Appendix 1 COMFIT Approval Document

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

February 14, 2012

Paul Pynn
Watts Wind Energy Inc.
300 Prince Albert Rd
Dartmouth, NS 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 4.6 MW large-wind facility in Ketch Harbour, Nova Scotia (Application Number 86). 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 September 19th 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 with the proposed project.

- 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.

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.

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. In addition, the Department of Energy will require reporting from your organization on an annual basis. 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

Appendix 2 Federal Approvals

October 18, 2014

Your file
045 Ketch Harbour
Our file
14-2368

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

RE: Wind Farm: 3 Wind Turbines - Harrietsfield, NS
(Within a 0.20NM radius of N44° 32' 11.38" W63° 36' 33.58"/See attached spreadsheet for individual structure details)

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 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

Information						Upon completion		
Name	LAT dd mm ss.ss	LONG -ddd mm ss.ss	Ground Elevation (Feet)	Structure Height (Feet)	Total Height (Feet)	Lighted Y/N	Painted Y/N	Construction Date
Example 1	60 39 16.59	-110 36 14.01	2162.5	463	2625.5	Y	N	15-Jun-07
T1	44 32 21.48	-063 36 37.76	196.8504	492.1260	688.9764			
T2	44 32 11.38	-063 36 33.58	203.4121	492.1260	695.5381			
T3	44 32 01.12	-063 36 28.44	196.8504	492.1260	688.9764			
					0			
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Transport Canada / Transports Canada

Print

TC File No/Ref No: 2014-182

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)

   3 Turbine Wind Energy Facility in Harrietsfield, Nova Scotia

   See attached document for turbine heights and locations

4. Geographic Coordinates ☑ NAD83 ☐ NAD27 ☐ WGS84

   N Latitude deg ____ min ____ sec ____ W Latitude deg ____ min ____ sec ____

5. Nearest Community: Harrietsfield
   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): 2015-07-22

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

Canada

TC File No/Ref No: 2014-182

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)

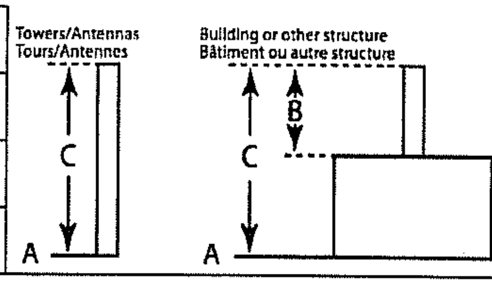
13. Monitoring to Standard 621, article 4.7

- [ ] 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
2014-07-23	Trent MacDonald	[signature]

Transport Canada Assessment

Marking and lighting required (as per Standard 621)

- [x] Lighting Required
- [x] Paint Required
- [ ] Temporary Lighting Required
- [ ] No Lighting or Painting required

Comments (Transport Canada use Only)

- lighting and Paint Required on all 3 structures

Civil Aviation Inspector	Signature	Date (yyyy-mm-dd)
C. Allain	[signature]	2014-10-09

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.

Radio And Radar Communication Assessment						
Turbine Number	Latitude	Longitude	Ground Elevation (m)	Nacelle Height (m)	Rotor Diameter (m)	Total Height (m)
1	44°32'21.48" N	63°36'37.76" W	60	100	100	210
2	44°32'11.38" N	63°36'33.58" W	62	100	100	212
3	44°32'01.12" N	63°36'28.44" W	60	100	100	210

Trent MacDonald <tmacdonald@eonwind.com>

Interference Assessment - 045 Ketch Harbour

XNCR, Windfarm Coordinator <Windfarm.Coordinator@dfo-mpo.gc.ca> Thu, Jul 24, 2014 at 12:37 PM
To: Trent MacDonald <tmacdonald@eonwind.com>

Hello,

The proposed wind farm (Ketch Harbour) is located 7 km away from the Chebucto Head radar site, 12 km away from the Georges Island radar site, and 14 km away from the Shannon Hill 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 4:31 PM
To: XNCR, Windfarm Coordinator
Subject: Interference Assessment - 045 Ketch Harbour

[Quoted text hidden]

Trent MacDonald <tmacdonald@eonwind.com>

Interference Assessment - 045 Ketch Harbour

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 Ketch Harbour

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

Appendix 3 Environmental Protection Plan

Harrietsfield Williamswood Wind Farm (4.6 MW)

Environmental Protection Plan

Harrietsfield Williamswood Wind Project
244 Fraser Road, Williamswood
Nova Scotia B3V 1B7

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Table of Contents

Section A – Introduction

1.0 General

The Harrietsfield Williamswood Wind Farm (Project; HWWF) is proposed as a 4.6 megawatt (MW) wind energy installation 3 kilometres (km) southwest of the community of Harrietsfield in Halifax Regional Municipality. The site is located on private land between Nova Scotia Trunk 306 (NS-306) and Nova Scotia Trunk 349 (NS-349) and is suspected as a section of land decimated by Hurricane Juan in 2003.

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. Several wooded swamps and shrub-treed bogs have been delineated through field studies. One watercourse crossing will occur at the HWWF; 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 or work in 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 HWWF.

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 Fraser Road and Hwy-306 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 personnel understand the importance of avoiding wetlands unless their alteration has been identified in the construction package. Delineation of wetlands has been completed; all but two wetlands are determined to be avoidable. The number and area of wetlands altered will become more defined following a Felt Lichen study over the Project area. This study could impact access road routing to site.

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 will not enter 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 field 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 a small portion of existing roadway and construct a new access road; this work may require a number of 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 limited. 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 summer 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 revealed observations of two Provincially-ranked species: Wiegand's Sedge (*Carex wiegandii*), Provincial rank of S3, and Blue Felt Lichen (*Degelia plumbea*), Provincial rank of S2. Due to the observation of Blue Felt Lichen, a commitment to the completion of a Felt Lichen study has been made immediately following severe winter weather.

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 (Harrietsfield-Sambro) 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 Captain William Spry Public Library and the Harrietsfield Williamswood Community Center, 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.

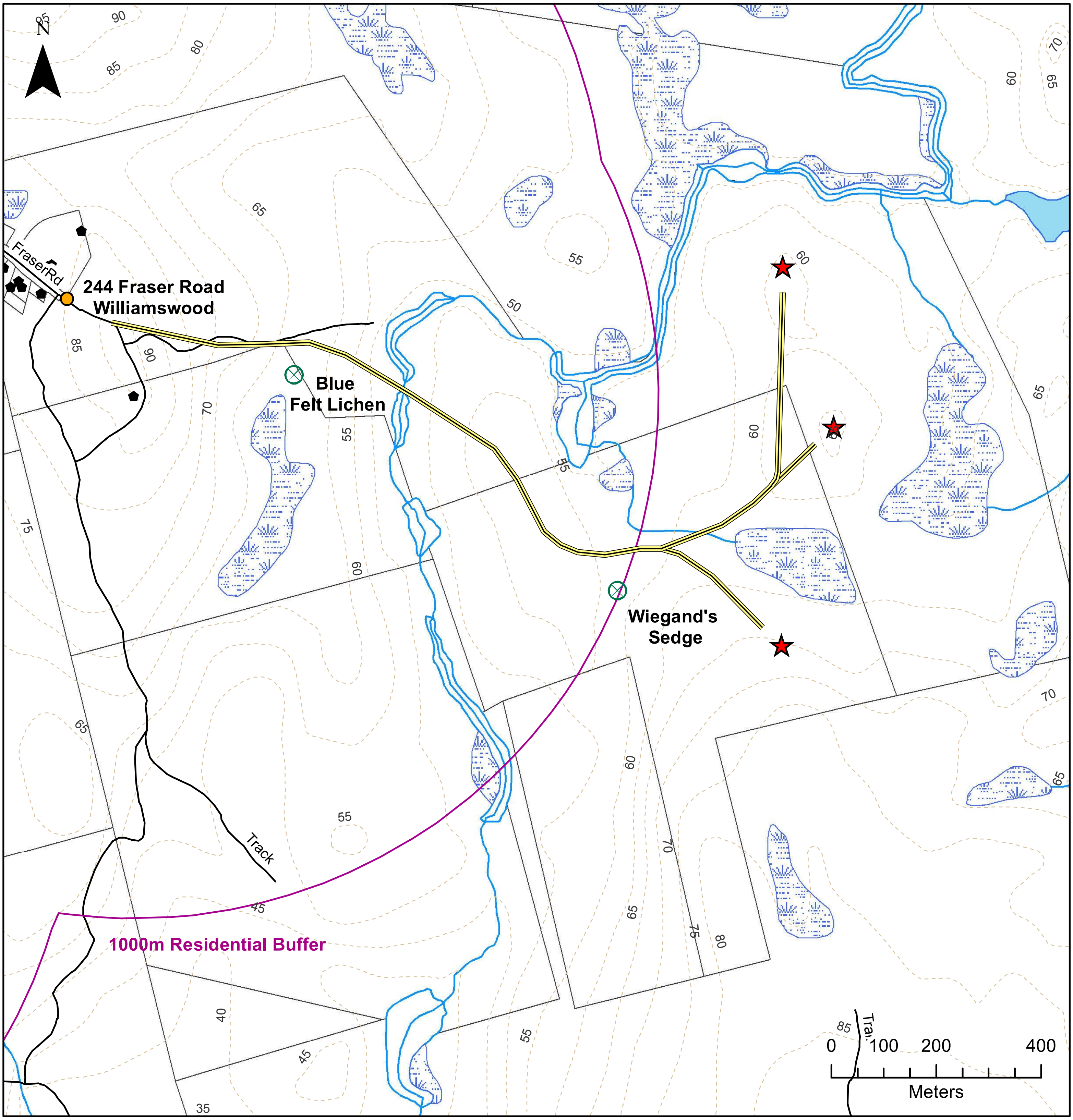
c) Where a member of public expresses a concern, the Proponent will seek to better understand the perspective of the community member and the specifics of the complaint. The Proponent and community member will embark on joint fact finding to identify the source of the complaint and possible mitigative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

