September 2011

NORTHLAND POWER

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McLean's Mountain Wind Farm

Design and Operations Report - Final

Submitted by:

DILLON CONSULTING

McLean's Mountain Wind Farm - Renewable Energy Approval (REA) Application Submission

Design & Operations Report

FINAL SUBMISSION
September 2011

Northland Power Inc.

09-1983

Submitted by

Dillon Consulting Limited

Executive Summary

Northland Power Inc. (NPI) and Mnidoo Mnising Power (MMP) form the McLean's Mountain Wind Limited Partnership (MMWLP). MMWLP proposes to develop the McLean's Mountain Wind Farm (MMWF), located south of the community of Little Current, in the Municipality of Northeastern Manitoulin and the Islands (NEMI); geographic Township of Howland, and the geographic Township of Bidwell in the District of Manitoulin, Ontario and falls within the traditional lands of the Anishnabee of Mnidoo Mnising. The selection of the project's location was based primarily on the wind resource, access to the Provincial transmission system, environmental constraints and local landowner support.

The proposed wind farm (the "project") will consist of 24, 2.5 MW wind turbines with a nameplate capacity of 60 MW. The electricity generated from the wind turbines will be collected through a network of collection grid lines to the on-site transformer. The transformer will step-up the voltage to 115 kV. A 10.3 kilometre transmission line will be installed to connect the project to the Provincial Grid on Goat Island. A section of the transmission line will involve a submarine cable to cross the North Channel to access Goat Island. Each wind turbine will be accessed by a short access road.

The proposed project will require approval under Ontario Regulation 359/09 – Renewable Energy Approval (REA) under the *Green Energy Act*. Based on the REA Regulations, this project is a "Class 4" wind facility. The *Design and Operations Report* is one component of the REA Application for the Project, and has been written in accordance with Ontario Regulation 359/09, the Ontario Ministry of Natural Resources' (MNR) Approval and Permitting Requirements Document for Renewable Energy Projects (September 2009) and MOE's draft Technical Bulletin Two: Guidance for preparing the Design and Operations Report (March 2010).

The *Design and Operations Report* presents the Site Plan, Facility Components, Cultural and Natural Features and Water Bodies, Noise receptors, the Facility Design Plan, and the Facility Operations Plan. Appended to the Design and Operations Report is the Environmental Management and Protection Plan (EMPP) that outlines construction and operating procedures that the owner's of the facility and their contractors are obligated to comply with during all stages of the project.

It is the general conclusion of the *Design and Operations Report* that this project can be operated without any significant adverse residual effects to the natural or social environment. Significant adverse effects to the natural and social environment have been avoided through careful site selection, facility layout planning and strict adherence to all regulatory requirements. All turbines, access roads and ancillary facilities have been sited with landowner consultation to minimize the impact to current agricultural operations. No significant adverse environmental effects are anticipated.

There are net benefits of this project resulting from an increased municipal tax base for NEMI, increased number of employment opportunities (especially during the construction stage) and the generation of clean, renewable electricity from wind power. The operation of the wind farm will also provide annual economic benefits through royalties to landowners and a continuing need for supplies and services in the local and regional rural economies.

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1. INTRODUCTION

Northland Power Inc. (NPI) and Mnidoo Mnising Power (MMP) together form the McLean's Mountain Wind Limited Partnership (MMWLP) MMWLP proposes to develop the McLean's Mountain Wind Farm (MMWF). The proposed wind farm (the "project") will consist of 24, 2.5 megawatt (MW) wind turbines that will generate 60 MW of electricity. The proposed project will require approval under Ontario Regulation 359/09 – Renewable Energy Approval (REA) under the *Green Energy Act*. Based on the REA Regulations this project is a "Class 4" wind facility. This *Construction Plan Report* is written in accordance with Ontario Regulation 359/09.

For the purposes of all the environmental studies, twenty-nine (29) potential turbine sites have been identified and examined. Approval is only being sought for the construction of 24 turbines. The five additional turbine sites will only be implemented, should any of the preferred 24 sites become unsuitable for development.

The McLean's Mountain Wind Farm Environmental Study Report (ESR) document was released in July 2009 for a 30–day public review, as part of the former Environmental Assessment process. The ESR document is consistent with the former Environmental Screening provisions of Ontario Regulation 116/01 for a Category B project and with the requirements of the *Canadian Environmental Assessment Act*. The ESR document was developed to assist in the determination of potential environmental effects, including both the social and natural environment, which could result from the proposed project. The ESR document contains additional information that is not required under the REA legislation and can provide further reference as required.

The REA approval process replaces approvals formerly required under the Environmental Assessment Act, Planning Act, and Environmental Protection Act. The project is being developed under the *Green Energy Act* (GEA) Feed-In-Tariff (FIT) program.

This *Design and Operations Report* has been prepared to fulfill the requirements of Item 4 in Table 1 of the Ontario Regulation 359/09, Renewable Energy Approvals as per the table below (**Table 1-1**).

Table 1-1: Adherence to O.Reg 359/09 Design and Operations Report Requirements

Requirements	*Section Reference*
1. Set out a site plan of the project location at which the renewable energy project will be engaged in, including:	
i. one or more maps or diagrams of,	
A. all buildings structures, roads, utility corridors, road allowances and easements required in respect of the renewable energy generation facility and situated within 300 m of the facility	Section 4 Appendix A
B. Any ground water and surface water supplies used at the facility	Section 4.2.5.2 Table 6.1
C. any things from which contaminants are discharged into the air	N/A
D. any works for the collection, transmission, treatment and disposal of sewage.	Section 4.2.5.1
E. any areas where waste, biomass, source separated organics and farm material are stored, handled, processed or disposed of,	N/A
F. the Project Location in relation to any of the following within 125 m: properties described in Column 1 of the Table to section 19, heritage resources, archaeological resources, the portion of the Oak Ridges Moraine Conservation Plan Area that is subject to the Oak Ridges Moraine Conservation Plan, the area of the Niagara Escarpment Plan, the Protected Countryside, the Lake Simcoe watershed, and	N/A
G. any noise receptors or odour receptors that may be adversely affected by the use or operation of the facility.	Section 3 .1 Appendix A
ii. a description of each item diagrammed under subparagraph I, and	Section 3.1 Section 4.2
iii. one or more diagrams of land contours, surface water, drainage and any of the following, if they have been identified in complying with this Regulation: properties described in Column 1 of the Table to section 19, heritage resources, archaeological resources, water bodies, significant or provincially significant natural features and any other natural features identified in the Protected Countryside or in the portion of the Oak Ridges Moraine Conservation Plan Area that is subject to the Oak Ridges Moraine Plan.	Section 3 Appendix A
2. Set out conceptual plans, specifications and descriptions related to the design of the renewable energy generation facility, including a description of:	

Table 1-1: Adherence to O.Reg 359/09 Design and Operations Report Requirements	
Requirements	***Section Reference***
i. any works for the collection, transmission, treatment and disposal of sewage, including details of any sediment control features and storm water management facilities.	Section 4.2.4 Section 4.2.7 Section 5.3
ii. any things from which contaminants are discharged into the air, and	N/A
iii. any systems, facilities and equipment for receiving, handling, storing and processing any waste, biomass, and source separated organics, farm material and biogas.	N/A
3. Set out conceptual plans, specifications and descriptions related to the operation of the renewable energy generation facility, including,	
i. in respect of any water takings,	
A. A description of the time period and duration of water takings expected to be associated with the operation of the facility	Section 4.2.5.2
B. a description of the expected water takings, including rates, amounts and an assessment of the availability of water to meet the expected demand, and	Section 4.2.5.2
C. an assessment of and documentation showing the potential for the facility to interfere with existing uses of the water expected to be taken.	Section 4.2.5.2
ii. a description of any expected concentration of air contaminants discharged from the facility.	N/A
iv. in respect any biomass, source separated organics and farm material at the facility	
A. the maximum daily quantity that will be accepted,	N/A
B. the estimated annual average quantity that will be accepted,	N/A
C. the estimated average time that it will remain at the facility,	N/A
D. the estimated average rate at which it will be used, and	N/A
v. in respect of any waste generated as a result of processes at the Project Location, the management and disposal of such waste, including:	
A. the expected types of waste to be generated,	Section 5.4
B. the estimated maximum daily quantity of waste to be generated , by type,	Section 5.4
C. Processes for the storage of waste, and	Section 5.4
D. Processes for final disposal of waste.	Section 5.4

