet	Summer, Autumn	Yellow
Tennessee Warbler	Spring	Yellow
Blackpoll Warbler	Spring, Autumn	Yellow
Wilson's Warbler	Summer	Yellow
Canada Warbler	Spring, Summer	Red
Pine Siskin	Summer, Autumn	Yellow

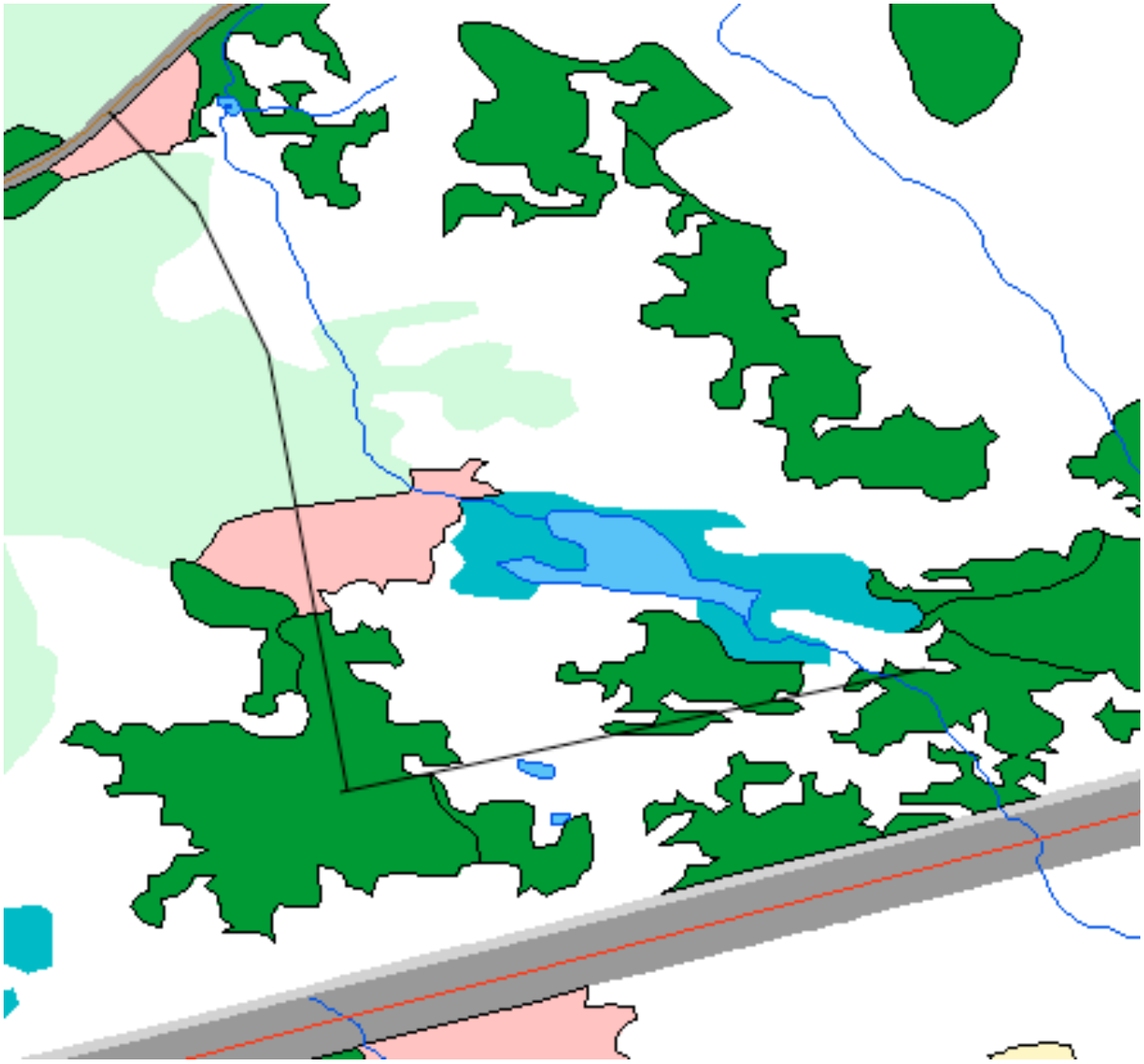
Table 2. Sample effort and wind conditions (weather data from Stanstead International Airport, at time of the end of each visit).

Date	Start time	Duration	Wind	
			direction (degrees)	speed (km/h)
Sep 6	6:30	3.0	330	7
Sep 9	11:00	2.3	290	22
Sep 18	8:03	4.0	280	24
Sep 20	8:55	2.4	350	16
Sep 30	9:17	1.5	170	4
Oct 11	13:51	1.8	30	15
Oct 19	9:43	2.1	270	26
Oct 23	7:55	1.8	340	10
Nov 04	8:00	2.2	350	15

Table 3. Species list, with days detected, individuals detected per day, and high counts of migrants. (Bold = provincial Status Rank of May Be at Risk (loon) or Sensitive (jay, kinglet))

Species	**Days**	**Median/day (w/ range)**	**High migrant totals (> 5 birds/day, w/ date)**
Canada Goose	1	1	
Ring-necked Pheasant	1	1	
Common Loon	1	1	
Turkey Vulture	1	1	
Osprey	1	1	
Sharp-shinned Hawk	1	1	
Bald Eagle	2	2 (1-3)	
Broad-winged Hawk	1	1	
Red-tailed Hawk	2	1.5 (1-2)	
Shorebird sp.	1	1	
Downy Woodpecker	1	1	
Hairy Woodpecker	5	1 (1-3)	
Northern Flicker	5	3 (1-7)	7 (9/06)
Pileated Woodpecker	1	1	
American Kestrel	1	1	
Least Flycatcher	1	1	
Red-eyed Vireo	1	1	
Gray Jay	1	2	
Blue Jay	5	3 (1-38)	38 (9/06)
American Crow	9	5 (2-20)	
Common Raven	9	5 (3-12)	
Black-capped Chickadee	3	8 (3-9)	
Red-breasted Nuthatch	1	1	
Golden-crowned Kinglet	1	1	
Hermit Thrush	1	5	
American Robin	5	3 (1-146)	146 (9/06), 10 (9/30)
American Pipit	1	1	
Cedar Waxwing	1	5	
Black-and-white Warbler	3	1 (1-2)	
Common Yellowthroat	5	4 (1-13)	
Northern Parula	1	1	
Magnolia Warbler	1	1	
Yellow Warbler	1	1	
Chestnut-sided Warbler	1	1	
Blackpoll Warbler	1	4	
Palm Warbler	5	3 (1-12)	12 (9/18), 7 (9/30)
Yellow-rumped Warbler	5	7 (1-12)	8 (9/18), 12 (9/20), 7 (10/11)
Wilson's Warbler	1	2	
Song Sparrow	5	4 (2-9)	9 (9/30)
Lincoln's Sparrow	1	1	
Swamp Sparrow	4	2.5 (1-5)	
White-throated Sparrow	5	3 (1-6)	6 (9/30)
Dark-eyed Junco	5	2 (1-4)	
Red-winged Blackbird	1	1	
Purple Finch	4	10.5 (1-36)	36 (10/23), 20 (11/04)
Red Crossbill	1	1	
American Goldfinch	6	3.5 (1-12)	12 (11/04)

Figure 1. Forest cover map of site (from https://ca.nfis.org; not ground-truthed as of this report), showing transects walked during surveys (dark line). Transects follow the proposed access road to the turbines, which are planned to be placed at the corner and eastern end of transects. Pink = Mixedwood; dark green = Coniferous; light green = Regenerating; teal = Wetlands; white = Unspecified.



Pre-construction survey of spring bird migration and breeding birds at the Porters Lake Wind Farm

Andrew G. Horn
for EON WindElectric Inc

Summary

As part of pre-construction assessment of a two-turbine wind farm proposed at Forked Pond (near Porters Lake), Nova Scotia, a spring migration and breeding bird survey was undertaken. It consisted of nine visits from 11 April to 13 July 2014, that included transects, area searches, playbacks for federal species at risk, passage migration counts (April-May only), and point counts (June and July only).

Few migrants were encountered, and although two federal species at risk (Common Nighthawk and Rusty Blackbird) and several provincially sensitive species were found, each was encountered only once, with no evidence of breeding on the site. Together with similar results from a fall migration survey in 2013, the results suggest the site has low sensitivity for impacts on birds.

Determining Site Sensitivity and Level of Concern

Background information

The site was burned over in 2008, in one of Nova Scotia's worst wildfires. The predominant habitat that remains consists of a series of burnt-over rock outcrops that are partly covered with low shrubby vegetation, separated by narrow sedge-dominated seeps, with a few remnant patches of boggy spruce and tamarack.

Pre-existing information on species found near the site (from sources suggested in EC 2007b) comes mainly from coverage by birders and others of nearby birding "hotspots", such as Conrad Beach and West Lawrencetown Marsh (Maybank 2005), which are on the coast with strikingly different habitat to the present site.

A pre-construction avian survey for the Gaetz Brook Community Wind Project (Strum Consulting 2013), occupies the same relation to the coast as the present site, but 6 km to the east and with quite different habitat (the present site burned over in 2008). No significant risk factors were found at that site, apart from one pair of Canada Warblers that were probable breeders at that site (Horn 2013).

Site sensitivity

The present site is not on a ridge, cliff, shoreline, or other topographical feature that would concentrate birds, and has little habitat that is particularly well suited to migration stopover, such as high dense vegetation, running water, or late fruiting bushes. It does, however, have boggy coniferous open areas, which might conceivably be suitable breeding habitat for several species of concern, notably Olive-sided Flycatcher and Rusty Blackbird.

Based on this information, it seems that the site has low sensitivity, but given the potential suitable habitat for species of concern, it was treated as one of High Sensitivity. Combining that with the small size of the project (two turbines) yields a Level of Concern (from Table 3 of EC 2007b) of Category 2, which calls for "basic surveys spread over a one-year period".

Methods

For migration surveys, EC protocols (2007a) recommend near-weekly visits spread through the main migration period for most bird species, using the methods of transects, area searches, and/or passage migration counts. Six visits were made to the site from 11 April to 30 May (Table 2). Each visit began with a search for carcasses under the communication tower near the north end of the site, and two of its three guy wires. The transect in Figure 1 was then walked, with frequent scanning of the sky for migrants and with area searches of any potential migrant stopover habitat within sight of the transect (shrubby seeps, berry bushes, and remnant forest patches). Forked Pond was scanned for waterfowl on each day.

For breeding bird surveys, EC protocols (2007a) recommend several visits during the main breeding period for most bird species (late May to July), with at least two visits 10 days apart and including the methods of transects, area searches, and/or point counts. Given the site had already been searched in this way in May, but without point counts, two more visits were made in June that included 5-minute point counts from 7 stations approximately 300m apart along the transect in Figure 1.

Special sampling effort was directed at two federally species that early visits suggested might be present on the site: Common Nighthawk and Rusty Blackbird. For Common Nighthawk, the site appeared to have extensive suitable breeding habitat, because it has extensive burnt over areas, yet none were detected during the regular surveys. Therefore an additional visit was made on 13 July, during morning twilight when the species is most readily detected. Ten minutes were spent listening from each of three locations: the north end of the transect described above (Figure 1) and Highway 107 immediately south of each proposed turbine location.

For Rusty Blackbird, approximately 30 seconds of song and (after an approximately 20-second pause) 30 seconds of mobbing calls of the species were played at roughly natural amplitude levels (~85 dB) near the west and east shores of Forked Pond during each visit in May and June.

Species totals and (in the case of point counts) locations are archived and publicly available on eBird (http://ebird.org).

Results

The species list is in Table 2. No migrants were detected that could be unambiguously distinguished from local breeding birds (specifically, none flocked with other species, were

present in groups of five or more individuals, were well away from unsuitable breeding habitat, or flew in a single directed flight over the study site).