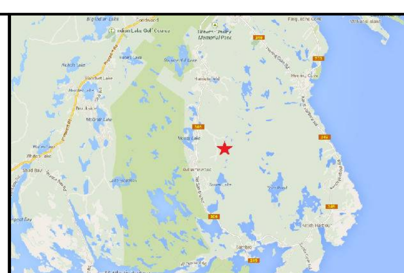
f) In the unlikely event that complaints cannot be resolved directly with the community member, the Proponent will seek review options in a form of alternate dispute resolution as defined under the *Nova Scotia Environment Act*, including but not limited to conciliation, negotiation, mediation or arbitration.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

Appendix A - Site Plan



Legend

Turbine Location	Building Point
ECA Rare Flora	Roads
	Access Road
	1000m Buffer
	Watercourse
	Contours
	Lake
	Wetland



Wattswind
THE ENERGY TO LEAD

Harrietsfield Williamswood
Wind Farm

Map Parameters
Projection:UTM/NAD83/Z20
Project No: 045

Date: 3/24/2015

Appendix B – Emergency and Project Contact Information

Organization	***Contact Name/ Service***	***Address***	***Phone Number***
Harrietsfield-Sambro Fire Department		1070 Old Sambro Rd, Harrietsfield, NS	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	Victoria General Hospital	1276 South Park St. Halifax, NS	1 (902) 473-2700
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
Shubenacadie First Nation	Jennifer Copage, Sipekne'katik Consultation Coordinator	118 Sesame St. Micmac, NS B0N 1W0	1 (902) 758-3372
Department of Natural Resources		1701 Hollis St. Halifax, NS B3J 2T9	1 (902) 424-5935

Organization	***Contact Name/ Service***	***Address***	***Phone Number***
Nova Scotia Environment	Steven Westhaver, District Manager	30 Damascus Road, Bedford NS B4A 0C1	1 (902) 424-8183

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 139514

GRANTED TO

EON WINDELECTRIC

Project Description

MISCELLANEOUS ACTIVITIES

Subject Property: PID #00459909 (Lot 12935) (Lot 12935)

Property owner(s): BASSAM NAHAS

APPROVAL CONDITIONS

PERMIT IS ISSUED FOR A MET TOWER AND THREE WIND TURBINES.
WIND TURBINES MUST MAINTAIN COMPLIANCE WITH THE PROVISIONS OF THE PLANNING DISTRICT 5 LAND USE BY-LAW.

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
REGIONAL MUNICIPALITY
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 Friday, July 11, 2014

ISSUED BY SEAN AUDAS

SIGNATURE Rosemary MacNeil

Appendix 5 Avian Bird Reporting

Pre-construction Baseline Spring Bird Surveys near Fraser Road, Willamswood, Nova Scotia

Andrew G. Horn and Emma McIntyre

This document summarizes the results of a 2014 spring bird migration survey at the proposed wind turbine project across Ocean Run from the end of Fraser Road, Williamswood, Nova Scotia.

Determining site sensitivity and Level of Concern

Background information

Collection of background information, from sources suggested in EC 2007b, is still ongoing. Most of the information on the birds within 10 km has been collected by birdwatchers along the coast at least 4.5 km away, and is not relevant to the present site. Information at a closer range is available from the Maritimes Breeding Bird Atlas (MBBA) and from pre-construction surveys for a wind project (that, in the end, was not constructed) 2.5 km to the east.

As far as is known, the site is not known to be immediately near species at risk, large colonies or staging areas, recognized important areas, raptor concentrations, or migration corridors. Thus its Site Sensitivity (EC 2007b) is not expected to be Very High.

Site sensitivity

The site is not on a landform, such as a ridge or coastline, that might concentrate migrants, nor is near wetlands or other resources that might attract migrants on stopovers, nor lies on a flight path between such areas. Thus in terms of migrants, the site appears to meet the criterion of Low Sensitivity. The size category of the project (2-4 turbines) is Small, so the Level of Concern is likely to be Category 2, which calls for “basic surveys spread over a one-year period” (EC 2007b). For the migration periods (spring and fall) 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.

Methods

The area of the site was visited on 8 days during spring migration, between 21 April 14 and 9 June. An effort was made to visit at periods likely to have heavy movements of migrants through the region (an approaching low- or departing high-pressure system). When this was not possible (e.g., because of prolonged northerly air flow), effort focussed on finding birds on stopover.

Table 1 gives a summary of the methods used on each visit, which consisted of line transects, area searches, passage migration counts, and, on June 9th only, point counts. Line transects and area searches followed the proposed axis road route and turbine locations, except on 13 May. On the latter day, high water blocked access to the site, so the ATV trail to Semmidinger Hill was walked instead, with the assumption that if migrants were using those areas on that day then they would likely also be using the main study area, which was just across Ocean Run.

Transects and area searches were not standardized, so that the observers could adjust their sampling in relation to the logistics of access (which was initially difficult) and the dispersion of habitats of interest (e.g., patches of potential stopover habitat and vantage points to observe fly-overs). Nonetheless, measures of the level of effort (time spent and distant walked) were recorded along with the number of individuals, and, where relevant, behaviour (e.g. display behaviour), of every species encountered. Passage migration counts were conducted on three days suitable for migration, between mid-morning and mid-afternoon.

On June 9, methods shifted to a breeding bird survey protocol, including point counts from 10 stations regularly spaced across the site. The methods will be described in detail in a subsequent report, but that day's sampling is included here because it falls within the migration period.

Results

The species list is in Table 2. The only birds seen that were identifiable as possible migrants (i.e., moving across the whole study area, or seen in large groups or mixed flocks, or seen in habitat inappropriate for breeding) were one Palm Warbler and one unidentified warbler, both seen in sustained southeast-northwest flights on separate occasions during a passage watch on 26 May. All other birds, judging from their localized movements and display or breeding behaviour (including song) appeared to be on breeding territories.

Four species of raptor were seen. None were in large numbers (Table 2), but they included a pair of Red-tailed Hawks near a probable nest site. No species at risk were found, but several species with a provincial rank of 3 (Sensitive) or less were (Table 2).

Discussion

These results suggest that, in terms of spring migrants, the site has Low Sensitivity under the criteria of EC 2007b. A pre-construction survey of a wind project 2.5 km to the east, using similar methods and the same observer, also showed few movements over this landscape and is attached as an appendix.

Since movements of spring migrants in Nova Scotia are generally less numerous and diverse than in fall, fall surveys might be worthwhile. Also, because the site has potentially suitable breeding habitat for at least two species at risk (Olive-sided Flycatcher and Rusty Blackbird), it is being checked more thoroughly for these species during a breeding survey in June and July 2014. The report on that survey will provide further information on the habitats and locations of the breeding species reported here.

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.

Table 1. Search effort.

Date	Time	Duration (min)	Protocol	Weather			
				°C	**Wind direction (degrees)**	**Wind speed (km/h)**	**Conditions**
04/21/2014	16:00	90	Transect	11	200	29	Mainly clear
05/04/2014	9:00	210	Transect	11	310	5	Mainly clear
05/13/2014	8:30	180	Transect to Semmidinger Hill	7	10	17	Clear
05/13/2014	12:00	45	Passage watch (Semmidinger Hill)	12	30	13	Clear
05/16/2014	12:45	60	Passage watch (from W of site)	21	240	22	Mainly clear
05/25/2014	8:45	230	Transect	21	230	19	Mainly clear
05/26/2014	8:43	95	Passage watch (from NW of site)	10	180	17	Mostly cloudy
05/31/2014	8:30	240	Transect	12	120	9	Mainly clear
6/9/2014	06:30	300	Point counts	14	40	7	Mainly clear

Table 2. Species detected on all surveys combined, except June 9, when methods were changed (see Methods). No migrants were seen on June 9. Species in **bold** have provincial status rank of Sensitive.