Table 1-1: Adherence to O.Reg 359/09 Design and Operations Report Requirements	
Requirements	***Section Reference***
4. Include an environmental effects monitoring plan in respect to any adverse environmental effects that may result from engaging in the renewable energy Project, setting out:	
i. performance objectives in respect of the adverse environmental effects.	Section 6 Table 6.1
ii. mitigation measures to assist in achieving the performance objectives mentioned in subparagraph I,	Section 6 Table 6.1 EMPP
iii. a program for monitoring adverse environmental effects for the duration of the time that the Project is engaged in, including a contingency plan to be implemented if any mitigation measures fail.	Section 6 Table 6.1 EMPP Avian and Bat Post-Construction Monitoring Plan (PCMP)
5. Include a response plan setting out a description of the actions to be taken while engaging in the renewable energy Project to inform the public, aboriginal communities and municipalities, local roads boards and Local Services Boards with respect to the Project, including,	
i. measures to provide information regarding the activities occurring at the Project Location including emergencies,	Section 7 EMPP
ii. means by which persons responsible for engaging in the Project may be contacted, and	Section 7.2
iii. means by which correspondence directed to the persons responsible for engaging in the Project will be recorded and addressed.	Section 7.3
6. If the Project Location is in the Lake Simcoe watershed, a description of whether the Project requires alteration of the shore of Lake Simcoe, the shore of a fresh water estuary or a stream connected to Lake Simcoe or other lakes or any permanent or intermittent stream and,	
i. how the Project may impact any shoreline, including the ecological functions of the shoreline, and	N/A
ii. how the Project will be engaged into,	
A. maintain the natural contour of the shoreline through the implementation of natural shoreline treatments, such as planting of natural vegetation and bioengineering, and	N/A
B. use of vegetative riparian area, unless the Project Location is used for agricultural purposes, and will continue to be used for such purposes.	N/A

The MOE's Draft Technical Bulletin Two: Guidance for preparing the Design and Operations Report provides further guidance for the Design and Operations Report, as per the table below (**Table 1-2**).

Table 1-2: Design and Operations Report Requirements: MOE Draft Technical Bulletin Two	
Requirements	***Section Reference***
Report Introduction	Section 1
Site Plan	Section 3
Facility Design Plan	Section 4
Facility Operations Plan	Section 5
Environmental Effects Monitoring Plan	Section 6
Emergency Response and Communications Plan	Section 7

Additional information about the Project can currently be found in the *Construction Plan Report*, *Decommissioning Plan Report* and the *Project Description Report*. Technical studies associated with the REA requirements have been completed. In addition to this report the REA submission package includes:

- Project Description Report;
- Construction Plan Report;
- Noise Study Report;
- Natural Heritage Assessment Reports (Records Review, Site Investigation, Evaluation of Significance, and Environmental Impact Statement (EIS));
- Water Bodies Assessment Summary Report;
- Archaeological Assessment Reports (Stage 1 and 2) ;
- Cultural Heritage Self-Assessment Report;
- Decommissioning Report;
- Consultation Report;
- Property Line Setback Report;
- Wind Turbine Specification Report;
- Environmental Management and Protection Plan (EMPP);
- Post-Construction Monitoring Plan (PCMP); and
- Supporting Documents.

2. THE PROPONENT

Northland Power Inc. (NPI) is a developer, owner and operator of power generation facilities and the proponent of the "McLean's Mountain Wind Farm Project". In February 2011, Mnidoo Mnising Power (MMP), a company formed by the United Chiefs and Councils of Mnidoo Mnising (UCCMM), entered into a 50/50 partnership with Northland Power Inc. to form the MMWLP and to develop, own and operate the McLean's Mountain 60 MW Wind Farm project.

NPI's development activities include building, owning and operating wind energy facilities. In the course of developing its wind energy projects, NPI satisfies various

environmental approval requirements and obtains regulatory approvals that vary depending on the jurisdiction, project capacity and site location.
The MMP company was formed to lead renewable energy projects on Manitoulin Island in order to protect First Nations' rights, heritage and ensure the future for First Nations' youth.

MMWLP is the primary contact for this project. The MMWLP contact information is as follows:

Full Name of Company:	*McLean's Mountain Wind Limited Partnership*
Address:	*30 St. Clair Avenue West, 17th Floor* *Toronto, Ontario M4V 3A1* *Canada*
Telephone:	*Local Office: (705)-368-0303* *Mobile: (705)-271-5358*
Prime Contact:	*Rick Martin, Project Manager*
Email:	*rickmartin@northlandpower.ca*

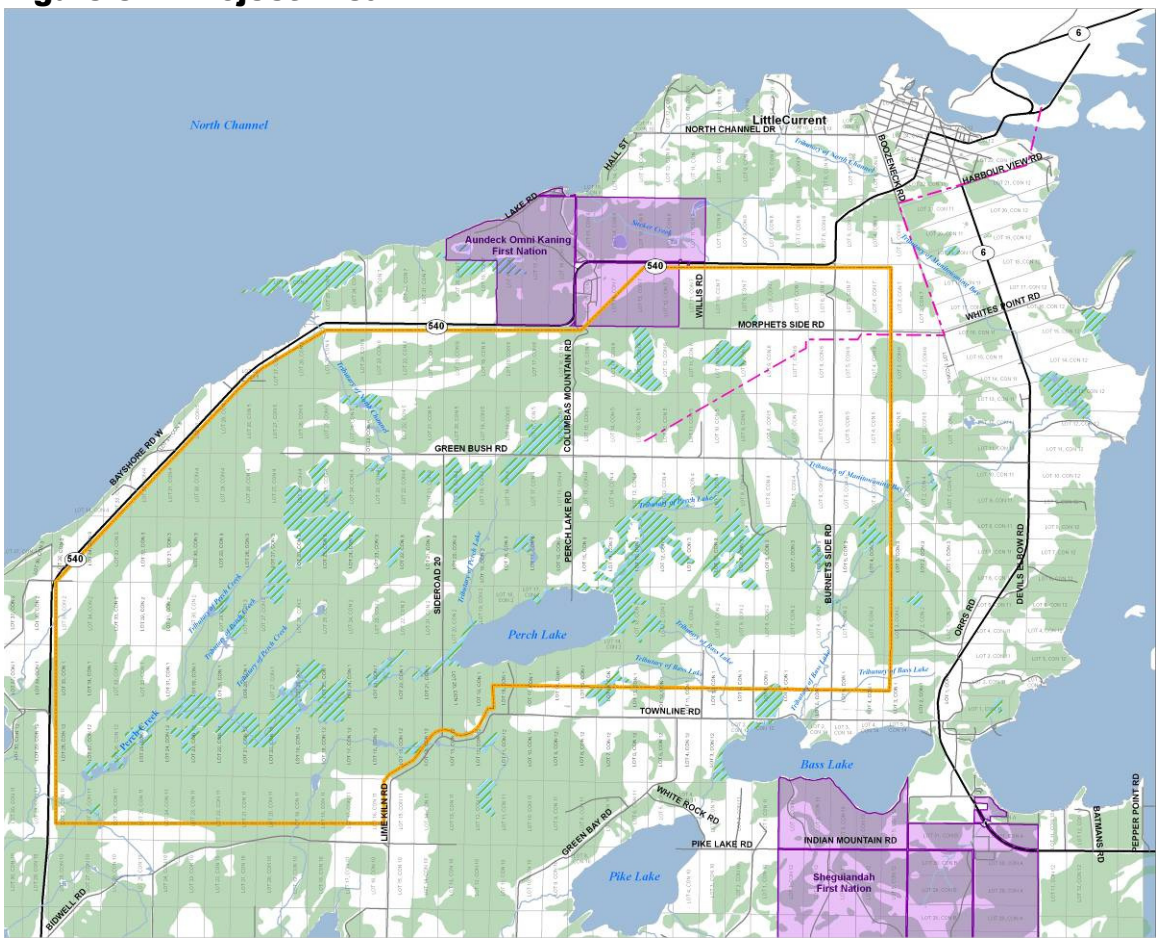
Dillon Consulting Limited is the prime consultant for the preparation of this *Design and Operations Report*. The Dillon contact is:

Full Name of Company:	*Dillon Consulting Limited*
Address:	*235 Yorkland Boulevard, Suite 800, Toronto, ON M2J 4Y8*
Telephone:	*Office: (416)-229-4646 ext 2335*
Prime Contact:	*Don McKinnon, Associate and REA Project Manager*
Email:	*dpmckinnon@dillon.ca*

3. PROJECT LOCATION

The Project Study Area is located entirely in the Municipality of Northeastern Manitoulin and the Islands; geographic Township of Howland and the geographic Township of Bidwell, in the District of Manitoulin and falls within the traditional lands of the Anishnabee of Mnidoo Mnising. The project location is about 5 kilometres from the Town of Little Current. Within this broader Project Study Area is the Project Site Area, where the wind turbines and associated wind farm infrastructure will largely be located (excluding a portion of the transmission line and the connection yard at the Hydro One grid, which is located on the adjacent Goat Island). **Figure 3-1** presents the location of the Project Area.