Two federally listed species were found, both only once. First, a Common Nighthawk was heard during the search specifically for that species on the morning of 13 July. The bird was heard from Highway 107, and for several minutes sounded like it was circling over Forked Pond, although most of the nighthawk calls heard (steady calling by one bird throughout the 10-minute listening period) came from across Highway 107 south of the site.

Second, a probable Rusty Blackbird (the identification mainly relied on its flight call and is thus uncertain) flew west to east over the north side of Forked Pond on 21 May. It stopped briefly at the shore of the pond before continuing to fly eastward. The species was not encountered on any other visit, despite repeated efforts to locate it using playback (see Methods).

Besides these two federally (and provincially) listed species, four other species with provincial statuses of Yellow (Sensitive) were encountered: Grey Jay, Tree Swallow, Golden-crowned Kinglet, and Ruby-crowned Kinglet. All were encountered only once, and likely do not breed on the site.

No carcasses were found under the communications tower.

Discussion

The spring migration surveys suggest the site does not concentrate migrants in the spring; a fall migration survey of the site (Horn 2013) reached the same conclusion. Of course, with any site, migrants might pass overhead undetected, especially at night, a possibility that can be assessed using specialized techniques such as recording of night flight calls, but that, at least with current methods, can only be ruled out categorically by using radar. Given the small size of the present project, its setback from the coast, and the scarcity of heavy diurnal migration movements that might indicate a migration corridor, such expensive and labour-intensive methods might not be warranted. If multiple projects are being proposed nearby along the coast, however, these more intensive methods should be considered.

The breeding bird survey revealed only one species at risk or provincially sensitive species that might breed on the site, Common Nighthawk. If the species actually nested on the site, it likely would have been encountered more frequently, but as the species is mainly active at dawn and dusk it may have been missed (thus the species is listed as a potential breeder in Table 3). The nighthawk is an open country species, so clearing associated with the proposed project would likely not appreciably reduce suitable habitat, but to the author's knowledge, the effects of wind turbines on this species has not been studied. The project's footprint is small, however, so if there were any effect it would apply to one or two territories. Also, no Common Nighthawk mortalities were recorded in Canada's Wind Energy Bird and Bat Monitoring Database as of December 2013, even though all eight of Canada's commonest species of swallow (which are also aerial feeders) are among the 25 species

most frequently found to collide with turbines (out of a total of 145 species listed; Bird Studies Canada et al. 2013).

Overall, these results suggest that the site has Low Sensitivity under the criteria of EC 2007b.

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Table 1. Search effort and weather conditions.

Date	Time	Duration (min)	Protocol*	Weather			
				°C	Wind direction (degrees)	Wind speed (km/h)	Conditions
11 April	8:00	90	Transects, area searches only	7	200	31	Mainly clear
21 April	8:30	90	"	4	220	16	"
12 May	6:30	120	"	1	350→130	15	Cloudy
15 May	7:45	90	"	9	210	16	Cloudy
21 May	8:20	120	"	8	40	5	Fog
30 May	8:14	100	"	14	280	7	Mostly cloudy
10 June	6:50	120	Point counts	17	360	13	Mostly cloudy
22 June	6:15	120	Point counts	12	250	8	"
13 July	4:30	90	Point counts (for crepuscular spp)	16	250	3	Clear

*All visits included transects and area searches.

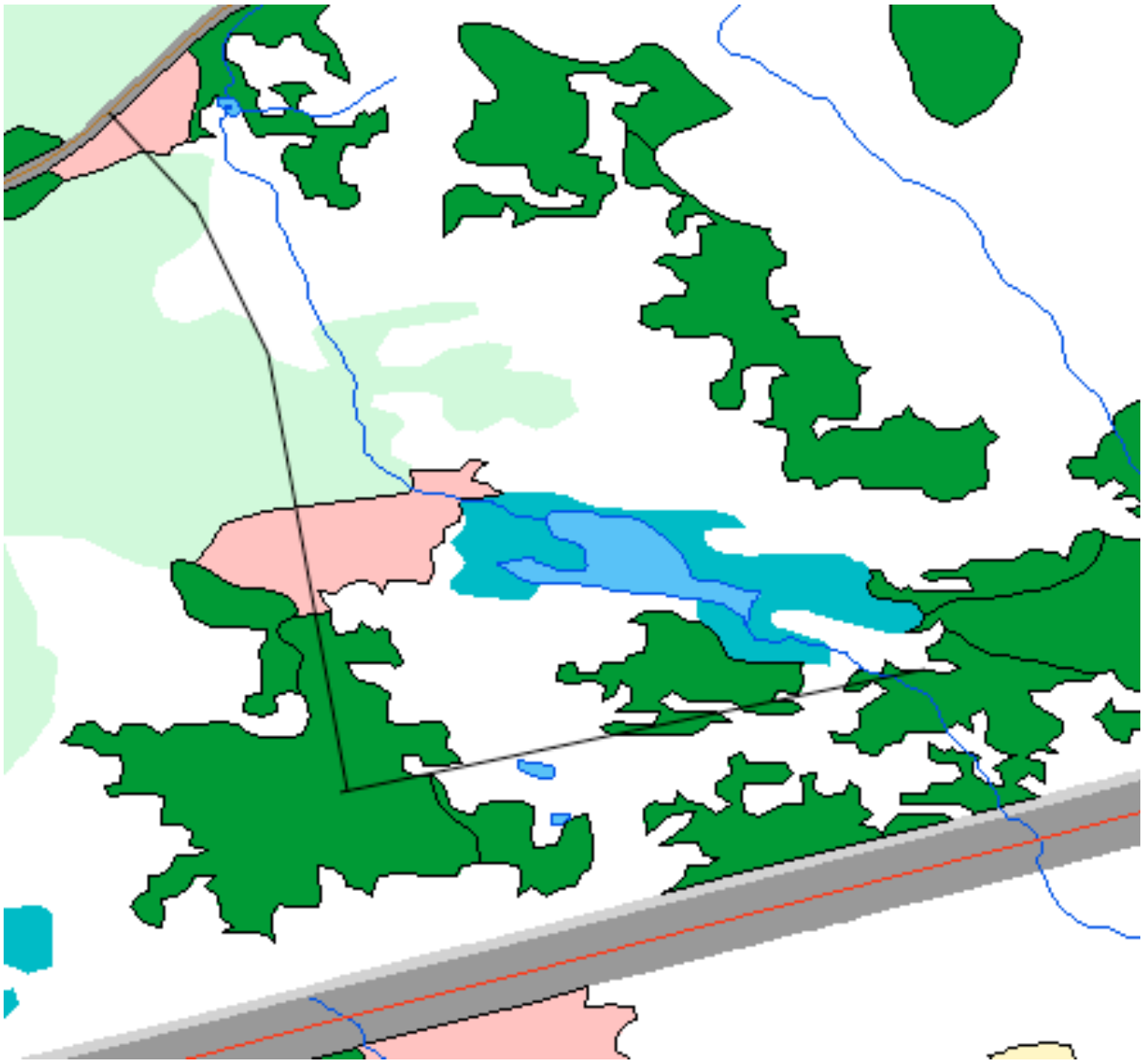
Table 2. Species detected, with median number of visits and point count stations during which they were detected (ranges in parentheses). Species detected on only one visit (and thus unlikely breeders on the site) are in grey; species with a provincial status rank of Yellow (Sensitive) or lower are in **bold**.

Common name	Scientific name	# visits	#/ visit	#counts	#/count	Comments
Canada Goose	*Branta canadensis*	3	2 (1, 3)	0	--	
American Black Duck	*Anas rubripes*	1	1	0	--	
Ring-necked Duck	*Aythya collaris*	2	2	0	--	
Ring-necked Pheasant	*Phasianus colchicus*	2	2.5 (1, 4)	2	1	
Osprey	*Pandion haliaetus*	5	2 (1, 3)	4	1	Nest on cell tower, perched on met tower
Broad-winged Hawk	*Buteo platypterus*	2	1	1	1	Not breeding on site
Herring Gull	*Larus argentatus*	1	2	0	--	
Mourning Dove	*Zenaida macroura*	6	3.5 (1, 7)	6	2 (2, 3)	
Common Nighthawk	*Chordeiles minor*	(1)	1	0	--	See text
Belted Kingfisher	*Megaceryle alcyon*	1	1	0	--	
Hairy Woodpecker	*Picoides villosus*	6	2 (1, 3)	3	1 (1, 2)	
Northern Flicker	*Colaptes auratus*	7	3 (1, 5)	7	1	
Pileated Woodpecker	*Dryocopus pileatus*	1	1	0	--	
Alder Flycatcher	*Empidonax alnorum*	3	18 (8, 20)	7	4.5 (2, 6)	
Blue-headed Vireo	*Vireo solitarius*	5	2 (1, 3)	4	1 (1, 2)	
Gray Jay	*Perisoreus canadensis*	1	1	0	--	At transect start (Hwy 7).
Blue Jay	*Cyanocitta cristata*	5	3 (1, 6)	2	1	
American Crow	*Corvus brachyrhynchos*	8	2 (2, 5)	4	1.5 (1, 2)	
Common Raven	*Corvus corax*	5	2 (1, 3)	3	2 (1, 2)	
Tree Swallow	*Tachycineta bicolor*	1	1	0	--	
Black-capped Chickadee	*Poecile atricapillus*	5	2 (1, 3)	1	1	
Red-breasted Nuthatch	*Sitta canadensis*	1	1	0	--	
Winter Wren	*Troglodytes hiemalis*	1	1	0	--	
Golden-crowned Kinglet	*Regulus satrapa*	1	1	0	--	
Ruby-crowned Kinglet	*Regulus calendula*	1	1	0	--	
Hermit Thrush	*Catharus guttatus*	6	4.5 (1, 9)	6	2 (1, 3)	
American Robin	*Turdus migratorius*	6	1.5 (1, 8)	1	1	
Black-and-white Warbler	*Mniotilta varia*	2	1.5 (1, 2)	0	--	
Common Yellowthroat	*Geothlypis trichas*	5	12 (5, 31)	7	3.5 (1, 5)	
American Redstart	*Setophaga ruticilla*	1	2	0	--	
Yellow Warbler	*Setophaga petechia*	3	1 (1, 1)	2	1	
Chestnut-sided Warbler	*Setophaga pensylvanica*	2	2.5 (1, 4)	2	1 (1, 3)	
Palm Warbler	*Setophaga palmarum*	7	5 (1, 12)	6	1 (1, 5)	
Yellow-rumped Warbler	*Setophaga coronata*	6	1.5 (1, 4)	1	3 (2, 4)	
Black-throated Green Warbler	*Setophaga virens*	4	1 (1, 2)	1	1	
Song Sparrow	*Melospiza melodia*	8	16 (8, 21)	7	4.5 (1, 6)	
Lincoln's Sparrow	*Melospiza lincolnii*	4	4 (3, 5)	6	1 (1, 3)	
Swamp Sparrow	*Melospiza georgiana*	7	1 (1, 4)	4	1 (1, 2)	

Common name	Scientific name	# visits	#/ visit	#counts	#/count	Comments
White-throated Sparrow	*Zonotrichia albicollis*	6	14 (9, 23)	7	3 (2, 5)	
Dark-eyed Junco	*Junco hyemalis*	8	2 (1, 8)	3	1	
Red-winged Blackbird	*Agelaius phoeniceus*	1	1	1	1	
Rusty Blackbird	*Euphagus carolinus*	1	1	0	--	See text
Common Grackle	*Quiscalus quiscula*	5	3 (1, 6)	5	2 (1, 3)	
Purple Finch	*Haemorhous purpureus*	7	1 (1, 4)	4	1 (1, 2)	
American Goldfinch	*Spinus tristis*	8	6 (3, 11)	5	2 (1, 4)	

Figure 1. Forest cover map of site (from https://ca.nfis.org) showing the proposed access road to the turbines, to be placed at the corner and eastern ends of the road. The transect for avian surveys followed this road to the easternmost turbine site, then headed north to return to the transect by paralleling the north shore of Forked Pond within the Unspecified [white] habitat type. Point count stations (7 in total) were every 300 m along the transect.