Species		**Visits seen**	**Median/visit (min-max)**
American Black Duck	*Anas rubripes*	1	2
Ruffed Grouse	*Bonasa umbellus*	5	3 (1, 4)
Great Blue Heron	*Ardea herodias*	1	1
Osprey	*Pandion haliaetus*	2	1.5 (1, 2)
Sharp-shinned Hawk	*Accipiter striatus*	1	1
Broad-winged Hawk	*Buteo platypterus*	2	1
Red-tailed Hawk	*Buteo jamaicensis*	2	1.5 (1, 2)
Herring Gull	*Larus argentatus*	1	3
Mourning Dove	*Zenaida macroura*	5	4 (2, 5)
Hairy Woodpecker	*Picoides villosus*	5	2 (1, 5)
Black-backed Woodpecker	*Picoides arcticus*	2	2.5 (1, 4)
Northern Flicker	*Colaptes auratus*	5	2 (1, 4)
Pileated Woodpecker	*Dryocopus pileatus*	3	1 (1, 1)
Yellow-bellied Flycatcher	*Empidonax flaviventris*	1	4
Blue-headed Vireo	*Vireo solitarius*	5	2 (1, 12)
Red-eyed Vireo	*Vireo olivaceus*	1	2
Gray Jay	*Perisoreus canadensis*	1	1
Blue Jay	*Cyanocitta cristata*	6	3 (1, 8)
American Crow	*Corvus brachyrhynchos*	4	2.5 (1, 5)
Common Raven	*Corvus corax*	4	1.5 (1, 2)
Tree Swallow	*Tachycineta bicolor*	2	2 (2, 2)
Black-capped Chickadee	*Poecile atricapillus*	7	6 (1, 8)
Boreal Chickadee	*Poecile hudsonicus*	2	1.5 (1, 2)
Red-breasted Nuthatch	*Sitta canadensis*	4	2 (1, 3)
White-breasted Nuthatch	*Sitta carolinensis*	1	5
Brown Creeper	*Certhia americana*	3	2 (2, 4)
Winter Wren	*Troglodytes hiemalis*	5	3 (1, 5)
Golden-crowned Kinglet	*Regulus satrapa*	4	3 (1, 4)
Ruby-crowned Kinglet	*Regulus calendula*	5	4 (1, 5)
Swainson's Thrush	*Catharus ustulatus*	1	1
Hermit Thrush	*Catharus guttatus*	6	2.5 (1, 6)
American Robin	*Turdus migratorius*	1	1
Ovenbird	*Seiurus aurocapilla*	2	1 (1, 1)
Black-and-white Warbler	*Mniotilta varia*	3	4 (3, 6)
Nashville Warbler	*Oreothlypis ruficapilla*	1	1
Common Yellowthroat	*Geothlypis trichas*	3	6 (3, 7)
American Redstart	*Setophaga ruticilla*	1	1
Northern Parula	*Setophaga americana*	4	1 (1, 2)
Magnolia Warbler	*Setophaga magnolia*	5	3 (1, 12)

Species		**Visits seen**	**Median/visit (min-max)**
Blackburnian Warbler	*Setophaga fusca*	1	1
Chestnut-sided Warbler	*Setophaga pensylvanica*	3	2 (1, 5)
Palm Warbler	*Setophaga palmarum*	7	4 (1, 8)
Yellow-rumped Warbler	*Setophaga coronata*	5	6 (3, 15)
Black-throated Green Warbler	*Setophaga virens*	4	5.5 (3, 8)
Song Sparrow	*Melospiza melodia*	3	1 (1, 2)
Swamp Sparrow	*Melospiza georgiana*	1	1
White-throated Sparrow	*Zonotrichia albicollis*	4	2.5 (1, 10)
Dark-eyed Junco	*Junco hyemalis*	5	2 (1, 8)
Common Grackle	*Quiscalus quiscula*	1	2
Purple Finch	*Haemorhous purpureus*	5	4 (1, 8)
American Goldfinch	*Spinus tristis*	8	3 (1, 12)
passerine sp. (Palm Warbler?)	Passeriformes sp.	1	1

APPENDIX: Pre-construction Baseline Spring Migration and Breeding Bird Surveys at the Proposed Bear Cove Wind Development

Andrew G. Horn

Summary

This document summarizes the results of spring migration and breeding bird surveys at the proposed wind turbine project at Bear Cove, near Ketch Harbour. These surveys consisted of 15 visits from 15 April to 1 July 2012. Methods included point counts, transects, area searches, passage migration watches, owling, and playback surveys for species at risk.

The surveys did not reveal any high sensitivity factors for migrating or breeding birds (e.g., colonies, staging area), nor any species at risk (except for one Barn Swallow flying over one turbine site), and few migrants were seen. Two provincially Yellow-listed species (Gray Jay and Boreal Chickadee) breed with 1 km of the proposed turbine locations, but in small numbers. These results suggest that the Site Sensitivity (EC 2007b) is Low, pending results of autumn migration surveys.

Background information

Construction of two 2.3 MW turbines is planned for a site at Bear Cove, near Ketch Harbour, Nova Scotia. An initial evaluation of the required preconstruction bird surveys (in consultation with EC 2007a, b) classed the site as having High Sensitivity, because, being 1.5 km from the Atlantic coast, it is on a landform that might concentrate birds. Furthermore, an initial assessment of the habitats at each site (through readily available maps and AGH's experience with the area) concluded that the sites might have adequate habitat for species of concern, specifically Olive-sided Flycatcher (boggy open areas), Canada Warbler (wet woods with dense understory), and, especially, Rusty Blackbird (boggy conifers with open water). Thus, as a precautionary approach, the site was treated as having a Very High Site Sensitivity, pending the results of preconstruction surveys.

The size category of the project (2 turbines) is Small, so the Level of Concern is at least Category 2. Given the uncertainties expressed above, however, the site was treated as Category 4, at least until spring and summer baseline surveys were completed.

Methods

Spring migration

The site was visited during the main spring migration period, April 15 to May 31, with an effort to visit every three days during the peak migration period (May 1-21) and every five days outside that period. Most visits included line transects and point counts between dawn and four hours after sunrise (Table 1). The line transects were the shortest line connecting all the point count stations (Figure 1). They were initially planned to follow the methods in EC 2007a, but were found to detect the same birds as in the point counts, so instead they were used to detect any species not detected during the point counts. Point counts were conducted every 250m along each transect (Figure 1). Each lasted 5 minutes (initial trials showed that extending the time to 10 minutes gained few additional individuals). All detections were estimated as occurring within 50, 100, or >100 m from the observer. Line transects and point counts were followed by unstandardized area searches, focused on searching for species or habitats that are suspected of being present but missed by the other methods.

Suitable days for daytime migration (i.e., those with no precipitation and light to moderate tail winds) included 15- to 90-minute passage migration counts, following the methods in EC 2007a, noting flight heights, positions, and directions relative to the proposed turbines (Table 1).

One evening visit on 4 May searched for owls, with playback of Saw-whet, Long-eared, and Great Horned Owl (in that order), approximately every 300 m along the main transect, up to the point marked “2” in Figure 1.

Breeding season

CWS protocols (EC 2007a) recommend that a breeding bird survey last up to 4-10 days between late May and July. The present site being small, it fell at the low end of that range. Given that it had already been visited throughout May as part of the migration surveys, only three additional visits were made, with two of them separated by at least two weeks (as recommended in EC 2007a; Table 1). The visits began with point counts as described above, followed by searches for additional species in each patch of habitat within the project area, especially for Olive-sided Flycatcher and Rusty Blackbird, which were searched for with playback in the boggy areas west and north of the planned turbine locations, and Canada Warbler, which was searched for with playback in the wetter areas around the north turbine site and along the main west-east transect (Figure 1).

Disposition of data

All data were georeferenced and formatted to be compatible with the Wind Energy Bird & Bat Monitoring Database hosted on the website of Bird Studies

Canada (http://www.bsc-eoc.org/birdmon/wind/main.jsp), for later uploading to that site.

Results

Spring migration

No obvious migrants (i.e., non-breeding species, mixed flocks, or birds passing through the entire site) were encountered during the spring transects and point counts. During passage counts, some possible migrants were seen (Table 2), including at least six individual raptors of species that showed no breeding evidence later in the season (Northern Harrier, Broad-winged Hawk, Red-tailed Hawk; some of the Red-tailed Hawk sightings in Table 2 might be repeat registrations of individuals), one flock of three unidentified warblers, and three individual swallows, including one Barn Swallow (a species assessed by COSEWIC as Threatened). The overall passage rate was 8.3 bird/h (54 individuals in 6.5h observation).

Flight paths lacked strong directionality overall, and most birds seen were flying well above turbine height (Table 2). Sightings were too sparse for firm conclusions about flight paths through the area. Nonetheless, it is worth noting that the few sightings of apparently migrant raptors were concentrated along the valley to the north of the project that includes Charlies Lake, as well as the ridge with the planned turbine locations (Figure 1).

Breeding bird survey

Birds breeding at the site (Table 3) were widespread species typical of the habitats they were found in. No species at risk were found, but two provincially Yellow-listed species (Gray Jay and Boreal Chickadee) breed with 1 km of the proposed turbine locations, as do several Partners in Flight Priority Species, and several species known to have flight displays (Table 3).

Conclusions

The spring survey results suggest that the project area does not concentrate migrants. The possibility that flight paths of migrant raptors are concentrated near the turbine locations could be checked further during autumn surveys.

The breeding bird survey results did not reveal any particularly sensitive features within the project area. Although two provincially ranked species (Boreal Chickadee and Gray Jay) breed in suitable habitat at the site, their level of abundance is quite low (likely 2-3 family groups each) and they were never detected closer than 600 m from the proposed turbine locations.

Overall, these results suggest that the Site Sensitivity (EC 2007b) is Low, pending results of autumn migration surveys.

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.

Rosenberg, K. V., and T. P. Hodgman. 2000. Partners in Flight Bird Conservation Plan for Eastern Spruce-Hardwood Forest (Physiographic Area 28).