Figure 3-1: Project Area



The selection of the project's location was based primarily on the wind resource assessment results, access to the local electrical transmission system, environmental constraints and local landowner support.

4. SITE PLAN OF THE PROJECT LOCATION

The site plans are presented in **Appendix A**. The site plan details the location of facility components, natural features, noise receptors, required setbacks and lands within 300 metres of all project components and construction activities. The UTM coordinates for the locations of the noise receptors within 2000 metres of project components and their distances from the project location boundary can be found in the *Environmental Noise Impact Assessment Report* **(Appendix B)**. The project does not fall within or adjacent to any protected properties and no cultural heritage resources or significant archaeological resources fall within the project location (see the *Archaeological Assessment Reports* and *Cultural Heritage Self-Assessment Report*).

The following are not shown in the site plans because they will not be collected, transmitted, treated, stored, handled, processed or disposed of in the construction, operation or decommissioning of the facility:

- surface water supplies;
- sewage;
- biomass; and
- source-separated organics.

Figure A-1 in **Appendix A** provides the location of major facility components making up the outer boundary of the project location. The purpose of this figure is to provide the larger context for the facility components and natural features that will be shown in more detail in **Appendix A** - **Figures A-2** and **A-3**.

The proposed McLean's Mountain Wind Farm layout with all project components is provided in **Appendix A** - **Figure A-2**. The wind turbine setbacks were determined based on the REA setback requirements that ensure:

- minimal impact on sensitive natural environments;
- public safety in the event of ice shedding or turbine failure; and
- acceptable sound levels for surrounding receptors.

The locations of all noise receptors within 2000 metres are also shown in **Appendix A - Figure A-2**. The closest noise-sensitive receptor to a wind turbine is Receptor ID 281, which is 700 metres from a wind turbine #23.

Appendix A -Figure A-3 builds on the previous two figures and includes land contours and delineates all required set-backs. Setbacks apply only to those natural features deemed 'significant' by the *Evaluation of Significance Report* (included in the *Natural Heritage Assessment*) and watercourses that are intermittent or permanent. Setbacks include:

- 30 metre Watercourse setbacks;
- 120 metre River/Stream setback;
- Perch Lake setback;
- 120 metre ANSI setback;
- 61.5 metre non-participating landowner lot setback (A Property Line Setback Report is included in the REA submission);
- 61.5 metre road setback; and
- 550 metre noise receptor setback.

All wind turbines have been sited at least the length of the wind turbine blade plus 10 meters from any non project participating property boundaries.

MMWLP have sited its wind turbines to reflect the MOE's position (as outlined in their March 19 and 22, 2010 letters to NPI) that "hunt camps" (existing or proposed) do not need to be considered as sensitive noise receptors. Please find these letters attached as **Appendix E**.

The transformer lies outside of all required setbacks. Additional information is provided in the *Environmental Impact Statement Report*, and more specifically the *Natural Heritage Assessment Report* and *Water Assessment Report*. **Table 4-1** below lists all wind turbines and setbacks from non-participating receptors, lot lines and other significant features.

Table 4-1: Turbine Setbacks to Receptors and Significant Features

Turbine ID #	Nearest Non-Participating Receptor (m)	Nearest Non-Participating Lot Line (m)	Nearest Public Road (m)	Heritage or Archaeological Resources closer than 120m (m)	ANSI Closer than 120m (m)	Wetland Closer than 120m (m)	Watercourse Closer than 120m (m)
5	998	686	205	n/a	n/a	n/a	n/a
6	1200	575	443	n/a	n/a	n/a	n/a
9	1100	75	356	n/a	n/a	n/a	n/a
10	1420	430	356	n/a	n/a	n/a	n/a
11	1391	218	594	n/a	n/a	n/a	n/a
12	917	250	285	n/a	n/a	n/a	n/a
13	817	200	776	n/a	n/a	n/a	n/a
14	1146	225	581	n/a	n/a	n/a	n/a
15	928	100	80	n/a	n/a	n/a	n/a
16	1607	150	1367	n/a	n/a	n/a	n/a
17	2584	135	625	n/a	n/a	n/a	n/a
18	721	331	500	n/a	n/a	n/a	n/a
19	1110	303	370	n/a	n/a	n/a	n/a
20	737	295	370	n/a	n/a	n/a	n/a
21	1534	68.2	360	n/a	n/a	n/a	n/a
23	698	520	574	n/a	n/a	90	n/a

Table 4-1: Turbine Setbacks to Receptors and Significant Features

Turbine ID #	Nearest Non-Participating Receptor (m)	Nearest Non-Participating Lot Line (m)	Nearest Public Road (m)	Heritage or Archaeological Resources closer than 120m (m)	ANSI Closer than 120m (m)	Wetland Closer than 120m (m)	Watercourse Closer than 120m (m)
25	919	550	1167	n/a	n/a	n/a	n/a
28	1800	220	880	n/a	n/a	n/a	n/a
29	1663	400	1212	n/a	n/a	n/a	n/a
30	1440	445	645	n/a	n/a	60	n/a
31	1795	430	1650	n/a	n/a	n/a	n/a
34	1095	197	608	n/a	n/a	n/a	n/a
35	1290	500	1295	n/a	n/a	n/a	n/a
36	1911	230	1913	n/a	n/a	n/a	n/a
38	1800	225	1800	n/a	n/a	n/a	n/a
39	2707	415	1470	n/a	n/a	n/a	n/a
40	2035	175	1953	n/a	n/a	92	n/a
42	970	550	1010	n/a	n/a	n/a	n/a
43	2258	65	1885	n/a	n/a	n/a	n/a

4.1 Noise Receptors

Building upon the project specific guidelines, noise impact prediction modelling was undertaken. The noise impact from the Project's wind turbine array and transformers and including neighbouring wind turbines operating at maximum rated power on the nearest points of reception was predicted using an acoustic model, ISO 9613, as required by the MOE.

The analysis shows that the noise impact from the Project does not exceed the most restrictive noise limits that apply for areas with acoustic designation of Class 3 (Rural) as defined by the MOE. Consequently, there is no need for the application of any additional mitigation measures and no further studies are contemplated for environmental noise in relation to the Project.

Details regarding the proposed wind turbines acoustic emissions and sound power level are provided in the *Environmental Noise Impact Assessment Report* developed by Aerocoustics Engineering. This report is included in **Appendix B** of this document.

5. FACILITY DESIGN PLAN FOR THE PROJECT

5.1 Name Plate Capacity and Classification

The McLean's Mountain Wind Farm is designed to generate a maximum of 60 MW of electricity. According to Part II, Section 4 of O. Reg. 359/09, the project is a Class 4 Wind Facility. The characteristics of a Class 4 Wind Facility, as described in the regulation, are as follows:

- at a location where no part of a wind turbine is located in direct contact with surface water other than in a wetland;
- the nameplate capacity of the facility is greater than 50 kW; and
- the greatest sound power level is greater than 102 dBA.