Habitat types as defined at https://ca.nfis.org [with interpretations based on ground truthing in brackets]: Blue = Water [Forked Pond]; Pink = Mixedwood [remnant mixed forest]; dark green = Coniferous [remnant coniferous forest]; light green = Regenerating; teal = Wetlands; white = Unspecified [mainly regenerating areas with low scrub, scattered young trees, and sparse snags].



Appendix 6 Bat Species Reporting

Characterization of the magnitude of bat activity at the proposed Porters Lake Wind Energy Project, Halifax County, NS

Final Report Prepared for:
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Context

Project Background

EON WindElectric is proposing to install two wind turbines to generate 3.8 megawatts (MW) of electricity near the communities of Lake Echo and Porters Lake, Halifax County, Nova Scotia. The project is in an early phase with wind monitoring occurring onsite at a measurement tower.

Commercial scale wind energy production is one of the fastest growing sectors of the global energy industry as the demand for renewable energy sources for electricity generation continues to increase (Nelson 2009). This demand, combined with recent advances in wind turbine technology that have improved the cost-competitiveness of wind energy, has led to a global increase in the number of wind energy installations. In Canada, energy production and regulation falls under provincial jurisdiction and thus most renewable energy targets are set at the provincial level. In the province's Renewable Electricity Plan, the Provincial Government of Nova Scotia has set an aggressive target of 40% of the province's electricity needs to be met by renewable energy by the year 2020 (Nova Scotia Department of Energy 2010). Of this amount, 25% has been set as coming from made-in-Nova Scotia sources by 2015, and the wind energy sector is anticipated to be the largest contributor in meeting these goals. As of 2014, Nova Scotia power estimates that close to 10% of current electricity needs are met by wind energy (NSP 2014). The Porters Lake project is part of the Community Feed-In Tariff program (COMFIT) of the Renewable Electricity Plan which facilitates small-scale, local renewable projects that involve community groups.

Despite the many environmental benefits of electrical generation via wind energy, the rapid global growth of the wind energy sector has raised concerns regarding the impacts of these developments on both resident and migratory populations of wildlife (Arnett et al. 2008b). Large numbers of bat fatalities have occurred at wind energy facilities (Johnson 2005a) and this is gaining considerable global attention. As a result, fatalities of bats have become a primary environmental concern associated with wind energy development.

Efforts to minimize conflicts between wildlife and wind energy have focused mainly on two areas: risk avoidance and impact mitigation (Weller and Baldwin 2012). Impact mitigation refers to those efforts focused on developing methods to reduce wildlife fatalities at operational wind facilities and does not apply to this project at this time. Risk avoidance involves conducting surveys prior to construction to avoid sites, or areas within sites, with high levels of usage by wildlife. The assumption of this approach is that low indices of activity prior to construction should result in low fatality rates post-construction since there should be fewer animals 'available' to be killed. This further assumes that bats are not attracted to the infrastructure once built (Baerwald and Barclay 2009). As the planning phase proceeds for the development of the project, surveys of the wildlife at the proposed site are being undertaken to address any potential wildlife issues related to the development of the site. This document provides a summary of the echolocation survey undertaken for bats at the Porters Lake Wind Energy Project in 2014.

Regulatory Context

The following legislation and policy were considered in relation to the proposed survey at the Porters Lake Wind Energy Project:

- Federal Species at Risk Act (http://laws-lois.justice.gc.ca/eng/acts/S-15.3/page-1.html)
- Nova Scotia *Wildlife Act* (http://nslegislature.ca/legc/statutes/wildlife.pdf)
- Nova Scotia *Endangered Species Act* (http://www.novascotia.ca/legislature/legc/statutes/endspec.htm)

Additional resources that are relevant to the proposed surveys used include:

- Atlantic Canada Conservation Data Centre (http://www.accdc.com/)
- Wild Species: The General Status of Species in Canada (http://www.wildspecies.ca/home.cfm?lang=e)
- Global Species Rankings (http://www.natureserve.org/explorer/)

Study Objectives

The objectives of this project were to:

(1) Provide information on the occurrence and relative magnitude of bat activity in the proposed development area, based on analysis of echolocation survey results;

(2) Provide relevant information on the resource requirements of local bat species that may be useful for the decision-making process on the proposed development; and

(3) Make relevant recommendations based on the results of this project and recent developments in the field of bats and wind energy.

Review of Key Issues

Background

As of July (2014) in Nova Scotia, there are >150 wind turbines in operation with a total capacity of approximately 335 MW (CanWEA 2014). As of yet, we are not aware of any incidents of major mortality, though bats have been killed. For context and qualification, most of these turbines have been in operation for only a short period of time (months to less than 10 years) and it is not known how thoroughly all existing operational turbines have been surveyed for bat fatalities, or how well documented and reported the findings are. In the following sections we discuss the various means by which bats may be impacted by wind energy developments, including direct mortality, changes to habitat availability, and disruption of movement patterns (e.g., foraging, mating, migrations, or abandonment of sites).

Direct Mortality

Proximate causes of bat fatalities at wind energy developments may be due to direct strike by rotating turbine blades, collision with turbine towers, barotrauma or any combination of the three. Barotrauma involves tissue damage to the lungs due to rapid or excessive air-pressure reduction near moving turbines blades (Baerwald et al. 2008, Cryan and Barclay 2009). The discussion of the relative role of barotrauma in the death of bats at wind energy developments remains on-going (Grodsky et al. 2011, Capparella et al. 2012, Rollins et al. 2012). In North America, significant bat fatality events at wind energy developments occur primarily in the late summer and early fall, peaking during the period that coincides with fall migration (Johnson 2005b, Cryan and Brown 2007, Arnett et al. 2008a). These trends have led researchers to believe that migration plays a key role in the susceptibility of certain bat species to wind turbine fatalities (Cryan and Barclay 2009). Although some fatality has also been documented during the spring (Brown and Hamilton 2006, Arnett et al. 2008a), numbers are much lower, and are thought to be a result of more scattered migratory behaviour, or possibly the use of different routes compared to fall migration.

The species that have the largest number of kills at wind farms are the long-distance migratory bats, including the hoary bat (*Lasiurus cinereus*), the eastern red bat (*L. borealis*), and the silver-haired bat (*Lasionycteris noctivagans*). In North America, these species make up about 75-80% of the documented fatalities at wind energy developments, with the hoary bat alone comprising almost half (Kunz et al. 2007, Arnett et al. 2008a). The cumulative impacts of current mortality rates as a result of wind turbines on these affected species could have long-term population effects (Kunz et al. 2007). With mortalities at wind turbines in Europe from a large catchment area, including resident and migrating individuals, (Voigt et al. 2012, Lehnert et al. 2014), these effects could be having large scale impacts on these species. Bat fatalities in North America have also been reported for resident hibernating bat species, including the big brown bat (*Eptesicus fuscus*), the little brown bat (*Myotis lucifugus*), the northern long-eared bat (*M. septentrionalis*), and the tri-colored bat (*Perimyotis subflavus*) (Nicholson 2003, Johnson 2005b, Jain et al. 2007, Arnett et al. 2008a). At some sites in the eastern United States high numbers of fatalities of these resident, hibernating species have been reported (Kunz et al. 2007).

Various explanations for the high incidence of bat fatalities at wind energy developments have been proposed (Johnson 2005b, Kunz et al. 2007, Arnett et al. 2008a, Cryan and Barclay 2009). Estimates of the number of bat fatalities vary widely from less than 3 bats/turbine/year (Johnson et al. 2003, Johnson et al. 2004) to upwards of 50 bats/turbine/year (Nicholson 2003, Kerns et al. 2005, Jain et al. 2007). Given the considerable variability in species composition and rates of bat fatalities among wind energy facilities, it is likely that location-specific qualities of individual facilities are important (e.g., located along migration routes or other flight corridors). It has also been proposed that the use of turbines with increasing height has extended developments further into the flight space used by migrating bats (Barclay et al. 2007). However, behavioural observations of bats around wind turbines shows flight patterns typical of foraging activity prior to collisions with turbines which may put bats at increased risk for collisions or interactions (Horn et al. 2008). Recent work has demonstrated that many bats are actively foraging during migration (Reimer et al. 2010, Valdez and Cryan 2013). Others have hypothesized that collisions may result from bats being attracted to turbines out of curiosity, misperception (failure to avoid a detected obstacle or interference with perception of an obstacle), or as potential feeding, roosting, and mating opportunities (reviewed in Cryan and Barclay 2009). New work

using thermal imaging cameras found bats closely approached turbine structures (monopoles, nacelles and turbine) as well as made flight loops, dives, and hovering behaviours , and chased other bats around structures (Cryan et al. 2014). The authors suggest that bats are attracted to these structures, perhaps to roost, forage around or seek mates, but to date, the cause(s) of bat fatalities at turbines remains unclear and is an active area of research.

As mortalities may be the result of site-specific and design-specific characteristics and conditions, it is important to conduct site-specific monitoring studies to make reliable inferences on the potential impacts of a wind energy development on local bat populations (American Society of Mammalogists 2008).

Habitat Availability

In forested landscapes, habitat availability for bats may be impacted by the alteration or removal of vegetation to accommodate roads and wind turbine installations. This may include the direct loss of resources (e.g., roost trees), fragmentation of habitat components (e.g., foraging and roosting areas), or other disturbance that may cause bats to vacate certain areas. Together these can act to degrade the local environment for bat colonies/populations that reside in the area during the summer. This negative impact of new wind energy developments is likely to occur, and will contribute to the cumulative effect of habitat loss that is occurring throughout the range of most bat species (Altringham 2011).

At the site level, small-scale clearings in forested landscapes have been shown to attract certain bat species, which use these areas for foraging (Grindal and Brigham 1998, Hayes and Loeb 2007). Removal of vegetation can create edges and small clearings which can act to concentrate prey for bats. The extent to which this loss of vegetation can be perceived to be beneficial to bats is not known. Further, the extent of fragmentation varies from site to site, as there must be a balance between the availability of suitable roosting resources with the availability of suitable foraging areas within commuting distance to provide conditions that favour the occupancy of resident bat species (Henderson and Broders 2008). Differential effects of forest fragmentation are known for different species of a bat community (Patriquin and Barclay 2003, Segers and Broders 2014) thus necessitating the need for bat species considerations in managements plans, not just broad level management plans for bat communities.

Movement Patterns

From the perspective of bat movement, resident bats may be affected by wind energy developments through alterations to foraging areas and possible disruption of commuting movements between roosting and foraging areas. There is some genetic evidence to suggest that bat movements can be impeded by fragmentation of habitat, which can scale up to population or distributional level effects (Kerth and Petit 2005, Meyer et al. 2009). However, this is not well understood for most species.

Little is known about the dynamics of movement (e.g., altitude, travel routes, frequency of visitation) of resident, hibernating bats to and from hibernation sites. Anecdotal evidence suggests that bats likely use ridges and other linear landscape elements (e.g., riparian corridors) as travel routes, depending on

the landscape (Arnett 2005, Lausen 2007, Furmankiewicz and Kucharska 2009). In the late summer and early autumn large numbers of bats congregate at the entrances to underground hibernacula in an activity referred to as 'swarming' (Davis and Hitchcock 1965, Fenton 1969, Thomas and Fenton 1979, Glover and Altringham 2008). During the swarming period bats do not roost in hibernacula; research being conducted in Nova Scotia indicates that resident bats are 'on the move', roosting transiently on the landscape (Lowe 2012), though we do not have a full understanding of the dynamics of these behaviours. Swarming may serve several functions, including courtship, copulation, and orienting young-of-the-year to over-wintering sites (Fenton 1969, Thomas and Fenton 1979).