Table 1. Sampling effort. Passage migration locations refer to Figure 1.

Method, date	**Time**	**Duration**	**Comments**
Point counts and transects			
15 April	930-1149	2:19	Transects only
21 April	557-829	2:32	
5 May	550-836	2:46	
19 May	555-844	2:49	
22 May	525-809	2:44	
26 May	510-715	2:05	Transects only
1 June	510-854	3:44	
11 June	515-850	3:35	
18 June	0800-1500	7	Transects, search for species at risk
1 July	529-835	3:06	
Passage counts			
15 April	11:49-12:20	0:31	
15 April	1300-1317	0:17	From 1, wind S 20
21 April	805-820	0:15	From 2, wind S 20
29 April	1315-1355	0:40	From 1, wind W 20
9 May	1325-1355	0:30	From 1, wind S 10
9 May	1423-1515	0:52	From 2, wind S 10
15 May	1017-1130	1:31	From 2, wind SW 10 (gusts 30)
20 May	953-1115	1:22	From S turbine, wind SW 15
20 May	915-950	0:35	From 2, wind SW 15
Owling			
4 May	2030-2200	1:30	

Table 2. Species detected during passage counts, with median height above ground level (estimated to 50 m if ≤ 350, to 100 m if > 350), and number circling (⦸) or flying in each cardinal direction.

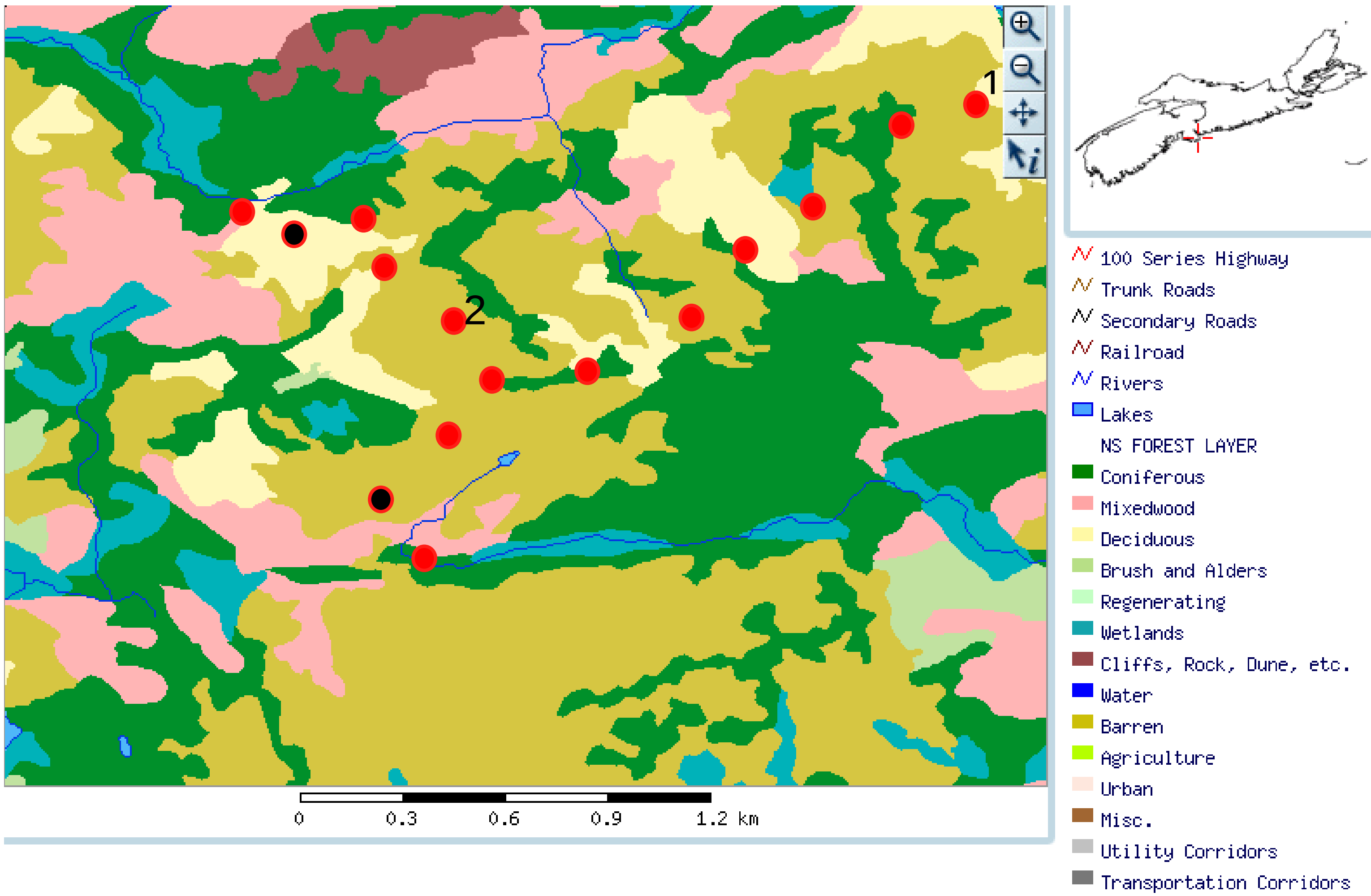
Species	**Median height in m (range)**	**Flight direction**							
		⦸	**N**	**NE**	**SE**	**S**	**SW**	**W**	**NW**
Double-crested Cormorant	250 (50-500)		1			6	1		
Great Blue Heron	100					1			
Osprey	250 (200-300)	1						1	
Bald Eagle	200	1							
Northern Harrier	60 (20-100)							2	
Broad-winged Hawk	250 (200-300)					1	1		
Red-tailed Hawk	200 (100-300)	3			1	2	3		
Unidentified Buteo	200		2						
Herring Gull	350 (150-500)	1	4	6			1		
Great Black-backed Gull	200 (100-300)	1					1		
Unidentified Gull	300	3							
American Crow	60 (20-100)			1				1	
Common Raven	300							2	
Tree Swallow	100 (100-100)		1					1	
Barn Swallow	100							1	
Unidentified Warbler	200								3

Table 3. Breeding birds, with number per point count, breeding evidence, and Partners in Flight priority (Rosenberg and Hodgman 2000). Yellow-listed species in **bold**, species with flight display starred (*).

Species	n/count	Breeding evidence	PIF priority
Ruffed Grouse	0.39	FY	PIF II
Ring-necked Pheasant	0.85	T	
Herring Gull	0.04	T	
Mourning Dove*	2.61	T	
Great Horned Owl	0.04	P	
Northern Saw-whet Owl	0	S	
Hairy Woodpecker	0.11	T	
Northern Flicker	0.35	T	
Unidentified Woodpecker	0.49	T	
Yellow-bellied Flycatcher	0.07	T	
Alder Flycatcher*	0.99	T	
Solitary Vireo	0.28	CF	
Gray Jay	0.35	FY	
Blue Jay	1.55	T	
American Crow	2.36	T	
Common Raven*	0.25	T	
Black-capped Chickadee	1.41	FY	
Boreal Chickadee	0.07	T	PIF II
Red-breasted Nuthatch	0.07	T	
Ruby-crowned Kinglet	1.27	T	
Golden-crowned Kinglet	0	A	
Hermit Thrush	2.96	T	
American Robin	0.49	T	
Nashville Warbler	0.85	T	PIF II
Northern Parula	0	T	PIF II
Yellow Warbler	0.14	T	
Chestnut-sided Warbler	1.41	T	
Magnolia Warbler	0.78	T	
Yellow-rumped Warbler	1.24	T	
Black-throated Green Warbler	0.28	T	PIF II
Palm Warbler	2.68	CF	
Black-and-white Warbler	0.56	T	
American Redstart	0.14	T	
Ovenbird*	0.92	T	
Mourning Warbler	0.04	S	
Common Yellowthroat*	2.58	CF	
Song Sparrow	0.04	T	
Lincoln's Sparrow	0.81	T	
White-throated Sparrow	3.21	T	
Dark-eyed Junco	1.94	T	
Common Grackle	0.21	H	

Purple Finch*	1.31	NB	PIF II
American Goldfinch*	0.67	T	

Figure 1. Approximate turbine sites (black dots), point count stations (red dots), and passage count vantage points (numbers, corresponding to Table 1) on forest cover map of site (https://ca.nfis.org/provinces/ns/index_eng.html). The southern turbine was also a point count station.


1
2
0
0.3
0.6
0.9
1.2 km
100 Series Highway
Trunk Roads
Secondary Roads
Railroad
Rivers
Lakes
NS FOREST LAYER
Coniferous
Mixedwood
Deciduous
Brush and Alders
Regenerating
Wetlands
Cliffs, Rock, Dune, etc.
Water
Barren
Agriculture
Urban
Misc.
Utility Corridors
Transportation Corridors

Pre-construction Baseline Breeding Bird Survey near Fraser Road, Willamswood, Nova Scotia

Andrew G. Horn and Emma McIntyre

This document summarizes the results of a breeding bird survey conducted in 2014 at the proposed wind turbine project across Ocean Run from the end of Fraser Road, Williamswood, Nova Scotia.

The survey did not reveal any high sensitivity factors for breeding birds (e.g., colonies or large concentrations) or any species at risk. Several provincially Yellow-listed (Sensitive) species breed in the project area, but in low numbers. These results suggest that the Site Sensitivity (EC 2007b) is Low.