5.2 Wind Farm Components

The major components of the project during the Operations and Maintenance phase of the project are as follows:

- Twenty-four (24) wind turbines;
- 690V /34.5 kV step up transformers (located in the nacelle of each turbine);
- 34 kV collection system to link the wind turbines to the substation;
- Transformer/substation (34.5 kV to 115 kV);
- A 10.3 km, 115 kV single circuit transmission line;
- A connection station at the point of connection with the provincial grid;
- Transition yard;
- Wind turbine access roads; and
- Four (4) meteorological towers (which are already installed and operating).

Wind Turbine Generators

The project includes twenty-four (24) GE 2.5 MW wind turbine generators with a total installed nameplate capacity of 60 MW. The turbine towers are 98.3 metres in height and the blade diameter including hub, are 103 metres across. The nacelle, located at the top of each turbine tower, houses the generator, inverter, gearbox, bearings, couplings, rotor and auxiliary equipment. The nacelle is constructed of fiberglass, lined with sound insulating foam, and has lighting and ventilation to allow work to be conducted inside. The turbine blades are mounted on a hub and shaft that are connected to the nacelle. Each turbine tower consists of several stacked segments which are mounted on a concrete foundation. Specifications of the turbines can be found in the *Wind Turbine Specifications Report*.

A summary of the basic specifications of the GE 2.5 MW wind turbines can be found below in **Table 5-1**. Please refer to the *Wind Turbine Specifications Report* for more detailed information on the wind turbines proposed for the Project.

Table 5-1: Basic GE 2.5 MW Wind Turbine Specifications

Manufacturer	General Electric (GE)
Model	2.5xl
Name Plate Capacity (MW)	2500 kW
Hub Height	98.3 metres
Rotor Diameter	103 metres
Blade Sweep Area	8328 m^2
Mode of Operations	Horizontal Axis, Upwind, Pitch Controlled
Approximate Foundation Diameter	18 metres

Appendix D lists the UTM Coordinates for the project components, including all wind turbine sites, the operations and maintenance building and the transformer station.

Wind Turbine Lighting

The proposed wind turbines will be lit according to Transport Canada (TC) standards. Select wind turbines located on the perimeter of the proposed wind farm will be lit with appropriate lighting. The highest wind turbines in the wind farm will also be lit. Flashing lights are required. All lit wind turbines will flash simultaneously. The amount of lighting required for the proposed wind farm is not expected to unduly impact residents and cottagers in the area.

Ancillary Equipment

Step-up Transformers & Collection System

A small "step-up" transformer will be located in the base of the tower of each turbine to transform the electricity from 690 V to 34.5 kV for transmission through the collection system. The collection system will consist of four different feeder lines (see **Figure A-3** for mapping). The feeder lines will generally follow the turbine access roads, although in some cases, to reduce the distance of the lines, the lines may divert from the roads.

All feeder lines will be located underground with the exception of 2 water crossings where there will be overhead lines. It is expected that the above ground sections of the overhead lines would be supported by single poles although in some cases, double poles could be required (due to soil conditions, angles in the line, etc.). There are 4 additional water crossing or wetland crossing locations that will be directional drilled. Descriptions of these crossings are provided in the *Construction Plan Report* and *Waterbodies Assessment and Water Body Report.*

Met Tower

Currently there are four (4) met towers installed within the Project Study Area. At least one of these towers will remain (possibly all 4) to collect meteorological data during the operations of the facility. The met towers currently on-site collecting data are tubular in construction and are 60 metres tall. The foundations are steel reinforced concrete filled

tubular pile. Guy wires are mounted on steel anchors and embedded into the concrete pads. There are three anchor points and the guy wire radius is 35 metres.

Turbine Access Roads

Access roads are required in order to deliver the wind turbine components as well as allow operation and maintenance of the wind turbines. The central and eastern areas of the project will be accessed via Highway 6 and Green Bush Road, while the western area of the project will be accessed via Highway 540. There is the potential for Greenbush Road to be widened in at least 2 locations to 5.5 metres to 8 metres in width. The intersection of Green Bush Road and McLean's Mountain Road will require widening of the turning radius. A 38.1 metre turning radius is required for the delivery of the wind turbine components. Widening of the turning radius would involve the placement of granular material to create a widened roadbed. The road grade and vertical curves may have to be adjusted to comply with the *General Electric Specification Report - Site Roads and Crane Pad*. See *Appendix D* of the *Construction Plan Report* for the Specification Report. The widened intersections would be removed after component delivery but the entrances and any culverts would remain.

Access roads will be required to access each turbine site from existing public roads during both the construction and operation phases of the project (see **Figures A-2 and A-3** for the routing of the access roads). The access roads will be excavated and constructed, to be 5.5 metres wide with no ditches and be composed of a gravel base. Where turning is required the width of the road may be wider. One watercourse crossing, a tributary to Bass Lake, will be required and the crossing would be facilitated through the use of a culvert allow stream flow to continue.

For further information on the turbine access roads please refer to the *Construction Plan Report*.

Transformer and Transmission Line

Transformer/Sub-Station

A single walled transformer will be required to increase the voltage of the electricity from 34.5 kV to 115 kV. The higher voltage is required to allow connection with the provincial grid. The sub-station will consist of an open-air design facility with one transformer unit and would be surrounded by a security fence and would have security lighting. The sub-station would require an area of 50 metres x 80 metres of land (see **Figure 5-2** for the location of the sub-station).

A concrete containment system would be installed to capture any leaks from the transformer. The containment system would be sized so that it would contain all of the oil in the transformer should there be a complete failure of the unit (which would be a rare and unexpected event). The containment system is to be approximately 5 metres x 6 metres in size. Water in the containment system would be visually inspected for any evidence of oil (as oil would float to the top). If oil is present, a tank truck would be

brought to site to pump the water/oil mix into it. The water/oil mix will then be disposed of off-site at a licensed facility. If no oil is detected in the water, the water would be pumped out to an adjacent swale and then allowed to infiltrate into the ground. Given the small size of the containment system, the volume of water collected would be very small.

High Voltage Transmission Line

From the step-up transformer, a 115 kV single-circuit transmission line will be constructed to connect the project to the existing Hydro One transmission system circuit S2B that is located on Goat Island (see **Figures A-1 and A-2** for the proposed route). This connection will be facilitated through the transition yard, where the overhead transmission line will go underground and cross the channel to Goat Island. The 115 kV transmission line will be supported through either single or double poles. The transmission line is largely contained within municipal road rights-of-way but some private property will be crossed and MMWLP has acquired easements through the affected parcels of private land. It is anticipated that the maximum width of the right-of-way (RoW) would be 8-10 metres depending on the distance of poles and conductor swing. There will be the need to cross the North Channel to Goat Island with a submarine cable (500 metres of submarine cable). The cable will lie on the bed of the channel but be trenched in at both shorelines. Once on Goat Island, the cable will run underground for 300 metres to connect to the provincial transmission line at Hwy 6.

Other than the North Channel crossing the transmission line will have to cross 2 watercourses by overhead lines. These watercourses would be spanned by the overhead lines and there would be no effect to these watercourses. Descriptions of these crossings are provided in the *Construction Plan Report* and *Waterbodies Assessment Report*.

Connection Station

A connection station would be required at the point of connection with the provincial grid on Goat Island. Breaker/disconnect switches would be installed to allow the flow of electricity from the project to be turned off/on.

Operations and Maintenance Building

An operations building will be constructed and used for the duration of the wind farm project. This building will be located on Lot 13 Concession 5, Township of Howland and the footprint would be 450 m^2. This building would provide warehouse and workshop spaces, administrative offices and telecommunications areas. From this building the wind farm would be operated, monitored and controlled 24 hours per day. This building would have a separate containment area for the storage of spent oil and lubricants until they are transported off-site.

5.3 Sewage

To service the Operations and Maintenance Building a septic system, with a 4000 L tank, would be constructed. It would be the project owner's responsibility to ensure proper maintenance of the septic system, with regular pumping of the tank (every 4-5 years) and to ensure that no chemicals or hazardous materials that could destroy the bacteria required for sewage breakdown and cause environmental harm be released into the septic system.