Movement data from Ontario and Manitoba suggests that resident bats may move up to at least 120 km between hibernacula within a year, and up to at least 500 km between years (Fenton 1969, Norquay et al. 2013). In New England, there are records of bats moving 214 km between hibernacula within one year, with one female moving 128 km in only three nights during spring emergence from hibernation (Davis and Hitchcock 1965). Thus these resident hibernating species are at least capable of large scale migratory movements on the order of hundreds of kilometers. It is not known whether flight behaviour (e.g., height, routes, etc.) during this time differs from when resident species are in their summering area; the paucity of information on this aspect of their biology would appear to be one of the largest impediments in accurately predicting the impact of wind energy developments on local bat populations (Weller et al. 2009).

Bats in Nova Scotia

Nova Scotia Bat species

In Nova Scotia there are occurrence records for six species of bats (Table 1; van Zyll de Jong 1985, Broders et al. 2003, Segers et al. 2013), and each have been documented to have experienced fatalities at wind turbine sites (Arnett et al. 2008a). There are three species of long-distance migratory bats recorded in the province, the hoary bat, the eastern red bat, and the silver-haired bat. These three species have extensive distributional ranges throughout North America, with Nova Scotia at or near their northern range limit (van Zyll de Jong 1985). Low numbers of echolocation recordings of the long-distance migratory species in Nova Scotia by Broders (2003) and other unpublished work suggests that there are no significant populations or large scale migratory movements of these species in the province, but they do occur regularly and are often associated with coastal or off-shore autumn occurrences (Cryan and Brown 2007, Czenze et al. 2011, Segers et al. 2013). Two species of bats in the genus *Myotis*, the little brown bat and the northern long-eared bat, are the only abundant and widely distributed bats in Nova Scotia (Broders et al. 2003, Henderson et al. 2009). These 5–8 g insectivorous bats are sympatric over much of their range (Fenton and Barclay 1980, van Zyll de Jong 1985, Caceres and Barclay 2000). A third species, the tri-coloured bat, has a significant population in the province, however they are likely restricted to southwest Nova Scotia (Broders et al. 2003, Rockwell 2005, Farrow and Broders 2011). These three species are gregarious species that over-winter in caves and abandoned mines in the region (Moseley 2007, Randall and Broders 2014). There is only one unconfirmed observation of the big brown bat, also a gregarious species, hibernating at a cave in central mainland Nova Scotia (Taylor 1997).

Ecology of Resident Species

Northern long-eared and little brown bats are expected to be the most likely species to occupy the proposed development area. The life history of both of these species is typical for temperate, insectivorous bats. Their annual cycle consists of a period of activity (reproduction) in the summer, and a hibernation period in the winter. Females of the two species bear the full cost of reproduction in the summer, from pregnancy to providing sole parental care to juveniles (Barclay 1991, Hamilton and Barclay 1994, Broders 2003).

The northern long-eared bat is a forest interior species that primarily roosts and forages in the interior of forests (Broders 2003, Jung et al. 2004, Henderson and Broders 2008). Females form maternity colonies, roosting in coniferous or deciduous trees, depending on availability (Foster and Kurta 1999, Broders et al. 2006, Garroway and Broders 2008). Males typically roost solitarily in either deciduous or coniferous trees (Lacki and Schwierjohann 2001, Jung et al. 2004, Ford et al. 2006). The little brown bat is a generalist species that is associated with forests, as well as human-dominated environments (Barclay 1982, Jung et al. 1999). This species has been found to forage over water and in forests (Anthony and Kunz 1977, Fenton and Barclay 1980), and both males and females (i.e., maternity colonies) have been documented roosting in both buildings and trees (Crampton and Barclay 1998, Broders and Forbes 2004). During the summer, it appears that most of the commuting and foraging activity of northern long-eared and little brown bats occurs close to the ground (Broders 2003). Nonetheless, our ability to survey bat activity at high altitudes is extremely limited, and therefore our ability to make inference on the vertical distribution of bats is also limited.

A third species that occurs in significant numbers in Nova Scotia, the tri-colored bat, is not likely to occur in the proposed development area (Farrow and Broders 2011). In Nova Scotia, work that we have done in Kejimkujik National Park suggests that this species roost in *Usnea* lichen species and forages over waterways (Poissant et al. 2010).

White Nose Syndrome

In 2012, three species of bats found in Nova Scotia were listed by COSEWIC as Endangered, and in 2013 were listed as Endangered by the Province of Nova Scotia. This is primarily due to the spread of an emerging infectious disease known as White Nose Syndrome (WNS) that is responsible for unprecedented mortality in hibernating bats through much of eastern North America (Blehert et al. 2009, United States Fish & Wildlife Service 2012). The condition is caused by *Pseudogymnoascus destructans* (formerly *Geomyces destructans)*, a cold-loving fungus that thrives in cave conditions and as such, impacts bat population directly during the winter hibernation period (Lorch et al. 2011, Blehert 2012, Minnis and Lindner 2013). It is thought to disrupt patterns of torpor which results in death by starvation or dehydration (Cryan et al. 2010, Reeder et al. 2012, Warnecke et al. 2013). First documented in New York State in 2006 (Blehert et al. 2009), WNS spread rapidly to 22 states and five Canadian provinces by 2013 and is thought to be responsible for the death of more than 5.5 million bats (United States Fish & Wildlife Service 2012). White Nose Syndrome has been confirmed among populations of seven species of bats. The little brown bat, the most abundant species in the region currently affected by WNS, has experienced the most dramatic population declines (Frick et al. 2010). Some hibernacula have seen mortality rates of 90 to 100 percent of resident hibernating bats as a result of infection with WNS (United States Fish & Wildlife Service 2012), leading researchers to believe that WNS could lead to local extinctions of the little brown bat, as well as other species (Frick et al. 2010).

White Nose Syndrome was first documented in Nova Scotia in April 2011 and declines of 80% to 100 % have since been recorded in winter populations (Broders and Burns, unpublished data). A similar magnitude of decline in summer activity was also observed from 2012 to 2013, following the first full winter WNS was documented in the province (Segers and Broders 2014). Therefore, it would be

prudent to protect any surviving animals that may be genetically predisposed to surviving the infection. Even prior to WNS, bats were increasingly recognized as a conservation priority in North America. Now, in consideration of the sharp declines and rapid spread of WNS, serious concerns have been raised about the impact of WNS on the population viability of affected bat species, consequently impacting the conservation status of bat species at the local, national and global level (Table 1). Given that hibernacula represent one of the more critical resources for bats, as they allow successful over-wintering, they are important to protect.

Proximity to Hibernacula

The Nova Scotia Proponent's Guide to Wind Power Projects (Nova Scotia Environment 2012) states that wind farm sites within 25 km of a known bat hibernacula have a 'very high' site sensitivity. There are no known hibernacula within 25 km of the Porters Lake Wind Energy Project area (Moseley 2007, Randall and Broders 2014). The nearest known bat hibernaculum was a site used by thousands of bats pre-WNS is an abandoned mine at Lake Charlotte, which is located approximately 31 km from the proposed development area. At approximately 30.5 km away is Cave of the Bats, a historically smaller hibernaculum, located in the area of Dutch Settlement.

Table 1. Over-wintering strategy and conservation status of bat species recorded in Nova Scotia.

Species	Overwintering Strategy	Global Ranking[1]	COSEWIC Status	ACCDC status[3]	NSESA[4]
Little brown bat	Resident hibernator	G3	Endangered[2]	S1	Endangered
Northern long-eared bat	Resident hibernator	G2G3	Endangered[2]	S1	Endangered
Tri-coloured bat	Resident hibernator	G3	Endangered[2]	S1	Endangered
Big brown bat	Resident hibernator	G5	Not assessed	N/A	Not listed
Hoary bat	Migratory	G5	Not assessed	S1	Not listed
Silver-haired bat	Migratory	G5	Not assessed	S1	Not listed
Eastern red bat	Migratory	G5	Not assessed	S1	Not listed

[1] Global Ranking based on the NatureServe Explorer: G1 = Critically Imperiled, G2 = Imperiled, G3 = Vulnerable, G4 = Apparently Secure, G5 = Secure. All the above species were reassessed in July 2012.

[2] Assessed by COSEWIC and designated in an emergency assessment on February 3, 2012.

[3] Atlantic Canada Conservation Data Centre ranking, based on occurrence records from NB and NS: S1 = Extremely rare: May be especially vulnerable to extirpation (typically five or fewer occurrences or very few individuals).

[4] Listing status under the Nova Scotia Endangered Species Act: Endangered = a species facing imminent extirpation or extinction; species were reassessed in July 2013.

Methods

Study Area

The project area is located near the communities of Lake Echo and Porters Lake, Halifax County. This area is within the Eastern Shore Beaches Theme Region (Davis and Browne 1996) and Atlantic Coast Ecoregion (Webb and Marshall 1999). Softwood forests dominate the area that are primarily composed of white spruce and balsam fir where some red maple and yellow birch occur on more protected and productive areas. In June of 2008, an approximately 4,757 acre wildfire occurred in the area straddled by the communities of Lake Echo, Porters Lake and Mineville (CMRAERC 2009), including the Porters Lake Wind Energy Project. As a result, the project area is now in a state of regeneration, 6 years post-fire. The current landscape is thus highly disturbed and composed of patches of small, non- or partially-burned forest stands within a generally open-stand matrix composed of primarily low vegetation (below 2m in height) with some standing tree snags in various stages of decay.

Ultrasonic Surveys

We used three automated bat detectors (2x model Song Meter SM2Bat+, Wildlife Acoustics, Concord, MA; 1x Anabat, Titley Scientific, Columbia, MO) to sample at three locations within the proposed development area (Table 2, Figure 1). One SM2 detector was deployed adjacent to the measurement tower with a microphone recording 2 m off the ground. The second SM2 detector was deployed along a ridge near Forked Pond with the microphone placed at 2 m above ground. Microphones were oriented slightly down to shed rain. The Anabat detector was placed near the entrance to the project site with the microphone recording at approximately 1 m above ground. The seasonal timing of sampling likely corresponded to the end of the summer residency period, through to the autumn movements of resident species to local hibernacula, and autumn migration by migratory species. Detectors were programmed to turn on ½ hour before and after sunset and were reprogrammed throughout the season to adjust for increasing night length.

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 quantitatively identified using Kaleidoscope™ software (Wildlife Acoustics) which compares recorded sequences to known echolocation call sequences supplied to the company. We used the "Bats of North America 2.1.0" classifier of the program with the region set as Eastern Canada, and only included the 7 species with records for the province. Following the automatic classification by this program, we manually inspected all call spectrograms and assigned/confirmed call sequence identification. In the case of species in the genus *Myotis* (northern long-eared and little brown bat), we did not identify sequences to the species level for two reasons. First, the Kaleidoscope program uses reference calls from other regions of the species ranges and thus a regional-specific call library is not available for these species. Second, since the calls of the two species can be quite similar depending on the spatial context (Barclay 1999, Broders et al. 2004b), they cannot often not be reliably separated and we had some calls that were clearly *Myotis* species but not auto-

identified by the program to one species or another. Recordings from both detector types (SM2Bat+ and Anabat) were subject to the same identification process. We used the number of recorded echolocation files as the unit of bat activity, which approximates an echolocation call sequence, defined as a continuous series of greater than two calls (Johnson et al. 2004). Because an individual bat may be recorded making multiple passes, the data presented represent a measure of bat activity, and cannot be used as a direct measure of the number of bats within or passing through an area.

Differences in bat call sequence detections, call quality and ultimately species identifications are known among different models of bat detectors. Recent comparisons have shown that Wildlife Acoustics SM2Bat units record more bat call sequence files than Anabat units (Allen et al. 2011, Adams et al. 2012) and these differences must be incorporated into the interpretations and inferences of data when using both detectors.