Determining site sensitivity and Level of Concern

Background information

Background information (from sources suggested in EC 2007b) shows that most of the information on the birds within 10 km has been collected by birdwatchers along the coast at least 4.5 km away, and is not relevant to the present site. Information at a closer range is available from the Maritimes Breeding Bird Atlas (MBBA) and from pre-construction surveys for an abandoned wind project 2.5 km to the east of the present project site.

No species at risk were found breeding at the nearby wind project site (Horn 2012), but the MBBA lists two species at risk within the 10 X 10 km atlas square that contains the project area (Common Nighthawk, Barn Swallow, and Canada Warbler. As well, Canada Warbler was found in the three neighbouring atlas squares nearest the site.

The site is not known to be immediately near large colonies or staging areas, recognized important areas, raptor concentrations, or migration corridors, nor does it have any topographical feature (e.g., ridge, bluff, coastline) that might concentrate migrants, so its Site Sensitivity (EC 2007b) is not expected to be Very High. The project area appears to lack suitable breeding habitat for Common Nighthawk and Barn Swallow, but it does have what appears to be suitable breeding habitat for Olive-sided Flycatcher (open treed bogs), Canada Warbler (riparian forest with layered understory) and Rusty Blackbird (coniferous woods with pools). Until the present survey, the site had not been thoroughly searched for these species.

The size category of the project (2-4 turbines) is Small, so the Level of Concern is likely to be Category 2, which calls for “basic surveys spread over a one-year period” (EC 2007b). For the breeding season, EC protocols (2007a) recommend visits spread through the main breeding season for most bird species (May-July), using the methods of transects, area searches, and/or point counts.

Methods

The area of the site was visited on 6 days between 4 May and 14 July (Table 1). On each day, a transect was walked approximately between the 10 points noted in Figure 1, and point counts (5-minute, unlimited radius) were conducted at each of those points during the two visits in June (walking the transects between point count stations appeared to add as many species as extending point count duration to the more standard 10 minutes would have). On 14 July, these point counts were replaced with playback of mobbing calls of Black-capped Chickadees (approximately 30 s at 80 dB) at five locations scattered throughout the site. The points were chosen to be well spaced, visit the full variety of available habitats, and lie near the proposed axis road route and turbine locations.

We also conducted area searches of apparently appropriate habitats for species at risk, specifically wet forest with understory (Canada Warbler) and boggy clearings (Olive-sided Flycatcher), forest, and forest edges (Rusty Blackbird), including at least one playback of the target species’ song each time such an area was visited (duration and levels as for the chickadee calls above).

Point counts are conducted to measure the density of each species, but because of the small size of the study area and the strong dependence of species composition on time of day at this site (pers. obs.), a more robust index of species abundance for the present study, used to produce Table 2, is the total individuals encountered per visit to the site. Point count data are being retained, however, in case comparison with post-construction conditions is warranted. 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. Almost all species were possible breeders, because they showed localized movements, consistent presence across widely-spaced visits, and/or performed display or other breeding behaviours (including song). The exceptions were the duck (likely a Black Duck, *Anas rubripes*), Ring-necked Pheasant (heard from the site, but likely calling from off the site), Great Blue Heron (seen once, foraging), Tree Swallow, and Common Grackle (both heard flying over). However, any of these species might conceivably breed on the site.

No species assessed as at risk by COSEWIC were found, but several species with a provincial rank of 3 (Sensitive) were (Table 2). Their positions are not mapped in the figure, to avoid the misleading implication that they only occur where they were found; all were associated with mature spruce forests on the site and could conceivably breed anywhere on the site where that habitat occurs.

Breeding raptors included Osprey (only observed flying over the site, but likely nesting nearby) and Red-tailed Hawk (probable nest site indicated in Figure 1).

Discussion

Despite the presence of some provincially Sensitive species, given the small number of territories that could fall within the project footprint (ranging from less than one for Gray Jay to fewer than four for Yellow-bellied Flycatcher), in terms of breeding birds, the site appears to have Medium to Low Sensitivity under the criteria of EC 2007b. This conclusion applies only to this particular project; multiple projects in the same area might have cumulative effects via avoidance or disruption of habitat continuity.

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.

Horn, A.G. 2012. Pre-construction Baseline Spring Migration and Breeding Bird Surveys at the Proposed Bear Cove Wind Development. Unpublished report for Eon Wind Electric, Ltd.

Table 1. Search effort and weather conditions.

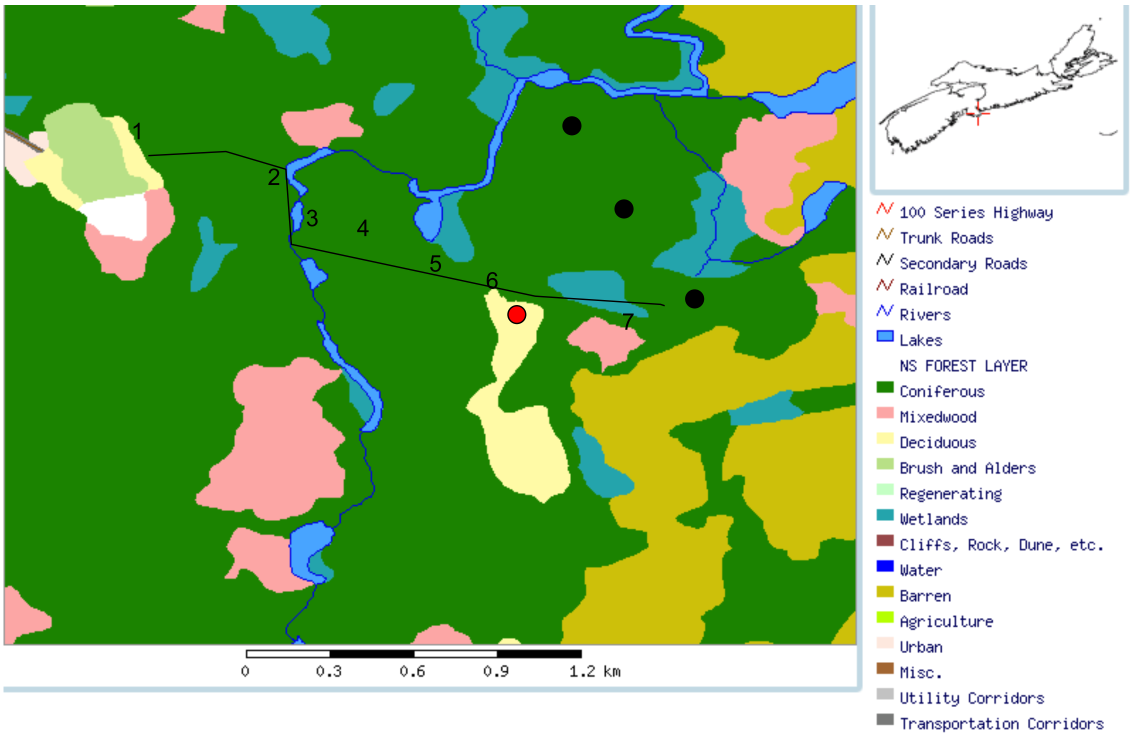
Date	Time	Duration (min)	Protocol*	Weather			
				°C	Wind direction (degrees)	Wind speed (km/h)	Conditions
4 May	9:00	210	Transects, area searches only	11	310	5	Mainly clear
25 May	8:45	230	"	21	230	19	"
31 May	8:30	240	"	12	120	9	"
9 June	6:30	300	Point counts	14	40	7	"
30 June	6:30	210	Point counts	19	320	9	Mostly cloudy
14 July	7:30	240	Chickadee playback	17	190	20	"

*All visits included transects and area searches.

Table 2. Species detected on the six breeding survey visits, with number of visits detected and median individuals detected per visit. Species in **bold** have provincial status rank of Sensitive.