5.4 Groundwater

A well will be required to provide a potable source of water for the Operations and Maintenance building. As there will be fewer than 10 part-time personnel at the facility on a part-time basis it is expected that only small quantities of water will be used. It is estimated using a low-flow toilet and faucet for the restroom facilities that 50 litres of water would be required per day, with an average annual use of less than 50,000 litres.

5.5 Water Crossings

Permanent culvert installation will be required along the turbine access roads. The assessment of the potential effects of culvert construction has been documented in the *Construction Plan Report*, the *Waterbodies Assessment Report* and the *Water Bodies Report*.

5.6 Equipment Related to Stormwater Management

No stormwater management or sediment control is required during the operation and maintenance phase of the facility. Thus no stormwater equipment is required. Stormwater management measures and equipment related to construction activities are discussed in the *Construction Plan Report*. As reported above, a concrete containment system would be installed to capture any leaks from the transformer. Water in the containment system would be visually inspected for any evidence of oil (as oil would float to the top). If oil is present, a tank truck would be brought to site to pump the water/oil mix into it. The water/oil mix will then be disposed of off-site at a licensed facility. If no oil is detected in the water, the water would be pumped out to an adjacent swale and then allowed to infiltrate into the ground.

Further Best Management Practices and Environmental Monitoring are included in **Appendix C:** *Environmental Management and Protection Plan* (EMPP).

5.7 Other Equipment

During the operation and maintenance phases the wind energy facility will not engage in, nor will any equipment be required for, the following activities:

- the use of surface water;
- the generation, collection, transmission or treatment of sewage;
- the production, handling, storing or processing of any waste, biomass, source separated organics, farm material or biogas;
- discharges of contaminants to air; and
- dewatering.

6. FACILITY OPERATIONS PLAN FOR THE PROJECT

6.1 Wind Turbine Operation

The wind turbines will be operated in a manner consistent with nationally recognized standards for operation of wind turbine facilities in Canada. The project will be operated by a staff of 10 people who would work out of the on-site operations building. Typical generated traffic would be low and include staff traveling to and from the operations building to visit/inspect the turbines, as required.

A communication system will be installed that will provide on-site notification and also allow remote monitoring of the status of the turbines. Components defined as critical, such as the rotor, generator, gearbox and cooling system, will be monitored using a supplier designed system to ensure safe shutdown. Controls will be implemented for fail safe action in the event of electrical or instrument losses.

The wind turbine system will be integrated with the electric interconnection Supervisory Control and Data Acquisition (SCADA) to ensure that the project critical controls, alarms and functions are properly coordinated for safe, secure and reliable operation.

At least one (1), but possibly all, of the existing four (4) currently installed meteorological monitoring towers will continue to be operated throughout the operation of the wind farm to assist MMWLP in assessing the performance of the turbines.
Wind Turbine and Ancillary Facilities MMWLP for the planned and unplanned service and maintenance of the wind turbines. MMWLP will employ two (2) local operators and there will be up to eight (8) GE staff onsite for a total of ten (10) operators to monitor and co-ordinate routine maintenance activities of the wind farm (e.g., line maintenance and inspection, snow clearing, etc.).

Normal maintenance on the individual wind turbines occurs twice per year. It involves complete checks of structural soundness, checks of the electronics systems, changing of hydraulic and lubricating fluids, etc. Two person teams, for safety reasons, conduct maintenance. The expected maintenance time involved is two days per turbine. Unexpected maintenance occurs infrequently and typically involves the replacement of a major component, such as a gearbox, transformer or blade. In the event of a major malfunction, a crane may be required to lift the affected component.

6.2 Stormwater

The project does not include any permanent stormwater treatment facilities. Stormwater collected within the sub-station transformer containment basin would be manually pumped out to a tanker truck (for off-site treatment), if oil is detected in the water. Uncontaminated water would be pumped out to a swale for ground infiltration.

6.3 Waste Management

Project operations will result in the generation of solid waste (i.e. office waste, materials packaging, used mechanical parts, etc.) and used turbine lubricant and oils. The daily expected quantity of waste to be generated is less than 5 kilograms of office waste.

The wind turbines need to be serviced annually. Approximately six oil or air filters will have to be replaced annually. The amount of spent oil is only about 1 litre of oil per turbine. The turbines may also need new brake pads, pitch batteries and pre-contacts for proper functioning. Every three years the turbines will need a complete set of oil changes, for the yaw drive, gearbox and pitch drives, which will accumulate about 900-1000 litres of waste oil. Every five years the converter coolant will need to be exchanged. The waste coolant, about 60 litres per turbine, will need to be disposed of.

Waste will be stored in a secured area of the Operations and Maintenance Building. Solid waste would be collected and transported off-site for disposal at the Town of Northeastern Manitoulin and the Islands (NEMI) landfill site, located at 9571 Highway 6 south, Little Current. The Town's landfill is equipped to deal with hazardous wastes. Liquid and hazardous industrial waste (oils etc.) will be disposed in accordance with Ont. Regulation 347.

7. ENVIRONMENTAL EFFECTS MONITORING PLAN

Section 6 of the *McLean's Mountain Wind Farm ESR* (July 2009) and the *Environmental Management and Protection Plan* (**Appendix C** to this report) and the *Avian and Bat Post-Construction Monitoring Plan* **(Appendix F)** reports outline the project environmental monitoring activities to be undertaken during the operations period. These plans should be considered as supporting documents to the rest of the *Design and Operations Report* and fulfills the requirements outlined by Ontario Regulation 359/09. These plans also outline the actions to be taken in the event that unanticipated events occur. This plan is applicable to all employees of MMWLP and provides guidance to all contractors and subcontractors on environmentally safe standards for project activities during operation and environmental monitoring of the project.

Table 7-1 presents a summary of the potential negative effects, performance objectives, mitigation strategies and the proposed monitoring plan for each environmental feature.

7.1 Project Commissioning and Schedule

McLean's Mountain Wind Farm is anticipated to be operational by November 2012 and is expected to be operational for 20-25 years. Environmental monitoring procedures will be implemented through each of the construction, operations and decommissioning phases of the project.

7.2 Avian and Bat Post-Construction Monitoring Plan (PCMP)

This monitoring plan has been designed to evaluate the accuracy of the predicted environmental impacts on birds and bats and to meet requirements set out in Regulation 359/09. Environment Canada and the Ontario Ministry of Natural Resources (MNR) are being consulted to confirm this monitoring strategy.

The project area has been assigned a Sensitivity Rating of 3 (High) in relation to bats, based on criteria provided by the MNR (MNR 2007). The major concern for the project area is the proximity to the North Channel shoreline, the presence of a forested ridge feature and the potential for these features to concentrate migrating bats. The closest turbine to the North Channel shoreline is 1.5 kilometres away.

Details of bird and bat pre-construction surveys are provided in sections 6.6 and 6.7, and Appendices D and E, of the *Environmental Study Report* (ESR) respectively. As stated in these sections, the expected level of impact to all guilds of birds and bats, after protection and mitigation measures have been implemented, is considered to be low. A list of setbacks protecting sensitive natural features and habitats is provided in Table 1, Item 1 of the concordance table outlining project fulfillment of REA requirements.

Concerns that have been identified and will require specific monitoring include:

- Potential mortality effects to birds and bats in the project area (ESR Sections 6.6.2 and 6.7.2).
- Potential risk of disturbance impacts to the 17 BCR 13 priority species that were observed during fieldwork in the Study Area (which includes 8 forest species, 7 open country species and 2 marsh/water species) and other sensitive species occurring, including sharp-tailed grouse, upland sandpiper and Wilson's snipe. A full list of the BCR 13 priority species observed in the Study Area can be found in Table 7 (p.28) of the Bird Study Report, *Appendix D* in the ESR, and in Section \ 6.9 of the ESR.

Species or groups that were determined to be of limited concern, and therefore not requiring specific monitoring, include:

- Fall migration of raptors, waterbirds and sandhill cranes (ESR Sections 6.6.2).
- Species at Risk not observed during surveys but potentially present including short-eared owl and golden-winged warbler, whip-poor-will; Canada warbler, common nighthawk and chimney swift, which were rarely observed; and loggerhead shrike which was historically observed in 1999 and 2000 (ESR Section 6.9).