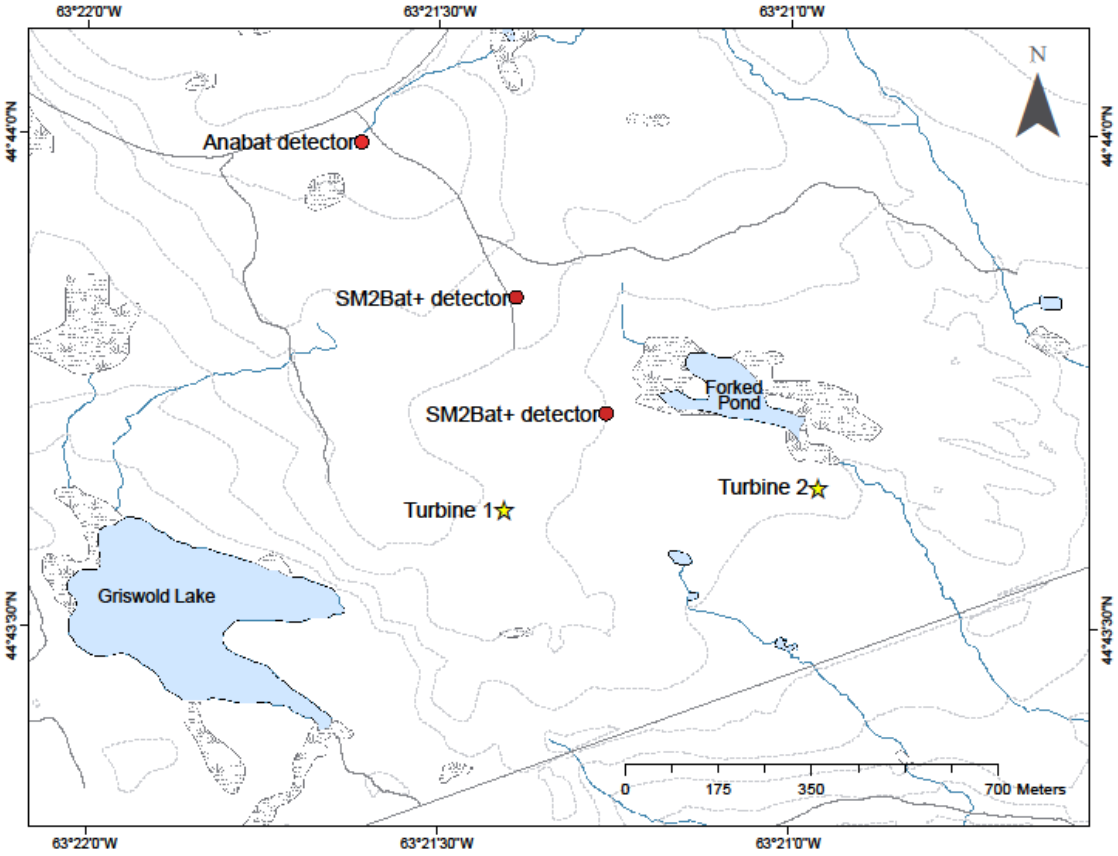

Figure 1. Locations of bat detectors used to sample for bat activity the Porters Lake Wind Energy Project, July to November 2014. GIS data supplied by Service Nova Scotia and Municipal Relations.

Table 2. Locations of ultrasonic survey sites for the 2014 survey of bat activity at the proposed Porters Lake Wind Energy Project area, Halifax County, Nova Scotia. Coordinates are NAD83 UTM Zone 20.

Site	Location	Detector type	Coordinates		Deployed	Retrieved
1	Entrance	Anabat	471483 E	4953375 N	21 Jul 2014	04 Nov 2014
2	Met tower	SM2Bat+	471772 E	4953083 N	21 Jul 2014	04 Nov 2014
3	Wetland	SM2Bat+	471941 E	4952865 N	21 Jul 2014	04 Nov 2014

Table 3. Site descriptions for ultrasonic survey sites for the 2014 survey of bat activity at the Porters Lake Wind Energy Project area, Halifax County, Nova Scotia.

Site	Description
1	About the highest point in the area in a regenerating 'forest' patch typical of the location
2	Located approximately 25 m from the base of the measurement tower; microphone was deployed 2 m off the ground.
3	Located in a regenerating 'forest' patch on a ridge above the Forked Pond wetland area.

Assessment of Potential for Hibernacula

To assess the potential for hibernacula to occur in proximity to the project area, we examined the available literature and the Nova Scotia Abandoned Mine Openings (AMO) Database (Fisher and Hennick 2009). To assess the AMO database location and attribute data were imported into a Geographic Information System (GIS; ArcMap 10.2, ESRI, Redlands, California). We estimated the centre of the Porters Lake project area and buffered the surrounding landscape to 25 km since wind farm sites within 25 km of a known bat hibernacula are to be considered to have a 'very high' site sensitivity (Nova Scotia Environment 2012). Records of underground abandoned mine openings occurring within the buffer were then exported into a spreadsheet where we subsequently excluded specific AMO's as being unlikely hibernacula based on four sequential attribute criteria (Table 4).

Table 4. Attributes of fields used from the Nova Scotia Abandoned Mine Openings Database used to exclude openings from the list of unexplored potential hibernacula for bats near the Porters Lake Wind Energy Project Area, Halifax County, Nova Scotia.

Ordering	Field Heading	Criteria used for exclusion
1	Origdepth	≤19 m in depth
2	Flooded	attribute = T (true)
3	Protection	those that are backfilled, excavated and backfilled, filled or sealed
4	Plug	those containing a plug of rock, rock & vegetation, rock & garbage, garbage (and where field "Landuse"= municipal garbage dump site)

Results

Bat detectors within the proposed wind energy development were deployed from July 21 through to November 4 2014 and recorded continuously throughout this period for a total of 318 detector nights. One bat detector running continuously from sunset to dawn is considered as 1 detector night.

Within the proposed wind energy development area there were 76 acoustic files recorded on the 3 detectors. Eleven of these were classified as bat-generated ultrasound files and the remaining classified as extraneous noise (Table 5). Of the eleven echolocation sequences, 4 were recorded at site 1 near the entrance of the project area (Anabat), 2 were recorded at site 2 near the base of the measurement tower (SM2Bat+) and 5 were recorded at site 3 on the ridge near Forked Pond (SM2Bat+). The majority of call sequences (9/11; 81.8 %) were classified as *Myotis* species (i.e., includes northern long-eared and little brown bats); as stated above no attempt was made to identify these call sequences to the species. There were two call sequences classified as red bat sequences that were recorded on the night of 01 August 2013 on two separate detectors.

The average number of recorded bat call sequences per night (averaged over all detectors at all three sites together) in the proposed development area was 0.10 (SD =0.36) during the sampling period. To place the relative magnitude of activity recorded in the study area into context, in 129 nights of monitoring along five forested edges in the Greater Fundy National Park Ecosystem from June to August 1999, the average number of sequences per night was 27 (SD = 44; Broders unpublished data). In 650 nights of monitoring at river sites in forested landscapes in southwest Nova Scotia from June to August of 2005-2006, the average number of sequences per night was 128 (SD = 232; Farrow unpublished data), though note that rivers act to concentrate bat activity, as they are used as foraging and commuting corridors (Laval et al. 1977, Fenton and Barclay 1980, Fujita and Kunz 1984, Krusic et al. 1996, Zimmerman and Glanz 2000, Lacki et al. 2007). Both of these previous comparisons were conducted prior to the emergence of white nose syndrome and therefore are likely not directly comparable. In a forested landscape in Colchester County, Nova Scotia, an approximate 99% decrease in bat echolocation activity was detected after significant mortality was noted in Nova Scotia following the arrival of white nose syndrome to the province. In that study the average number of bat call sequences recorded at forested and riparian areas, per night, dropped from 111.22 (SD 163.54) in 2012 to 0.95 (SD=1.84) in 2013 (Segers and Broders 2014).

According to the Nova Scotia Abandoned Mine Openings Database (Fisher and Hennick 2009), there are 1291 underground abandoned mine opening records in the vicinity of the Porters Lake project (within 25 km). Following our exclusion analysis, 42 of the AMO records remain that could potentially act as bat hibernacula (Appendix 1) where to our knowledge they have never been surveyed for bats before.

Table 5. Number of echolocation bat call sequence files recorded per night for the 2014 survey of bat activity at the proposed Porters Lake Wind Energy Project area, Halifax County, Nova Scotia. Only nights where a bat call sequence was recorded are displayed. MYO = *Myotis* species, LABO = *Lasiurus borealis.*

	Site 1		**Site 2**	**Site 3**		**Nightly Total**
Night of	MYO	LABO	MYO	MYO	LABO	(all sites)
25-Jul-14	0	0	0	1	0	1
01-Aug-14	0	1	0	0	1	2
02-Aug-14	0	0	1	1	0	2
06-Aug-14	1	0	0	0	0	1
08-Aug-14	0	0	1	0	0	1
20-Aug-14	1	0	0	0	0	1
21-Aug-14	0	0	0	1	0	1
23-Aug-14	0	0	0	1	0	1
03-Sep-14	1	0	0	0	0	1
Site total	3	1	2	4	1	11
Project Average						0.10
Num nights						106

Discussion

Interpretation of these data are problematic for assessing relative risk to bats at the proposed development given our knowledge of the devastating impacts that white nose syndrome has had, and is having, on local bat populations. The disease is now confirmed in nine counties in mainland Nova Scotia, including the proposed development area, and three counties in Cape Breton. Elsewhere, white nose syndrome reduced the summer bat activity by >75% (Dzal et al. 2011). In the winter of 2012-2013, there were hundreds of fatalities recorded at several known hibernacula in the province and annual monitoring counts of bats at such hibernacula down, on average, by 94% (Broders and Burns, unpublished data). These observations are suggestive of a major mortality event in the area, likely decreasing the magnitude of bat activity in many areas in the summer. This is supported by other work we are conducting in the region suggesting a >99% reduction in the magnitude of echolocation activity in 2013, relative to 2012 (Segers and Broders 2014), and decimation of a number of maternity colonies in the region. For these reasons this dataset must be interpreted with caution.

Given the context of white nose syndrome, as discussed above, there was no acoustic evidence of a significant movement or concentration of bats through the area investigated during this pre-construction survey of bat activity. The magnitude of activity was exceptionally low compared to baseline levels (collected prior to 2007), and comparable to levels recorded in 2013 (following white nose syndrome) that one would expect in a forested ecosystem in the region. Although we cannot rule out the possibility that mortality events associated with this development will occur, we have found no evidence to suggest that the proposed project will cause large numbers of direct mortality of bats. That being said, in light of white nose syndrome and the recent listing of the several species as endangered, the significance of any mortality is much greater than it would have been just a couple of years ago.

The majority of the identified echolocation sequences recorded for this project were attributable to the two species of *Myotis* bats known to occur in Nova Scotia, the little brown bat and the northern long-eared bat. This was expected as they were the only abundant and widely-distributed species in the province, and are two of only three species that had large numbers in the province (Broders et al. 2003). Although we did not distinguish the calls of *Myotis* species, the majority of the recorded sequences likely represent the little brown bat, as this species is known to forage in open areas and over water. The northern long-eared bat is a recognized forest interior species (Jung et al. 1999, Henderson and Broders 2008), and is less likely to use open areas for foraging and commuting (Henderson and Broders 2008). The current post-fire open landscape of the project area may be more suitable to little brown bats compared to northern long-eared bats. Additionally, the northern long-eared bat has lower intensity echolocation calls and is thus not recorded as well as the little brown bat (Miller and Treat 1993, Broders et al. 2004a). There were no echolocation sequences that were attributable to the tri-colored bat, which was expected as this species is only locally abundant in southwest Nova Scotia and the proposed development is outside of the known provincial distribution for this species (Farrow and Broders 2011).

Myotis bats are relatively new to the list of species among fatalities at wind turbines sites. This may be due to the fact that the first large scale wind developments were located primarily in western North America, typically in agricultural and open prairie landscapes (reviewed in Johnson 2005b). Fatalities of these resident, non-migratory species were largely absent from these sites, likely due to the association of these species with forested landscapes. More recently, evidence of *Myotis* fatalities resulting from collisions with wind turbines have been noted at sites in eastern North America (reviewed in Johnson

2005b, Jain et al. 2007, Arnett et al. 2008a). Although there are fewer documented fatalities of *Myotis* bats compared to long-distance migratory species, there is still a risk of direct mortality.