Common name	***Scientific name***	# visits	Median/visit (range)
Duck sp.	*Anatinae sp.*	1	2
Ring-necked Pheasant	*Phasianus colchicus*	1	1
Ruffed Grouse	*Bonasa umbellus*	3	3 (1, 3)
Great Blue Heron	*Ardea herodias*	1	1
Red-tailed Hawk	*Buteo jamaicensis*	1	1
Mourning Dove	*Zenaida macroura*	5	5 (2, 13)
Hairy Woodpecker	*Picoides villosus*	6	2 (1, 3)
Black-backed Woodpecker	*Picoides arcticus*	4	1 (1, 4)
Northern Flicker	*Colaptes auratus*	4	3 (1, 4)
Pileated Woodpecker	*Dryocopus pileatus*	2	1 (1, 1)
Yellow-bellied Flycatcher	*Empidonax flaviventris*	3	4 (1, 6)
Alder Flycatcher	*Empidonax alnorum*	1	1
Blue-headed Vireo	*Vireo solitarius*	5	6 (1, 12)
Red-eyed Vireo	*Vireo olivaceus*	3	2 (1, 5)
Gray Jay	*Perisoreus canadensis*	1	1
Blue Jay	*Cyanocitta cristata*	5	3 (1, 6)
American Crow	*Corvus brachyrhynchos*	4	2 (1, 5)
Common Raven	*Corvus corax*	2	2 (2, 2)
Tree Swallow	*Tachycineta bicolor*	2	2 (2, 2)
Black-capped Chickadee	*Poecile atricapillus*	6	5.5 (1, 8)
Boreal Chickadee	*Poecile hudsonicus*	1	2
Red-breasted Nuthatch	*Sitta canadensis*	3	3 (1, 3)
White-breasted Nuthatch	*Sitta carolinensis*	1	5
Brown Creeper	*Certhia americana*	2	3 (2, 4)
Winter Wren	*Troglodytes hiemalis*	5	5 (2, 10)
Golden-crowned Kinglet	*Regulus satrapa*	3	3 (1, 3)
Ruby-crowned Kinglet	*Regulus calendula*	4	2.5 (1, 5)
Swainson's Thrush	*Catharus ustulatus*	1	2
Hermit Thrush	*Catharus guttatus*	6	2.5 (3, 6)
American Robin	*Turdus migratorius*	2	2 (1, 3)
Ovenbird	*Seiurus aurocapilla*	2	1 (1, 1)
Black-and-white Warbler	*Mniotilta varia*	3	3 (1, 4)
Nashville Warbler	*Oreothlypis ruficapilla*	2	1.5 (1, 2)
Common Yellowthroat	*Geothlypis trichas*	5	6 (2, 9)
American Redstart	*Setophaga ruticilla*	1	1
Northern Parula	*Setophaga americana*	2	1.5 (1, 2)
Magnolia Warbler	*Setophaga magnolia*	6	11 (3, 12)
Blackburnian Warbler	*Setophaga fusca*	1	1
Chestnut-sided Warbler	*Setophaga pensylvanica*	1	2
Palm Warbler	*Setophaga palmarum*	6	3.5 (1, 8)
Yellow-rumped Warbler	*Setophaga coronata*	6	5.5 (1, 15)
Black-throated Green Warbler	*Setophaga virens*	5	7 (3, 15)
Song Sparrow	*Melospiza melodia*	3	2 (1, 3)
Swamp Sparrow	*Melospiza georgiana*	1	1
White-throated Sparrow	*Zonotrichia albicollis*	5	3 (1, 7)
Dark-eyed Junco	*Junco hyemalis*	6	2.5 (1, 8)
Common Grackle	*Quiscalus quiscula*	2	2 (2, 2)
Purple Finch	*Haemorhous purpureus*	4	6 (1, 8)
American Goldfinch	*Spinus tristis*	5	4 (1, 12)

Figure 1. Approximate proposed turbine sites (black dots) and point count stations (numbered 1-7; the remaining 3 were at each turbine site) on forest cover map of site (from https://ca.nfis.org/provinces/ns/index_eng.html). Red dot indicates approximate site of Red-tailed Hawk nest, black line traces approximate access road route that was proposed early in the consideration of the site (refer to more recent maps for currently proposed route).



Pre-construction Baseline Autumn Migration Bird Survey near Fraser Road, Willamswood, Nova Scotia

Andrew G. Horn and Emma McIntyre

This document summarizes the results of an autumn migration bird survey conducted in 2014 at the proposed wind turbine project across Ocean Run from the end of Fraser Road, Williamswood, Nova Scotia.

The survey found small numbers of migrants of several species passing through or stopping over the site. It did not reveal any high sensitivity factors for autumn migrants, however, such as high passage rates, key stopover locations, or species at risk, suggesting that the Site Sensitivity (EC 2007b) is Low.

Determining site sensitivity and Level of Concern

Background information

Information on migrant birds within 10 km of the site (from sources suggested in EC 2007b)exists, but most was collected along the coast at least 4.5 km away, and thus is not relevant to the present site. There is information from closer to the site in the Maritimes Breeding Bird Atlas (MBBA) and a pre-construction survey for an abandoned wind project 2.5 km to the east (Horn 2012), but these sources do not have information on autumn migrants.

The site is not near known staging areas, recognized important areas, raptor concentrations, or migration corridors, nor does it have any topographical feature, such as a ridge, bluff, or coast, that might concentrate migrants, so its Site Sensitivity (EC 2007b) is not expected to be Very High.At 2-4 turbines, the size category of the project is Small, so the Level of Concern is likely to be Category 2, which calls for "basic surveys spread over a one-year period" (EC 2007b). For fall surveys, EC protocols (2007a) recommend 8-10 visits spread through the main migration period, using the methods of transects, area searches, and/or passage migration counts.

Methods

The site was visited 10 times on 9 days between 30 August and 4 November, 2014 (Table 1). Seven visits included passage migration watches from vantage points to the west or north of the site for migrants passing over the site, and four included transects and area searches for migrants on stopover (Table 1, Figure 1). Three of the passage migration watches started near dawn to register the nocturnal flight calls of passerine migrants passing over the site. Passage watches later in the day were also included, to assess the use of the site by diurnal migrants, especially raptors.

Four of the visits included a transect with diversions for area searches where habitats suitable for stopover migrants (e.g., dense shrubs, wet areas) were encountered. On one day the transect was via the planned access road into the site (see breeding season report), but on the others the transect followed or paralleled the line shown in Figure 1, because of the ease of access there and because early in the surveys it was found that migrants were most readily encountered on south-facing slopes (presumably because of their exposure to the sun).

Species lists are archived and publicly available on eBird (http://ebird.org), where there are further notes (such as flight heights and directions) for many of the sightings.

Results

The species list is in Table 2. No large flocks of migrants were seen, apart from two flocks of double-crested cormorants (51 and 100 individuals) that both passed one to two kilometres south of the site (toward the Atlantic coast). The next highest day totals included 33 American robins that passed the site in small flocks, 12 golden-crowned kinglets foraging, presumably on stopover, in scattered flocks (usually with chickadees) in the conifer and mixed forests bordering Ocean Run, and one flock of 10 dark-eyed juncos foraging in mixed forest along Fraser Road.

Six species of raptor were seen, but with day totals of only one or two individuals (Table 2). No species at risk were encountered, although three provincially sensitive (ranked Yellow) were (Gray Jay, Boreal Chickadee, and Golden-crowned Kinglet).

Discussion

Avian fall migration across most of Nova Scotia is episodic in time and space, depending on regional and local weather conditions. For example, foggy conditions can produce massive “fall-outs” of migrants, in which birds are suddenly abundant where few were apparent just days earlier. Despite many years of birding and more formal research on migration in this region, the timing and routing of migration through the province is poorly understood.

This uncertainty is even true of the Chebucto Peninsula, where the present site is situated, despite its accessibility to naturalists in Halifax. Migrants certainly pass through the region, but the degree to which they “short cut” the peninsula, as opposed to follow the coast, is unknown, mainly because birders concentrate their efforts on the coast.

With that caveat in mind, the present survey shows no indication of heavy movements of migrants through the area. Migrants certainly do pass over the area, and some stop over, but no particularly high concentrations were found. These results are consistent with expectations based on the topographical and biotic features of the site.

Overall, these results suggest that, in terms of fall migrants, the site has Low Sensitivity under the criteria of EC 2007b. As noted in the report on the avian breeding bird survey for this project, the site’s most distinctive ecological value for birds is its mature conifer forest, where several provincially sensitive species breed.

Acknowledgement

AGH thanks Fulton Lavender for sharing his knowledge of the area and its birds.

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.

Horn, A.G. 2012.Pre-construction Baseline Spring Migration and Breeding Bird Surveys at the Proposed Bear Cove Wind Development. Unpublished report for Eon Wind Electric, Ltd.

Table 1. Summary of search effort. Locations for passage watches shown in Figure 1. Weather data are from daily records at Shearwater Air Base.

Date	**Time**	**Length (min)**	**Method**	**Weather**		
				Temp (C)	**Wind direction (degrees)**	**Max. wind gust (km/h)**
08/30/2014	06:00 AM	90	Passage watch (B)	14	230	37
09/08/2014	06:10 AM	80	Passage watch (B)	15	10	33
09/08/2014	10:45 AM	90	Passage watch (A)	"	"	"
09/17/2014	11:00 AM	90	Passage watch (A)	14	210	32
09/20/2014	06:00 AM	60	Passage watch (B)	12	210	54
09/23/2014	10:30 AM	330	Transect (from A)	13	310	37
10/01/2014	10:00 AM	270	Transect (via access rd)	13	30	32
10/11/2014	09:40 AM	260	Transect (from A)	10	calm	
10/20/2014	10:30 AM	153	Transect (from A) and Passage watch (A)	7	270	44
11/04/2014	01:00 PM	90	Passage watch (A)	6	310	39

Table 2 (next page). Species list, with number of visits seen and median number of individuals seen per visit (with range). Greyed out species are species found locally that were unlikely to include any migrants. Asterisked (*) sightings are discussed further in text. Birds listed as unidentified were detected by their nocturnal flight calls and were identified as likely being common migrant species, but identification was not certain.