Because large wind farm facilities are a relatively new addition to Ontario's infrastructure, large datasets with multiple years of study relating to environmental impacts do not exist to inform the accurate prediction of impacts. To address this uncertainty an adaptive monitoring and management plan has been developed. In the event that unexpected negative impacts occur, employment of this plan will allow for flexibility in the operation of the wind farm in an attempt to reduce these negative impacts and the likelihood of their future occurrence.

7.3 Purpose and Objectives of the Environmental Management and Protection Plan

The EMPP has been developed to provide the required protection measures for the activities associated with the construction, maintenance and operation phases of the McLean's Mountain Wind Farm, as such these are long term initiatives. The EMPP will be maintained by the Project Manager and is meant to be a living document, and such, will be updated from time to time when new technologies or best practices emerge that would further mitigate any potential adverse effects from all stages of the project.

This EMPP forms an integral component of all construction work to be done on this project. The purpose of the EMPP is to:

- Ensure that commitments to minimize environmental effects in general, and specific regulatory requirements, will be met;

- Provide concise and clear instructions regarding measures for protecting the environment and archaeological resources, and minimizing potential adverse environmental effects;
- Document environmental concerns and describe appropriate protection measures associated with Project construction;
- Provide a reference document for planning and/or conducting specific activities that may have an effect on the environment;
- Function as a training aid for environmental education and orientation; and,
- Communicate changes in the program through a revision process.

7.4 Performance Objectives

The key performance objective for each of the features elaborated on below is avoidance and/or minimization of potential effects through the appropriate use of mitigation measures throughout the operations phase of the Project. All mitigation measures assist in achieving these performance objectives.

7.4.1 Wind Farm Maintenance Activities and Operation

Regular wind turbine maintenance generally occurs twice every year. Regular maintenance includes mechanical inspections of the tower, turbine and transformer, as well as changing of hydraulic and lubricating fluids. Inspections for leaks of hydraulic and lubricating oils will be performed during routine maintenance. Generally turbine maintenance takes between 2-4 days per turbine depending on weather conditions. A summary of potential adverse effects, performance objectives, mitigation measures and the monitoring and contingency plan related to maintenance activities and operation of the wind farm are listed below in **Table 7-1. Section 6.4** discusses the wastes associated with regular turbine maintenance. Please see **Appendix G:** GE Maintenance Checklist for routine maintenance required for the turbines.

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Water Bodies and Aquatic Resources				
Surface Water	• Potential contamination from accidental spills • Erosion, sedimentation and surface water turbidity during maintenance activities	• No spills • No erosion or sediment transport • No surface water turbidity	• Following completion of the maintenance activity stream banks would be restored to original state • Siltation to a watercourse occurs, activities should cease immediately until the situation is rectified • Best Management Practices as described in the EMPP • See "Accidental Spills'	• See Accidental Spills
Groundwater	• Potential contamination from accidental spills	• No spills	• See Accidental Spills	• See Accidental Spills
Natural Heritage Resources				
Woodlands	• Dust emissions from road use to access turbines for maintenance • Contamination through accidental spills	• No Spills • Minimize magnitude and duration of emissions	• See Accidental Spills • See Dust and Odour Emissions	• See Accidental Spills • See Dust and Odour Emissions
Valleylands and Hazard Lands	There are no Valleylands or Hazard Lands within 120 metres of the project	N/A	N/A	N/A

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Areas of Natural and Scientific Interest	• There are no ANSI's within 120 metres of the project	N/A	N/A	N/A
Wetlands	• Contamination through accidental spills • Dust emissions from road use	• No spills • Minimize magnitude and duration of dist emissions	• See Accidental Spills • See Dust and Odour Emissions	• See Accidental Spills • See Dust and Odour Emissions
Provincial Parks and Conservation Reserves	None	N/A	N/A	N/A
Other Designated Natural Areas	None	N/A	N/A	N/A
Significant Wildlife and Wildlife Habitat	• Possible disturbance to use of adjacent bird habitat from operating turbines • Possible disturbance to wildlife movement from human activity/vehicles	• Minimize disturbance to threatened and endangered species, wildlife and amphibians. • No wildlife road kills	• Obtain all applicable permits for threatened and endangered species. • Maintenance vehicles restricted to primarily to daytime hours • Vehicle speeds in project areas restricted to 30 km/h with signage • See Environmental Noise • See Local Traffic • See Dust and Odour Emissions	• See Bird and Bat Post-Construction Monitoring Plan • Post-construction monitoring to assess the displacement effect on open country grassland and area-sensitive forest breeding bird species for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Significant Flora and Vegetation Communities	• Potential for effects in area of turbine by crane if needed for maintenance activities • Potential disturbance from vehicle generated dust	• Minimize disturbance to flora and vegetation communities.	• See 'Dust and Odour Emissions'	• See 'Dust and Odour Emissions'
Birds	• Mortality of birds due to contact with wind turbines • Reduction in breeding area	• Meet mortality threshold level as outlined in the Avian Post Construction Monitoring Plan (PCMP) (Table 3)	• Post-construction monitoring to assess impacts of turbines on bird populations for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan • Turbines have been well spaced apart to allow passage around turbines	• A 3-year post construction avian monitoring plan will be implemented • In the event that bird/bat mortality levels exceed threshold levels, an adaptive management plan will be implemented with the input of the MNR as outlined in the Avian PCMP
Bats	• Mortality of bats due to contact with turbines	• Meet mortality threshold level as outlined in the Avian Post Construction Monitoring Plan (PCMP) (Table 3)	• Post-construction monitoring to assess impacts of turbines on bat populations for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan • Turbines have been well spaced apart to allow passage around turbines.	• A 3-year post construction avian monitoring plan will be implemented. • In the event that bird/bat mortality levels exceed threshold levels, an adaptive management plan will be implemented with the input of the MNR as

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
				outlined in the Avian PCMP.
Air Quality and Environmental Noise				
Air Quality	• Emissions from equipment and vehicles	• Minimize duration and magnitude of emissions	• Maintenance workers would maintain and operate vehicles in a manner that reduces air emissions to the extent practical, including, avoiding idling times and performing regular maintenance on vehicles	• None Required
Dust and Odour Emissions	• Dust emissions from operation and maintenance vehicles	• Reduce dust emissions to the greatest extent possible	• Maintain all vehicles and equipment in good running condition and in compliance with regulatory requirement • Suppress road dust with water if necessary • Cover loads of materials that could create dust	• Adherence to Complaint Resolution Process
Environmental Noise	• Noise emitted from transformer and turbines. • Noise emitted from traffic and/or vehicles	• Maintain noise levels at receptor locations no greater than 40 dBA.	• Adherence to the receptor setback distance as outline in the project site plan • Maintain the turbines in good operating condition	• Monitoring of turbines and replacement of damaged blades • Public noise complaints monitoring and follow-up. • Adjust turbine operation to ensure applicable noise limits are met • Turbine Maintenance to ensure turbine are functioning properly

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Heritage and Archaeological Resources				
Protected Properties and Heritage Resources	None	None	None	• See Cultural Heritage Self-Assessment Report
Archaeological Resources	None	N/A	N/A	• See Stage 1 and Stage 2 Archaeological Assessment for Monitoring and Contingency Plans
Land Use and Socio-Economic Resources				
Existing Land Uses	• Temporary increase in noise and dust levels during maintenance	• Minimize disturbance to existing land uses, including local businesses	• See Environmental Noise • See Dust and Odour Emissions	• See Environmental Noise • See Dust and Odour Emissions
Recreation Areas and Cultural Features	• There are no public recreation spaces in the project area • The surrounding private lands are used for Fall hunting activity • The operating wind farm could have a minor disturbance effects to hunting activity (e.g. from turbine noise, traffic)	• Minimized disturbance to recreation areas	• See Local Traffic • See Environmental Noise • See Dust and Odour Emissions	• See Local Traffic • See Environmental Noise