Other than direct bat mortality as a result of collisions with turbines, there is also the potential that disruption of the forest structure (e.g., removal of trees and fragmentation of forest stands for roads and clearings) will degrade the local environment for colonies/populations of *Myotis* bats that reside in the area during the summer. This can occur by the elimination of existing roost trees, the isolation of trees left standing, as well as the elimination or degradation of foraging areas for bats. With the open landscape currently at the project site from the natural regeneration process following a wildfire, there are few forest stands that could currently support large resident bat populations. Therefore, negative impacts from clearing for infrastructure at the project site may be minimal. However, forest patches that do currently remain on the landscape would be important to retain as key bat habitat for any remaining animals and for the future.

Additionally, resident bat species make what are generally considered to be short distance migrations (range of tens to hundreds of kilometres) from their summering areas to underground sites where they hibernate. Little is known about the flight behaviour and dynamics of these movements (i.e., height of travel, and routes); therefore, it is difficult to predict the specific effects that wind developments will have on the movements of local populations of bats. Prior to white nose syndrome, two maternity colonies of little brown bats were known from houses at Mineville and West Chezzetcook (Arseneault 2013) and the Nova Scotia bat reporting website (www.batconservation.ca) lists a historic concentration of bats in this same area (MTRI and NSDNR 2013). It is not known where bats from these colonies hibernate at nor the routes of movement they make in the spring or fall from summering sites to hibernation sites.

The low number of call sequences attributed to the red bat, a long-distance migratory bat species, suggests that there are no large populations or significant migratory movements of these species at the study area. This fits with our current knowledge of the status of this species in the province where sightings are rare and often occur in the late summer/early autumn on the coast or offshore (Broders et al. 2003, Czenze et al. 2011, Segers et al. 2013). However occurrences do occur regularly, albeit in low frequency, and this species is especially vulnerable to wind facilities. This species is a solitary, tree-roosting species with an extensive distributional range throughout North American (van Zyll de Jong 1985). In addition to hoary and silver-haired bats, these species have received the greatest attention with regards to wind energy developments because they make up the large majority of documented fatalities at existing developments in North America. Any mortality of this species would be significant to Nova Scotia given there low numbers in the region. Significant bat fatality events at wind energy developments occur primarily in the late summer and early fall, peaking during the period that coincides with the long-distance fall migration of these species (Johnson 2005b, Cryan and Brown 2007, Arnett et al. 2008a). This has lead researchers to believe that migration plays a key role in the susceptibility of certain bat species to wind turbine fatalities (Cryan and Barclay 2009). It has been proposed that this may be because these species travel at a height that puts them at increased risk of collisions with rotating turbine blades (Barclay et al. 2007, Arnett et al. 2008a).

Recommendations

1. *Post-construction monitoring* – A rigorous post-construction monitoring program, appropriately designed to account for searcher efficiency and scavenger rates, needs to be established to quantify bat fatality rates. These surveys should be conducted over an entire season (April to October), but especially during the fall migration period (mid-August to late-September) for at least two years. Should fatalities occur, they should be investigated with respect to their spatial distribution relative to wind turbines, turbine lighting, weather conditions, and other site specific factors. Should trends be identified, operations should be adjusted in an adaptive management framework whereby mitigation can be focused on any identified high risk areas/infrastructure to minimize future fatalities. These data are essential for assessing potential risks at future developments in the region via assessment of cumulative effects; therefore it is critical that the results of these surveys be appropriately reported.

2. *Retain key bat habitat* – Key bat habitat should be identified in the project area (e.g., wetlands, riparian areas, mature deciduous-dominated forest stands) and retained to continue to support any existing summer colonies and or potential fall movement corridors of bats. Retention of these bat habitat resources should be in a spatial manner that provides connectivity in the project area and with the larger landscape to ensure foraging and roosting areas remain well connected. This is a general recommendation however, in the case of the current landscape at the project area there are likely few remaining mature forest stands to be retained. However, wetland/riparian areas may still be used by bats during migratory phases which would be important to retain as some bats do make migratory stopovers to feed and/or roost (McGuire et al. 2012).

3. *Minimize project footprint* – To the extent possible, minimize the direct loss of any key bat habitat resources (e.g., wetlands, riparian areas, mature deciduous-dominated forest stands), that may remain in the project area. Current remaining forest patches will likely be important to ensuring continuity in providing appropriate roosting areas well into the future as forest stand succession occurs. Retention of forest stands of a range of ages will provide mature trees for bat roosting resources in the future

4. *Develop an operations fatality mitigation plan* – Recent experimental case studies in Alberta and the United States have demonstrated dramatic reductions in bat fatalities at operational wind energy facilities can be made by changing operational parameters during the peak fatality period (Baerwald et al. 2009, Arnett et al. 2010). These include changes to when turbine rotors begin turning in low winds via alterations to wind-speed triggers and blade angles to lower rotor speed. These studies have found decreases in bat mortalities ranging from 44% to as high as 93% reductions on a nightly basis at relatively low cost to annual power production loss, at approximately ≤ 1%. This plan should be adaptive as operations continue through time and be in place prior to operations commencing such that if any bat mortalities be observed at the site once operational, the plan can be implemented immediately.

5. *Remain up to date with current research* –There is presently an abundance of on-going research aimed at determining the impacts of wind energy developments on populations of bats. Other studies are focusing on investigating the efficacy of potential mitigation measures, including the effects of weather on bat activity patterns and collisions with wind turbines, and possible bat deterrents (including acoustic (Arnett et al. 2013)and radar emissions). As these are active areas of research, it is essential that the most current studies and guidelines are used to guide management decisions and development plans for wind energy projects.

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Appendix 1. Identified abandoned mine openings (AMO's) from the Nova Scotia AMO Database that are located within 25 km of the Porters Lake Wind Energy Project and have the potential to be bat hibernacula.

Shaft ID	Location (As listed in database)	Original Depth (m)	Land Ownership
WAV-2-014	WAVERLEY (AMERICAN HILL)	23	Private
WAV-2-013	WAVERLEY (AMERICAN HILL)	110	Private
OLD-4-280	OLDHAM	30	Crown
LCA-4-002	EAST CHEZZETCOOK (LAKE CATCHA)	31	Private
LCA-4-001	EAST CHEZZETCOOK (LAKE CATCHA)	42.5	Private
LCA-4-003	EAST CHEZZETCOOK (LAKE CATCHA)	49	Private
OLD-4-202	OLDHAM	51	Private
WAS-1-001	WELLINGTON	30	Private
WAV-1-110	WAVERLEY (WEST WAVERLEY)	191.5	Private
OLD-2-019	OLDHAM	27	Private
OLD-2-022	OLDHAM	20	Private
WAV-2-182	WAVERLEY (AMERICAN HILL)	21	Private
LCA-6-103	EAST CHEZZETCOOK (LAKE CATCHA)	22	Private
LCA-6-104	EAST CHEZZETCOOK (LAKE CATCHA)	22	Private
LCA-5-101	EAST CHEZZETCOOK (LAKE CATCHA)	22	Private
LAW-16-086	MINESVILLE	23	Private
LCA-9-114	EAST CHEZZETCOOK (LAKE CATCHA)	23	Private
LCA-7-110	EAST CHEZZETCOOK (LAKE CATCHA)	23	Private
LCA-6-105	EAST CHEZZETCOOK (LAKE CATCHA)	23	Private
LAW-15-022	MINESVILLE	24	Private
MON-12-171	MONTAGUE	25	Private
MON-12-173	MONTAGUE	25	Private
LAW-16-076	MINESVILLE	27	Private
LCA-19-162	EAST CHEZZETCOOK (LAKE CATCHA)	27	Private
WAV-1-169	WAVERLEY (WEST WAVERLEY)	27	Private
WAV-2-203	WAVERLEY (AMERICAN HILL)	27	Private
LAW-16-084	MINESVILLE	29	Private
WAV-1-171	WAVERLEY (WEST WAVERLEY)	30	Private
WAV-2-200	WAVERLEY (AMERICAN HILL)	37	Private
LCA-21-159	EAST CHEZZETCOOK (LAKE CATCHA)	38	Private
LCA-12-152	EAST CHEZZETCOOK (LAKE CATCHA)	40	Private
LCA-1-067	EAST CHEZZETCOOK (LAKE CATCHA)	40	Private
WAV-1-156	WAVERLEY (WEST WAVERLEY)	40	Private
WAV-1-164	WAVERLEY (WEST WAVERLEY)	60	Private

Shaft ID	Location (As listed in database)	Original Depth (m)	Land Ownership
WAV-1-165	WAVERLEY (WEST WAVERLEY)	60	Private
WAV-2-184	WAVERLEY (AMERICAN HILL)	60	Private
LCA-12-166	EAST CHEZZETCOOK (LAKE CATCHA)	64	Private
WAV-1-253	WAVERLEY (WEST WAVERLEY)	68	Private
LCA-16-018	EAST CHEZZETCOOK (LAKE CATCHA)	33.5	Private
LCA-3-080	EAST CHEZZETCOOK (LAKE CATCHA)	47	Private
MON-6-148	MONTAGUE	23	Crown
MON-6-149	MONTAGUE	23	Crown

Appendix 2. Survey site photographs

Figure A1: Bat detector (Anabat) placement at site 1.

Figure A2. Bat detector (SM2Bat+) placement at site 2.

Figure A3. Bat detector (SM2Bat+) placement at site 2.

Appendix 7 Archaeology Report and Approvals

PORTERS LAKE WIND FARM
ARCHAEOLOGICAL SCREENING AND RECONNAISSANCE
HALIFAX REGIONAL MUNICIPALITY

ARCHAEOLOGICAL SCREENING & RECONNAISSANCE REPORT

Submitted to:

Eon WindElectric
and the
Special Places Program

Submitted by:

Boreas Heritage Consulting Inc.
and
Strum Consulting

September 2014

HERITAGE RESEARCH PERMIT: A2014NS067

Strum CONSULTING

BOREAS Heritage Consulting Inc.

PROJECT PERSONNEL

PRINCIPAL INVESTIGATOR:	Stephen G. Garcin, M.A.
PROJECT MANAGEMENT:	Melanie Smith, MES.
BACKGROUND STUDY:	Sara J. Beanlands, M.A.
FIELD STUDY:	Stephen G. Garcin, M.A. Sara J. Beanlands, M.A.
REPORT PREPARATION:	Stephen G. Garcin, M.A. Sara J. Beanlands, M.A.
GIS/DRAFTING:	Stephen G. Garcin, M.A.

EXECUTIVE SUMMARY

Eon WindElectric is proposing to develop a two turbine wind farm, located in Halifax Regional Municipality, approximately 3 kilometres west of the community of Porters Lake and approximately 2.5 kilometres southeast of Lake Echo. In order to evaluate the potential for impacting archaeological resources during the proposed development, Eon WindElectric retained Strum Consulting in June 2014 to conduct archaeological screening and reconnaissance of the proposed study area. Boreas Heritage Consulting Inc. (BHCI) assisted Strum in obtaining and completing the assessment in accordance with the Heritage Research Permit.

The archaeological assessment was conducted according to the terms of Heritage Research Permit A2014NS067, issued to BHCI Senior Archaeologist Stephen Garcin by the Special Places Program (SPP).

The archaeological screening and reconnaissance of the study area consisted of a background study and visual assessment of the property. It did not involve sub-surface testing. No evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified within the study area. Based on the results of the background study and reconnaissance, BHCI determined the study area to exhibit low potential for encountering Precontact and/or early historic Native archaeological resources, as well as historic Euro-Canadian archaeological resources.

It is therefore recommended that the study area, as identified in this report, be cleared of any requirement for further archaeological investigation.