Species	**Binomial**	**# visits**	**Median/visit (range)**
American Black Duck	*Anasrubripes*	1	4
Red-throated Loon	*Gaviastellata*	1	1
Double-crested Cormorant	*Phalacrocoraxauritus*	2	75.5 (51, 100)*
Great Blue Heron	*Ardeaherodias*	1	1
Osprey	*Pandionhaliaetus*	1	2
Northern Harrier	*Circus cyaneus*	1	1
Sharp-shinned Hawk	*Accipiter striatus*	1	1
Bald Eagle	*Haliaeetusleucocephalus*	2	1 (1, 1)
Broad-winged Hawk	*Buteoplatypterus*	1	2
Red-tailed Hawk	*Buteojamaicensis*	1	1
Herring Gull	*Larusargentatus*	2	2 (1, 3)
Mourning Dove	*Zenaidamacroura*	2	1 (1, 1)
Northern Saw-whet Owl	*Aegoliusacadicus*	1	2
Belted Kingfisher	*Megacerylealcyon*	1	1
Downy Woodpecker	*Picoidespubescens*	1	1
Hairy Woodpecker	*Picoidesvillosus*	2	1 (1, 1)
Northern Flicker	*Colaptesauratus*	3	4 (1, 4)
Pileated Woodpecker	*Dryocopuspileatus*	1	1
American Kestrel	*Falco sparverius*	1	1
Blue-headed Vireo	*Vireo solitarius*	1	2
Red-eyed Vireo	*Vireo olivaceus*	1	1
Gray Jay	*Perisoreuscanadensis*	4	1.5 (1, 5)
Blue Jay	*Cyanocittacristata*	9	4 (1, 8)
American Crow	*Corvusbrachyrhynchos*	9	4 (1, 10)
Common Raven	*Corvuscorax*	6	1.5 (1, 5)
Black-capped Chickadee	*Poecileatricapillus*	8	2.5 (1, 18)
Boreal Chickadee	*Poecilehudsonicus*	2	6.5 (2, 11)
Red-breasted Nuthatch	*Sittacanadensis*	1	3
White-breasted Nuthatch	*Sittacarolinensis*	1	1
Brown Creeper	*Certhiaamericana*	1	4
Winter Wren	*Troglodytes hiemalis*	3	2 (1, 2)
Golden-crowned Kinglet	*Regulussatrapa*	3	8 (4, 12)*
Hermit Thrush	*Catharusguttatus*	4	1 (1, 4)
American Robin	*Turdusmigratorius*	7	6 (1, 33)*
Black-and-white Warbler	*Mniotiltavaria*	1	1
Common Yellowthroat	*Geothlypistrichas*	5	2 (1, 3)
American Redstart	*Setophagaruticilla*	1	1
Blackpoll Warbler	*Setophagastriata*	2	2 (2, 2)
Palm Warbler	*Setophagapalmarum*	2	1.5 (1, 2)
Yellow-rumped Warbler	*Setophagacoronata*	7	3 (1, 9)
warbler sp.		4	1 (1, 7)
Song Sparrow	*Melospizamelodia*	1	1
Swamp Sparrow	*Melospizageorgiana*	1	1
White-throated Sparrow	*Zonotrichiaalbicollis*	6	2 (1, 3)
Dark-eyed Junco	*Junco hyemalis*	4	1.5 (1, 10)*
Common Grackle	*Quiscalusquiscula*	1	1
Purple Finch	*Haemorhouspurpureus*	5	1 (1, 2)
Pine Siskin	*Spinuspinus*	1	10
American Goldfinch	*Spinustristis*	7	2 (1, 6)
finch sp.		1	1
passerine sp.		2	7.5 (6, 9)

Figure 1. Approximate locations ofvantage points for passage watches (A, B) and transect from north referred to in Table 1 and Methods.

Appendix 6 Bat Species Reporting

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

Final Report Prepared for:
EON WindElectric
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Dartmouth, Nova Scotia

Attn: Trent MacDonald
Project/ Environmental Engineer

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November 2014

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Context

Project Background

EON WindElectric is proposing to install three wind turbines to generate electricity near the community of Williamswood, Halifax County, Nova Scotia. The project is in an early phase with no infrastructure installed at the time of survey efforts.

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).

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 Williamswood Wind Energy Project in 2014.

Regulatory Context

The following legislation and policy were considered in relation to the proposed survey at the Williamswood 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), other unpublished work , and recent compilation of sighting records (Lucas and Hebda 2011) suggests that there are no significant populations or large scale migratory movements of these species in the province. However, 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, little brown and tri-coloured bats are expected to be the most likely species to occupy the proposed development area. The life history 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 three 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.

The third species that occurs year-round in Nova Scotia is the tri-colored bat, is not likely to occur in the proposed development area as it is locally abundant in southwest Nova Scotia (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 Williamswood Wind Energy Project area (Moseley 2007, Randall and Broders 2014). The nearest known bat hibernaculum, Vault Cave, was a site with high autumn swarming activity pre-WNS (Randall 2011) in the Annapolis Valley. It is located approximately 106 km from the proposed development area.

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 Williamswood and Harrietsfield; both of which are part of the Halifax Regional Municipality in Halifax County. This area is within the granite barrens district of the Atlantic Coast Theme Region (Davis and Browne 1996) and is in the Atlantic Coast Ecoregion (Webb and Marshall 1999). Open softwood forests dominate the area primarily composed of white spruce, black spruce and balsam fir.

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 and adjacent to the proposed development area (Table 2, Figure 1). One detector was placed at a high point near the entrance to the site along a forest edge, a second was placed on a forested stream edge (riparian zone) and a third was placed in a forest canopy gap (Table 3). Microphones on the SM2Bat+ units were oriented slightly down to shed rain. 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 with manual verification for Anabat files in AnalookW. 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.

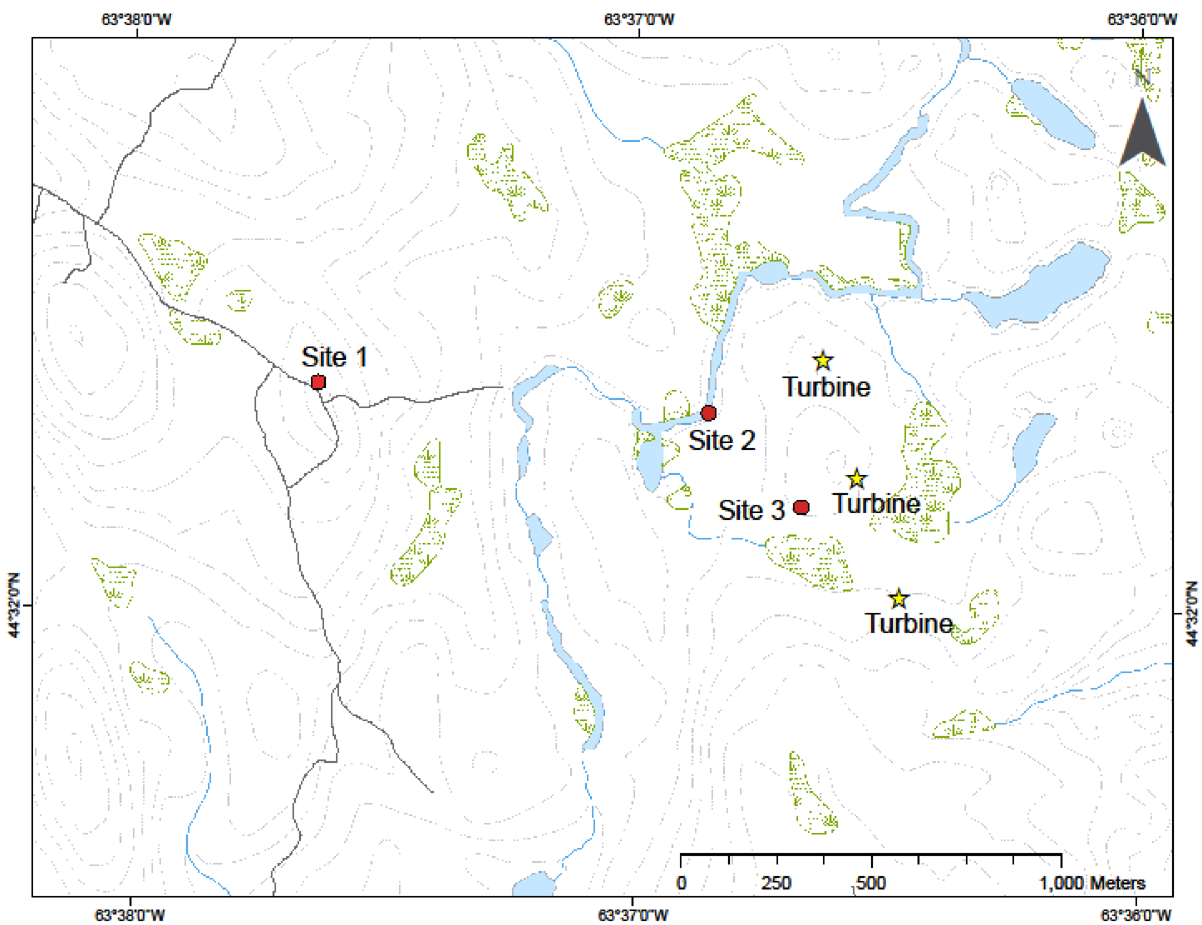

Figure 1. Locations of bat detectors used to sample for bat activity the Williamswood Wind Energy Project, August to October 2014. GIS data supplied by Service Nova Scotia and Municipal Relations. Stars indicate the proposed wind turbine locations as of August 01 2014.