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Mineral, Aggregate and Petroleum Resources	None	N/A	N/A	N/A
Game and Fishery Resources	• Disturbance to game species from noise and maintenance activities	• Minimize disturbance to game species.	• Keep equipment in good condition to minimize noise effects	• Complaint Resolution Process
Local Traffic	• There will be a negligible increase in local traffic during operations	• Minimize disturbance to local traffic	• None required during the operations and maintenance phase of the project	• Complaint Resolution Process
Viewscape	• Disruption in the local viewscape	• Minimize potential for disruption of local viewscape	• MMWLP has undertaken a visual assessment of the wind turbines. • Use of landscaping to mitigate any potential disruption in viewscapes from the Operations and Maintenance building and the transformer station. • Turbines to be coloured in such a way that they will blend into the surrounding environment as much as possible.	• Complaint Resolution Process
Local Economy	• There will be an increase in direct and indirect employment over the operations and maintenance phase of the project	• Create positive effects on the local economy	• MMWLP will locally source all required goods and services from qualified local suppliers whenever possible.	• None required

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
	• Local economic benefits from an increase in municipal taxes and landowner lease payments.			
Existing Infrastructure				
Provincial and Municipal Infrastructure	• There will be a negligible increase in truck traffic during the operations and maintenance phase	• Minimize disturbance to Provincial and Municipal Infrastructure	• Local residents would be notified of unconventional load movements if they occur • Any necessary permits would be obtained for unconventional loads	• See Local Traffic
Telecommunication Networks	• Potential interference with TV or radio signals	• Minimize any disturbance effects to TV and radio signals	• NPI has consulted with all agencies and licensed providers to identify any likely effects to telecommunications networks	• Complaint Resolution Process • MMWLP will review all complaints of interference on a case by case basis
Aeronautical Systems	• Aeronautical obstruction	• Minimize the potential to low flying aircraft	• Turbine lighting will conform to Transport Canada standards • To reduce rural light pollution lights with the minimal allowable flash duration, narrow beam and would be synchronized • NAV Canada has been consulted and will be responsible for updating all aeronautical charts with turbine locations	• Routine maintenance of the turbines and replacement of any safety lighting in the event of malfunction

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Waste Management				
Waste Generation	• Improper disposal of waste material might result in contamination to water resources and soil on and off project site	• Ensure the proper disposal of waste material	• Contractor will be required to remove all waste materials during maintenance activities • There will be a systematic collection and separation of waste materials within on-site storage areas in weather protected areas located at the operations and maintenance building	• See Accidental Spills
Accidental Spills	• Potential contamination of groundwater, surface water and wetland features from accidental spills	• No accidental spills to occur	• Labelling and proper storage of liquid wastes in secure areas of the operations and maintenance building that would ensure containment in the event of a spill • Septic tank design for the operations and maintenance building would conform to local building code requirements • As per section 13 of the EPA, all spills that could have a potentially adverse environmental effect would be reported to the MOE's Spills Action Centre • Spill kits would be provided on-site during maintenance activities at the operations building • Refuelling and equipment maintenance would occur in designated areas	• Monitoring would be required in the event of contamination from an accidental spill or leak • Contaminated soils would be removed and replaced as required

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
Public Health and Safety				
Structural Failure	• Public health and safety issue from falling ice from turbine collapse	• No structural failure of the turbines or ancillary equipments	• Adherence to required setbacks. • Install, operate and maintain turbines according to applicable industry standards • Use of lightning protection systems	• Inspections of turbines to occur after extreme weather events and contingency measures such as turbine shutdown to be implemented in the event of structural damage • Routine turbine maintenance to ensure turbines are functioning properly
Ice Fall	• Public health and safety issue from falling ice from turbine blades	• Limit potential for ice throw to impact pedestrians and automobiles	• Adherence to required setbacks • Automatic turbine shutdown due to weight imbalances • Signage in areas where potential icing could occur • Design of the turbine tower reduces ice accumulation	• Inspections of turbines after extreme weather events and contingency measures such as turbine shutdown would occur in the event of structural damage or icing of the turbine blades • Routine turbine maintenance to ensure turbines are functioning properly
Extreme Weather Events	• Potential damage to wind turbines and ancillary infrastructure from extreme weather events	• No structural failure of the turbines or ancillary equipment	• Project components have been designed to withstand the effects of extreme weather events • Install, operate and maintain turbines according to all applicable industry standards	• Inspections of turbines would occur after all extreme weather events and contingency measures such as turbine shutdown would be implemented in

Table 7-1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations

Environmental Feature	Potential Adverse Effect	Performance Objective	Mitigation Strategy	Monitoring Plan and Contingency Measures
			• Failsafe devices are capable of shutting down turbines in the event of excessive wind or malfunction of turbine components	the event of structural damage • Routine turbine maintenance to ensure turbines are functioning properly

8. EMERGENCY RESPONSE AND COMMUNICATIONS PLAN

MMWLP will provide information releases to the community in the event of an emergency, if new issues arise, or if the community has specific concerns. NPI representative contact information will be available to the public to address concerns and questions during the life of the project including construction, operation, and decommissioning.

8.1 Contingency Plans for Unplanned Events

Please refer to **Appendix C: EMPP**, *Section 5*: Contingency Plans for Unplanned Events" for descriptions of the following contingencies:

- Emergency Response Plan;
- Erosion Control Plan;
- Fuel and Hazardous Materials Spills;
- Archaeological and Heritage Resources;
- Wildlife Encounters; and
- Fires.

8.2 Communications Plan for Project Updates and Activities

MMWLP will continue its stakeholder engagement activities through operations phases. This could include some of the communications activities planned for the construction period as outlined in the *Construction Plan Report*.

Broad community relations activities are also seen as essential to the implementation of a successful project. To this end, the following activities will be undertaken:

a) offers to conduct on-site tours with community leaders, local media and other interested parties during construction and periodically during operations;

b) erect signs; and

c) establish a project reporting mechanism for status reports with key regulatory stakeholders.

MMWLP will engage and inform the public, identified Aboriginal communities, Local Services Boards, the Municipality of Northeastern Manitoulin and the Islands, and related Provincial Ministries (i.e., Ministry of the Environment) in the following manner:

1) In the event of an emergency a log book including key contact and their information (names, emergency phone numbers) will be posted at the Project Office. This log book will also include description of the chain of communications between the proponent and relevant responders under emergency scenarios applicable to the project.Technical staff will recommend resolution

actions and assist with response to public and stakeholders such as the local fire department.

2) The non-emergency communications related to the project will be dealt with via update bulletins will be posted at the Project Office and distributed to the local Aboriginal communities' offices as well as to the Municipal Town Office and relevant stakeholders. This could, for example, include notification of project changes or results of the ongoing project monitoring.

3) Throughout the life of the project, MMWLP will maintain detailed "issues identification and resolution tracking tables". The issues/resolution tables will record key information such name, address and the telephone number of the complainant; time and date of the complaint, details of the complaint; actions taken to remediate the cause of the complaint; and proposed actions to be taken to prevent reoccurrence in the future. This document would be available in a log book electronic file.

4) All correspondence regarding the proposed project will be directed to the main project contact – the Project Manager who will be available via the project office and may be contacted as follows:

Rick Martin, Project Manager
Northland Power Inc. Little Current Office/
McLean's Mountain Wind Limited Partnership
McLean's Mountain Wind Farm Office
P.O. Box 73
Little Current ON, P0P 1K0
Mobile: 705-271-5358, Manitoulin Island Office: 705-368-0303
E-mail: rickmartin@northlandpower.ca

All correspondence and concerns raised will be received through the Project Manager and will be recorded in a form of a log book in an electronic file including: detailed information (name, address and the telephone number of the complainant), response to concerns and methods addressing the concerns. The procedure for recording any complaints from the public would also include notifying the Ministry's Spills Action Centre at 1-800-268-6060 of the receipt of the complaint.