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1.0 INTRODUCTION

Eon WindElectric is proposing to develop a two turbine wind farm, located in Halifax Regional Municipality, approximately 3 kilometres west of the community of Porters Lake and approximately 2.5 kilometres southeast of Lake Echo. In order to evaluate the potential for impacting archaeological resources during the proposed development, Eon WindElectric retained Strum Consulting in June 2014 to conduct archaeological screening and reconnaissance of the proposed study area. Boreas Heritage Consulting Inc. (BHCI) assisted Strum in obtaining and completing the assessment in accordance with the Heritage Research Permit.

The archaeological assessment was directed by BHCI Principal and Senior Archaeologist Stephen Garcin and conducted according to the terms of Heritage Research Permit A2014NS067, issued to Garcin by the Special Places Program (SPP). Background research and technical support were provided by Sara Beanlands. The field component of the archaeological assessment was carried out on August 5, 2014.

This report describes the archaeological assessment of the Porters Lake Wind Farm study area, presents the results of this investigation and offers cultural resource management recommendations.

2.0 STUDY AREA

The archaeological study area for the proposed Porters Lake Wind Farm is located in Halifax Regional Municipality, approximately 3 kilometres west of the community of Porters Lake and approximately 2.5 kilometres southeast of Lake Echo (***Figure 1; Plate 1***). Comprising a total area of approximately 4.2 hectares, the study area includes two wind turbine footprints, each measuring approximately 100 metres by 100 metres, as well as a proposed 1.5 kilometre access road (***Figure 2***). The study area can be accessed off Highway #7.

PLATE 1: Porters Lake Wind Farm study area; facing northeast.

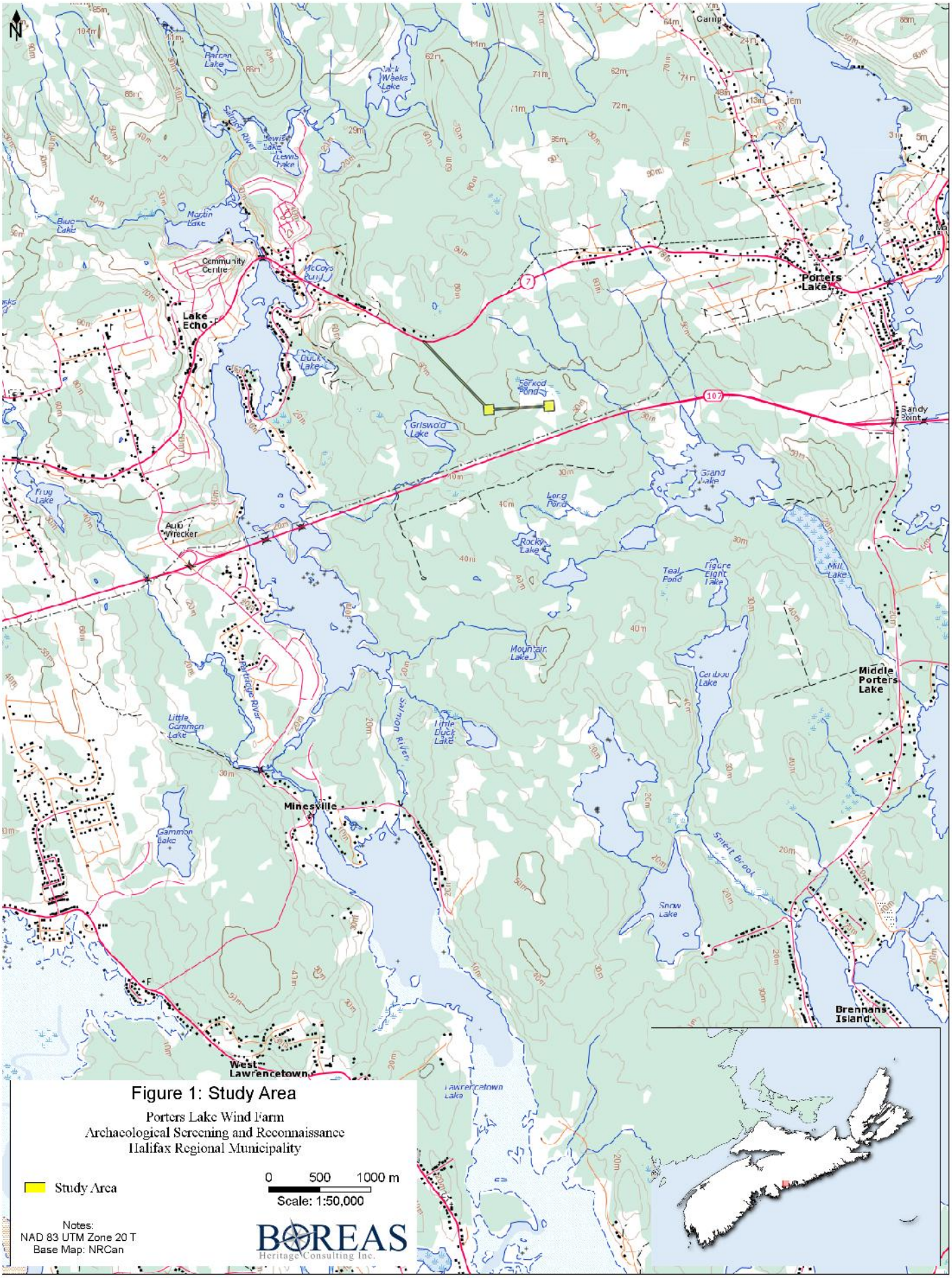
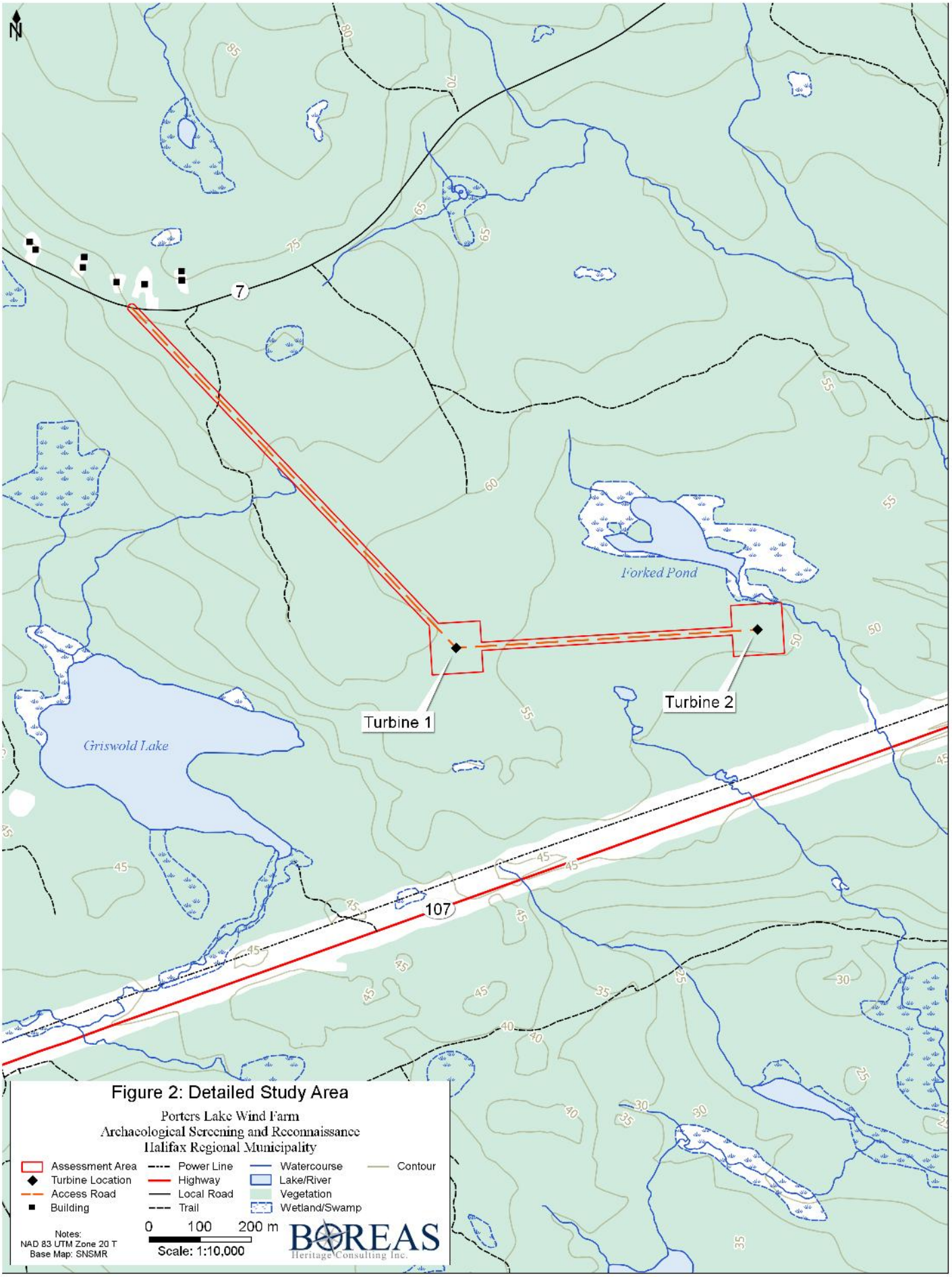


Figure 1: Study Area

Porters Lake Wind Farm
Archaeological Screening and Reconnaissance
Halifax Regional Municipality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7
107
Turbine 1
Turbine 2
Forked Pond
Griswold Lake
Figure 2: Detailed Study Area
Porters Lake Wind Farm
Archaeological Screening and Reconnaissance
Halifax Regional Municipality
Assessment Area
Turbine Location
Access Road
Building
Power Line
Highway
Local Road
Trail
Watercourse
Lake/River
Vegetation
Wetland/Swamp
Contour
0 100 200 m
Scale: 1:10,000
Notes:
NAD 83 UTM Zone 20 T
Base Map: SNSMR
BOREAS
Heritage Consulting Inc.

3.0 METHODOLOGY

The objectives of the assessment are to evaluate archaeological potential within the study area, to delineate areas considered to exhibit high potential for encountering archaeological resources, and to provide the most comprehensive information possible so that appropriate resource management strategies can be devised in light of the proposed development and before project implementation. To achieve these ends, BHCI designed a research strategy consisting of the following components:

3.1 Background Study

The objectives of the background study are to identify known archaeological and historic sites, delineate areas of archaeological potential, and provide a context for resources identified during the course of the assessment. The background study includes a review of previous archaeological research undertaken in the area, an examination of extant records and archival sources relating to historic settlement and development activities within the study area, and a review of relevant geomorphological research and environmental features that may have influenced human settlement and resource processing patterns.

Research is focussed on the identification of areas considered to exhibit high potential for encountering archaeological resources and includes a review of relevant documentation and inventory files, such as available land records, historic maps, and local and/or regional histories. A review of previous archaeological research in the greater area is conducted in order to determine the range and nature of archaeological remains that might be anticipated within the study area. Topographic maps and aerial photographs are consulted in order to identify geomorphological and hydrological attributes that correlate with high archaeological potential (e.g. waterfalls, rapids and marine terraces representing former coastal locations). The historical and cultural information is integrated with the environmental and physiographic data to identify areas of archaeological potential within the study area and to provide a framework for the initial interpretation of any resources encountered during the field component of the assessment.

3.2 Archaeological Reconnaissance

The objectives of the archaeological field reconnaissance are to conduct a visual inspection of the study area, to delineate areas exhibiting high archaeological potential, as identified during the background study and/or encountered during the course of the field survey, and to document any archaeological resources identified during the background study and/or the field survey.

In order to achieve comprehensive coverage of the property, the archaeological reconnaissance involves pedestrian transects throughout the study area in an effort to evaluate archaeological

potential and identify any surface features or other signs of human occupation (***Plate 2***). Particular attention is paid to geomorphological features deemed to have potentially influenced human settlement and resource processing patterns, and topographic and/or vegetative anomalies that might indicate the presence of buried archaeological resources. All areas of exposure, including tree falls, are visually examined for artifacts and cultural features. During the course of the survey, strategies will be identified for the appropriate methodology and scope of more detailed assessment for areas considered to exhibit high archaeological potential.