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

Site	Location	Detector type	Coordinates		Deployed	Retrieved
1	Forest edge	Anabat	362676 E	4883644 N	01 Aug 2014	26 Sep 2014
2	Riparian edge	SM2Bat+	362724 E	4883272 N	01 Aug 2014	03 Nov 2014
3	Forest gap	SM2Bat+	363400 E	4882894 N	01 Aug 2014	03 Nov 2014

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

Site	Description
1	Located along forested edge oriented into a clearing at a high point on the landscape near the entrance to the project area, microphone placed 1 m off the ground
2	Located along a forested stream edge with microphone oriented out over the water at 2 m off the ground
3	Located in a gap in the forest canopy, microphone placed in snag approximately 2.5 m off the ground.

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 Williamswood 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 Williamswood 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

The Anabat detector was deployed from 01 August to 26 September and continuously recorded during this time. The two SM2Bat+detectors were deployed from August 1st to November 3 , 2014. The detector at site 2 recorded from 01 August through to 20 October continuously before a storm flooded the unit. The detector at site 3 recorded from 01 August through to 23 October continuously until the battery ran low. A total of 220 detector nights were sampled where one bat detector running continuously from sunset to dawn is considered as 1 detector night.

Within the proposed wind energy development area there were 507 acoustic files recorded on the 3 detectors. A total of 129 of these were classified as bat-generated ultrasound files and the remaining classified as extraneous noise (Table 5). Of the 129 echolocation sequences, 24 were recorded at site 1 (Anabat), 88 were recorded at site 2 (SM2Bat+) and 17 were recorded at site 3 (SM2Bat+). The vast majority of call sequences (125/129; 97.0%) 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. This was followed by 1.5% (2/129) classified as hoary bat call sequences and 1.5% (2/129) of the call sequences classified as silver-haired bats.

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 1.53 (SD =2.21) 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, 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 421 underground abandoned mine opening records in the vicinity of the Williamswood wind energy project (within 25 km). Following our exclusion analysis, 8 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 Williamswood Wind Energy Project area, Halifax County, Nova Scotia. LACI= *Lasiurus cinereus,* MYO = *Myotis* species, LANO = *Lasionycteris noctivagans*.

	Site 1		Site 2			Site 3	Nightly
Night of	LACI	MYO	LACI	LANO	MYO	MYO	All sites
1-Aug-14	0	2	0	0	3	1	6
2-Aug-14	0	0	0	0	2	1	3
3-Aug-14	0	0	0	0	6	7	13
4-Aug-14	0	0	0	0	3	0	3
5-Aug-14	0	0	0	0	2	0	2
6-Aug-14	0	0	0	0	4	1	5
7-Aug-14	0	0	0	0	0	0	0
8-Aug-14	0	0	0	0	2	0	2
9-Aug-14	0	0	0	0	1	0	1
10-Aug-14	0	0	0	0	0	0	0
11-Aug-14	0	3	0	0	0	0	3
12-Aug-14	0	1	0	0	0	0	1
13-Aug-14	0	0	0	0	1	1	2
14-Aug-14	0	0	0	0	0	0	0
15-Aug-14	0	2	0	0	0	0	2
16-Aug-14	0	0	0	0	4	1	5
17-Aug-14	0	0	0	0	3	0	3
18-Aug-14	0	1	0	0	0	1	2
19-Aug-14	0	1	0	0	0	0	1
20-Aug-14	1	0	0	0	0	1	2
21-Aug-14	0	0	0	0	2	0	2
22-Aug-14	0	0	0	0	0	0	0
23-Aug-14	0	1	0	0	2	0	3
24-Aug-14	0	3	0	0	0	2	5
25-Aug-14	0	1	0	0	0	0	1
26-Aug-14	0	0	0	0	1	0	1
27-Aug-14	0	0	0	0	0	0	0
28-Aug-14	0	0	0	0	0	0	0
29-Aug-14	0	0	0	0	1	0	1
30-Aug-14	0	0	0	0	0	0	0
31-Aug-14	0	0	0	0	0	0	0
1-Sep-14	0	0	0	0	0	0	0
2-Sep-14	0	0	0	0	0	0	0
3-Sep-14	0	1	0	0	4	0	5
4-Sep-14	0	0	0	0	1	0	1
5-Sep-14	0	0	0	0	1	0	1

	Site 1		Site 2			Site 3	Nightly
Night of	LACI	MYO	LACI	LANO	MYO	MYO	All sites
6-Sep-14	0	0	0	0	0	0	0
7-Sep-14	0	0	0	0	0	0	0
8-Sep-14	0	0	0	2	2	0	4
9-Sep-14	0	2	1	0	1	0	4
10-Sep-14	0	2	0	0	2	0	4
11-Sep-14	0	1	0	0	1	0	2
12-Sep-14	0	0	0	0	1	0	1
13-Sep-14	0	0	0	0	1	0	1
14-Sep-14	0	0	0	0	4	1	5
15-Sep-14	0	0	0	0	3	0	3
16-Sep-14	0	0	0	0	0	0	0
17-Sep-14	0	1	0	0	1	0	2
18-Sep-14	0	0	0	0	2	0	2
19-Sep-14	0	0	0	0	0	0	0
20-Sep-14	0	0	0	0	0	0	0
21-Sep-14	0	0	0	0	0	0	0
22-Sep-14	0	0	0	0	0	0	0
23-Sep-14	0	1	0	0	4	0	5
24-Sep-14	0	0	0	0	2	0	2
25-Sep-14	0	0	0	0	1	0	1
26-Sep-14	0	0	0	0	2	0	2
27-Sep-14	-	-	0	0	2	0	2
28-Sep-14	-	-	0	0	0	0	0
29-Sep-14	-	-	0	0	0	0	0
30-Sep-14	-	-	0	0	1	0	1
1-Oct-14	-	-	0	0	1	0	1
2-Oct-14	-	-	0	0	0	0	0
3-Oct-14	-	-	0	0	1	0	1
4-Oct-14	-	-	0	0	0	0	0
5-Oct-14	-	-	0	0	0	0	0
6-Oct-14	-	-	0	0	0	0	0
7-Oct-14	-	-	0	0	9	0	9
8-Oct-14	-	-	0	0	0	0	0
9-Oct-14	-	-	0	0	0	0	0
10-Oct-14	-	-	0	0	0	0	0
11-Oct-14	-	-	0	0	0	0	0
12-Oct-14	-	-	0	0	0	0	0
13-Oct-14	-	-	0	0	0	0	0
14-Oct-14	-	-	0	0	0	0	0
15-Oct-14	-	-	0	0	1	0	1

	Site 1		Site 2			Site 3	Nightly
Night of	LACI	MYO	LACI	LANO	MYO	MYO	All sites
15-Oct-14	-	-	0	0	1	0	1
16-Oct-14	-	-	0	0	0	0	0
17-Oct-14	-	-	0	0	0	0	0
18-Oct-14	-	-	0	0	0	0	0
19-Oct-14	-	-	0	0	0	0	0
20-Oct-14	-	-	-	-	-	0	0
21-Oct-14	-	-	-	-	-	0	0
22-Oct-14	-	-	-	-	-	0	0
23-Oct-14	-	-	-	-	-	0	0
24-Oct-14	-	-	-	-	-	0	0
Site totals	1	23	1	2	85	17	129
Project Ave							1.53
Num nights							84

The symbol "– "means the detector was not recording on that night

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 and three counties in Cape Breton including the county where the project area is located. Elsewhere, white nose syndrome significantly reduced the summer Myotis bat activity by as high as 75% (Dzal et al. 2011, Jachowski et al. 2014). 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 low compared to baseline levels (collected prior to 2007), and more 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). 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).

Myotis species 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, and the elimination or degradation of foraging areas for bats.

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 in the spring or fall from summering sites to hibernation sites.

Collectively, call sequences of migratory species (hoary and silver-haired bats) represented only 3% of the total calls recorded. The low number of call sequences attributed to the hoary and silver-haired bat, 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, Lucas and Hebda 2011, Segers et al. 2013). However occurrences do occur regularly, albeit in low frequency, and these species are especially vulnerable to wind facilities. These species are generally solitary, tree-roosting species with extensive distributional ranges throughout North America (van Zyll de Jong 1985, Naughton 2012). In addition to red 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 hoary or silver-haired bats 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. Consideration of the potential for fragmentation of bat habitat resources should also be taken with regards to the development of road networks and transmission lines in the project area.

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), and minimize the extent of bat habitat impacted by the development. Forested wetlands/riparian areas may 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).

4. *Return to pre-project state upon decommissioning* – The project area should be returned to the state that existed prior to the development of the site once the project is decommissioned. This should include planning to ensure the continuity of forest stand succession to provide and maintain appropriate roosting areas well into the future as existing roost trees die off. Retention of forest stands of a range of ages will provide mature trees for bat roosting resources in the future.

5. *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.

6. *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 Williamswood Wind Energy Project and have the potential to be bat hibernacula.

Shaft ID	Location (as listed in database)	Original depth (m)	Land Ownership
LAW-16-086	MINESVILLE	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
LAW-16-084	MINESVILLE	29	Private
MON-6-148	MONTAGUE	23	Crown
MON-6-149	MONTAGUE	23	Crown

Appendix 2. Survey site photographs

Figure A1: Bat detector (SM3Bat+) placement at site 2. The red rectangle shows the location and orientation of the microphone.

Figure A2. Bat detector (SM2Bat+) placement at site 3 with red rectangle showing the location and orientation of the microphone.