The process and results of the field reconnaissance are documented in field notes and with photographs. A hand-held Global Positioning System (GPS) unit is used to record UTM coordinates within the study area. All coordinates are UTM projection with NAD 83 as datum. Any archaeological resources encountered during the course of the archaeological reconnaissance will be evaluated and documented for registration within the Maritime Archaeological Resource Inventory (MARI), a provincial archaeological site database maintained by the Nova Scotia Museum.

PLATE 2: Field reconnaissance of the Porters Lake Wind Farm study area; facing south.

4.0 RESULTS

4.1 Background Study

The following discussion details the environmental and cultural setting of the study area, which serves to identify locations that may be predicted to have high archaeological potential and provides a framework for the initial interpretation of any resources encountered during the field component of the assessment.

4.1.1 Environmental Setting

A number of environmental, topographic and hydrographic factors, such as water sources, physiographic attributes, soil types and vegetation, have influenced settlement patterns and contribute to the archaeological potential of the area.

Water Sources
Proximity and accessibility to both freshwater and water transportation routes are significant factors in determining Precontact and historic Native, as well as early Euro-Canadian, archaeological potential. The study area contains no significant water sources, and though there are a number of lakes in the vicinity, as well as a small brook extending south from Forked Pond to Grand Lake, these are considered to have had minimal influence on the suitability of the area for significant Precontact settlement, although they may have provided work areas associated with intermittent resource exploitation. The most significant water source in the vicinity of the study area is Porters Lake, located approximately 4 kilometres to the east, which is connected to the Atlantic Ocean near Lawrencetown Beach (***Figures 1 & 2***).

Topography
The study area is located within the greater terrestrial region known as the Atlantic Interior – Quartzite Barrens (Halifax) Unit (Davis & Browne 1996:56). The bedrock dominated topography is generally described as "ridge-swamp-swale" (***Plate 3***). The mantle of quartzite till ranges in thickness form 1 metre to 10 metres but averages less than 3 metres. The many long sub-parallel faults create linear valleys that are followed by rivers and sometime filled by lakes, as is the case at Porters Lake (Davis & Browne 1996:56). Elevation within the study area ranges from approximately 50 metres above sea level in the southeast to approximately 70 metres above sea level in the northwest.

Soils and Vegetation
Much of this area is covered by *Halifax* series soils, described as well-drained, stony, sandy loams, developed on till derived principally from quartzite (Davis & Browne 1996:56). The forest growth within this ecological region includes American Beech, Yellow Birch, Red Maple and

PLATE 3: General topography of study area, showing bedrock ridges and glacial erratics; facing east.

Sugar Maple, which occur on the higher and broader ridges. Swampy areas are dominated by Black Spruce, Balsam Fir and Red Maple. Scattered Black Spruce and White Pine are also found on the barrens, depending on soil conditions (Davis & Browne 1996:56). Extensive forest cutting has provided good habitat for deer and snowshoe hare, which in turn supports a population of bobcat.

4.1.2 Native Land Use

The land within the study area was once part of the greater Mi'kmaq territory known as *Eskikewa'kik*, meaning 'skin dressers territory'. The surrounding area is relatively dense with lakes and watercourses that would have been important transportation corridors, providing a resource base for the Mi'kmaq, their ancestors and predecessors for millennia prior to the arrival of European settlers. The Mi'kmaq seasonally moved throughout the region between areas where shelter and resources, including food and medicinal plants, were available and annually migrated between hunting and fishing grounds (Chute 1999).

According to the French missionary and orthographer, Capucin Pacifique, the Mi'kmaw name for Porters Lake was *Amsoaganeg*, or *Amaguncheech*, meaning 'the little breezy place' (Pacifique 1934:270; PANS 1967:544). Evidently, the Bellefontaine Road, which connects to Middle Porters Lake at the Canterbury Bridge, has been identified as the "Indian Trail" on historic documents and may represent the remains of a traditional portage route (Ferguson 2009:5).

A review of the Maritime Archaeological Resource Inventory, a provincial archaeological site database maintained by the Heritage Division, determined that there are no registered archaeological sites located within the study area. The lack of archaeological data for the area undoubtedly reflects a lack of archaeological investigation, rather than an absence of archaeological sites. The closest registered Native site is BeCt-03, the reported location of an isolated point fragment found on Porters Lake, approximately 5.5 kilometres southeast of the study area, near the community of Middle Porters Lake. A Late Archaic grooved axe (BeCt-02) was also reported near Chezzetcook Lake, west of the community of Gaetz Brook. An isolated Late Archaic plummet (BeCu-03) was also reported on Salmon River, approximately 8 kilometres southwest of the study area, while BeCt-04 is the location of a shell midden, situated near the community of Grand Desert, approximately 9.5 kilometres to the southeast.

4.1.3 Property History

Permanent Euro-Canadian settlement in the Porters Lake area began in the late eighteenth century when William Porter, a United Empire Loyalist and former Deputy Commissary General of Musters to the foreign troops during the American Rebellion, received, along with several others, a 1650 acre grant of land on December 13, 1784 (PANS 1967:544-545). Porter settled at the lower end of Porters Lake, where the water flows in Three Fathom Harbour and built a sawmill that he operated between 1790 and 1800 (Ferguson 2009:4). The greater area was settled primarily by Loyalists and disbanded soldiers from the American Revolution, and later by German and Dutch soldiers from Lunenburg (Ferguson 2009:4).

The Mi'kmaq were living in the area before and after the arrival of European settlers and it is interesting to note that in 1817, when the wooden church of St. Anselm's in West Chezzetcook was consecrated, records indicate that Natives and African-Canadians were in attendance in large numbers (Ferguson 2009:5). Most of the Mi'kmaq were later relocated to reservations in other parts of Nova Scotia.

In 1826, settlers described the area as "a short time since an unbroken forest" and stated that the frame of a meeting house had been raised near what was known as Mary Ville (PANS 1967:545). Sometime later, the area became known as Lake Porter and in 1852 the name was changed to Porter's Lake (Ferguson 2009:4-6). Highway #7 was built around 1835 and was paved between 1940 and 1954 (Ferguson 2009:55). Historically, farming, lumbering and sawmilling were the

economic base of the community (PANS 1967:545). Although gold was discovered at Thompsons Hill at East Porters Lake in 1897, the vein of gold was too small to develop commercially (Ferguson 2009:80). A cursory examination of historic mapping revealed that the study area occupies a portion of what appears to be un-granted land (Grant Index Sheet #66). An examination of the 1865 Church map of Halifax County (***Figure 3***) and 1907 E.R. Faribault map of Halifax County reveals settlement concentrated along the main road (Highway #7) and an absence of historic structures within the study area. Additional historic mapping depicted no historic features within the study area, thereby diminishing the potential for encountering significant historic/Euro-Canadian archaeological resources.

A number of significant forest fires have been recorded in the area, including one in the late 1880s. In June, 2008, a forest fire resulted in the burning of almost 4,800 acres of land, including that within the study area. It was determined that residue from Hurricane Juan (2003) fueled the fire, which was the largest in an urban area of Nova Scotia in the past 30 years.

4.1.4 Archaeological Potential

Based on the various components of the background study, including environmental setting, Native land use and property history, the study area is ascribed low potential for encountering Precontact and/or early historic Native archaeological resources, as well as historic Euro-Canadian archaeological resources.

4.2 Archaeological Reconnaissance

Fieldwork, consisting of a visual inspection of the property, was conducted on August 5, 2014 under sunny, warm conditions. The primary purpose of the visual assessment was to evaluate the archaeological potential of the study area and to investigate any topographical or cultural features identified during the background study.

Transmission Line/Access Road

The proposed 1.5 kilometre access road alignment, which will connect the turbine sites to Highway #7 (***Figure 2***), is characterised by a mix of low and wet swampy land and rocky and undulating terrain (***Plates 4 & 5***). Visual inspection of the alignment between proposed Turbine Site 1 and Highway #7 revealed the ground to be relatively wet in the northern portion of the study area. Evidence of past forest fire and tree-harvesting activity was observed throughout the alignment (***Plates 6 & 7)***, as well as higher areas of exposed bedrock and rough, undulating terrain. No evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified. Visual inspection of the alignment between proposed Turbine Site 1 and Turbine Site 2 revealed a mix of hummocky and undulating terrain, with areas of exposed bedrock, which would have been

Figure 3: A.F. Church - 1865

Porters Lake Wind Farm
Archaeological Screening and Reconnaissance
Halifax Regional Municipality

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PLATE 4: Low, wet area within proposed access road alignment; facing southeast.

PLATE 5: Uneven terrain within proposed access road alignment; facing southeast.

PLATE 6: Evidence of burning within proposed access road alignment; facing southeast.

PLATE 7: Evidence of past burning/forest fire and tree-harvesting activity.

unsuitable for occupation and/or work areas associated with resource exploitation by Precontact peoples. Evidence of past forest fire and tree-harvesting activity was observed throughout the alignment. No evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified.

Turbine Site 1

Turbine Site 1, situated approximately 400 metres northwest of Highway 107, is characterised by relatively level, yet rocky, terrain, which has been subjected to previous forest fire and tree-harvesting activity (***Figure 2; Plate 8***). In addition to the lack of a significant water source, visual assessment revealed a mix of hummocky and undulating terrain, with areas of exposed bedrock, which would have been unsuitable for occupation and/or work areas associated with resource exploitation by Precontact peoples (***Plate 9***). No evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified within the Turbine Site 1 study area.

Turbine Site 2

Turbine Site 2, situated approximately 600 metres east of Turbine Site 1 and approximately 300 metres north of Highway 107, is characterised by relatively level, yet hummocky, undulating and rocky terrain, which has been subjected to previous forest fire and tree-harvesting activity (***Figure 2; Plate 10***). Although the study area is located immediately south of Forked Pond, visual assessment revealed the pond to be bordered by low swampy areas that would have been unsuitable for occupation and/or work areas associated with resource exploitation by Precontact peoples (***Plate 11***). Numerous areas of exposed bedrock were also observed (***Plate 12***). No evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified within the Turbine Site 2 study area.

4.2.1 Archaeological Potential

Visual inspection revealed that the majority of the study area constituted a mix of hummocky, undulating and wet terrain that would have been unsuitable for occupation and/or work areas associated with resource exploitation by Precontact peoples. No evidence of archaeological resources or areas of elevated archaeological potential were encountered and no indication of significant historic cultural modification was identified within the study area. Based on the nature of the terrain, the distance to a significant water source, and the lack of evidence indicating significant cultural modification, the Porters Lake Wind Farm study area is considered to exhibit low potential for encountering significant archaeological resources.

PLATE 8: Rough and undulating terrain within proposed Turbine Site 1 study area; facing south.

PLATE 9: Areas of exposed bedrock within proposed Turbine Site 1 study area; facing northeast.

PLATE 10: Rough terrain within proposed Turbine Site 2 study area; facing east.

PLATE 11: Swampland bordering Forked Pond; facing north.

PLATE 12: Exposed bedrock within proposed Turbine Site 2 study area; facing east.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The 2014 archaeological screening and reconnaissance of the Porters Lake Wind Farm study area consisted of a background study and visual assessment of the property. It did not involve sub-surface testing. Based on the nature of the terrain, the distance to a significant water source, and the lack of evidence indicating significant cultural modification, the study area is considered to exhibit low potential for encountering significant archaeological resources.

Based on the results, the following management recommendations are provided:

1. It is recommended that the study area, as identified in this report, be cleared of any requirement for future archaeological investigation.

2. In the event that archaeological resources or human remains are encountered during development activities within the study area, immediate contact should be made with Sean Weseloh McKeane, Coordinator of Special Places, Communities Culture and Heritage, at 902-424-6475.

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