8.3 Complaints Resolution Process

MMWLP acknowledges that some members of the community may have negative reactions to some of the construction activities and long term wind farm operations. Both the complainants and MMWLP have a stake in collaborating to resolve issues. A solution, in which both parties have had input, is more likely to constitute a long-term solution and is one that can often be implemented more effectively and efficiently than a decision rendered through an adjudicative process. To resolve disputes in a collaborative manner MMWLP will establish a Complaint Resolution Process (CRP). The Construction Manager will be responsible for the implementation of the CRP, including

the documentation of all complaints and inquiries from the public in relation to Project construction and operations. The Construction Manager will attempt respond to initially response complaints within a one or two day period following receipt. At a minimum, the CRP shall include provisions for the following:

1. Direct communications between the complainant and the receiver of the complaint (if not MMWLP), and MMWLP as the project proponent.
2. Fact-finding concerning the complaint, including:
    a) the area affected by the construction or operation activity, the area's zoning and its occupation, and the proximity of the affected persons as well as their sensitivities;
    b) the characteristics and magnitude of the effect;
    c) the impact on the persons affected;
    d) any existing goals or standards acceptability;
    e) the history of operations in the affected area;
    f) any changes in existing conditions (e.g., changes to land use);
    g) the availability of additional mitigation measures;
    h) a balance between the needs of the community and those of MMWLP;
    i) technically, operationally, and economically feasible solutions;
    j) regulatory precedents regarding the effect; and
    k) other issues specific to the complaint.
3. All parties would have the ability propose constructive and feasible solutions and should be receptive to the solutions proposed by the other party.
4. Should the parties be unsuccessful in their attempts to resolve an issue through collaborative measures, they may, on agreement, request the services of a mediator.

9. CONSIDERATION FOR PROJECTS SUBJECT TO LAND USE PLANS

The Project lands, local and surrounding do not fall within any of the following:

- Greenbelt Plan Protected Countryside;
- Greenbelt Plan Natural Heritage System;
- Oak Ridges Moraine Conservation Plan Area;
- Niagara Escarpment Plan Area; and
- Lake Simcoe Watershed Plan Area.

10. SUMMARY AND CONCLUSIONS

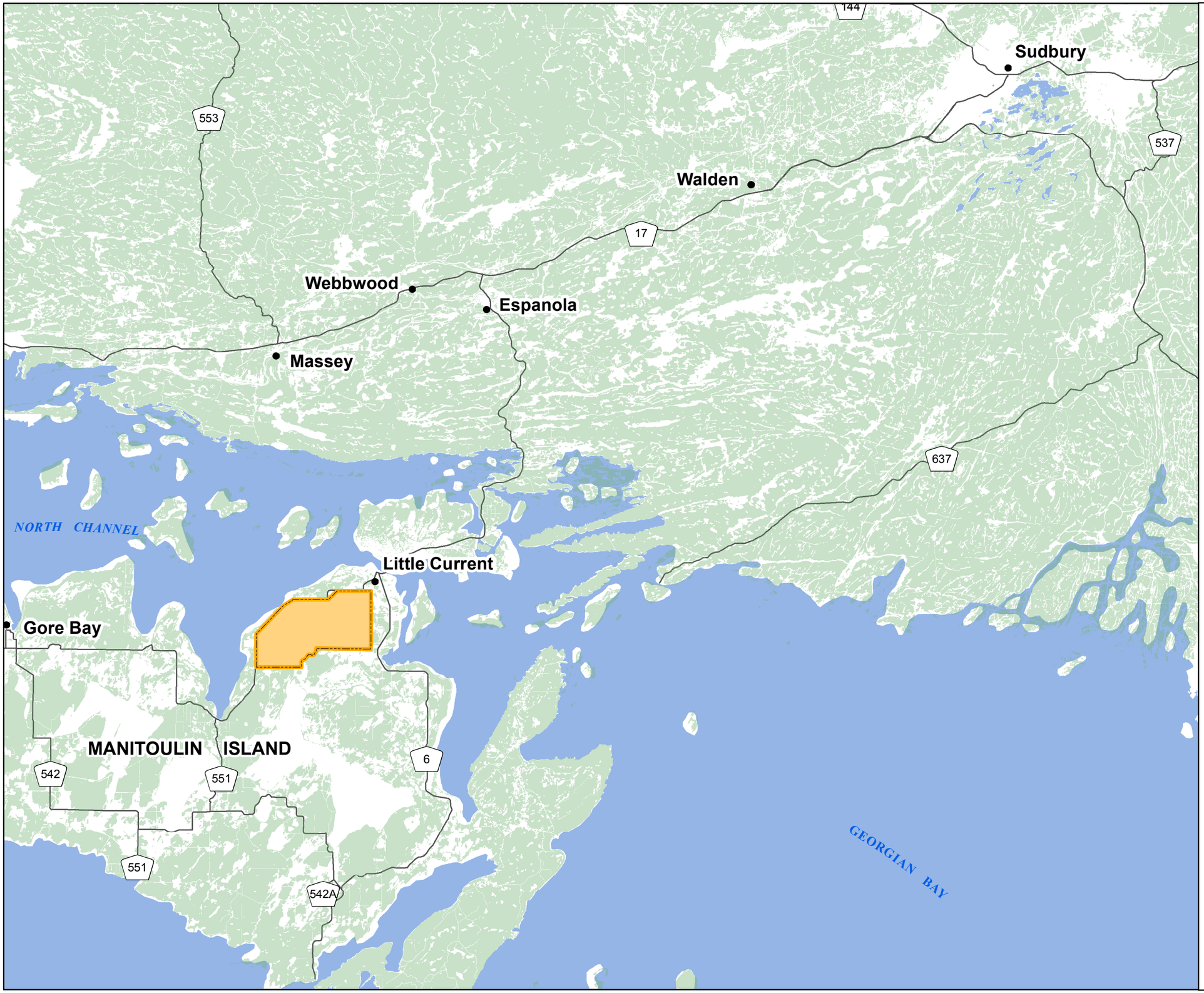
Significant adverse effects to the natural and social environment have been avoided through careful site selection, facility layout planning and strict adherence to all regulatory requirements. All turbines, access roads and ancillary facilities have been sited with landowner consultation to minimize the impact to current agricultural operations. No significant adverse environmental effects are anticipated.

The overall conclusion of this Design and Operations Report is that this project can be operated without any significant adverse residual effects to the natural or social environment.

There are net benefits of this project resulting from an increased municipal tax base for NEMI, increased number of employment opportunities (especially during the construction stage) and the generation of clean, renewable electricity from wind power. The operation of the wind farm will also provide annual economic benefits through royalties to landowners and a continuing need for supplies and services in the local and regional rural economies.

APPENDIX A

Site Plan & Mapping



NORTHLAND POWER

Mclean's Mountain Wind Farm
Figure A-1: General Location of Project

Legend

- Communities
- Highway
- Project Area
- Waterbody
- Woodlots

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DILLON CONSULTING

Created By: SFG
Checked By:
Date Created: May 27, 2008
Date Modified: July 21, 2011
File Path: I:\GIS\Northland Power\Mapping\Figure 4-1 General Site Plan.mxd

NORTHLAND POWER

McLean's Mountain Wind Farm
Figure A-2: Project Components Site Plan

Legend

- Noise Receptor
- Local Roads
- Highway
- 120 m Project Component Setback
- Lots/Concessions
- Water Body
- Watercourse
- Woodland
- Unevaluated Wetland
- 550m Noise Receptor Setback

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Access Road
- Feeder Lines
- Transmission Line
- Construction Staging Area

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NORTHLAND POWER

McLean's Mountain Wind Farm
Figure A-3: Natural Features and REA Setbacks Site Plan

Legend

- Residence
- Local Roads
- Highway
- 5 m Contours
- 40 dBA Noise Contour
- Lots/Concessions
- Water Body
- Watercourse
- First Nation Reserve
- Woodland
- Wetlands

Area of Natural and Scientific Interest, Life Science

- Sheguiandah Hill
- Sheguiandah Quartzite Quarry
- Bass Lake Marsh/Swamp

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Access Road
- Feeder Lines
- Transmission Line
- Construction Staging Area

REA Constraints

- 30m Watercourse Setback
- 120m River/Stream Setback
- 61.5m Non Participating Lot Setback
- 61.5m Road Setback
- Perch Lake Setback
- 120m Wetlands Setback
- 120m Life Science Area of Natural and Scientific Interest (ANSI) Setback
- 550m Noise Receptor Setback

N W E S

1:55,000

0 1 2 3

DILLON CONSULTING

Created By: KWR
Checked By: DM
Date Created: May 27, 2008
Date Modified: July 21, 2011
File Path: I:\GIS\091983 - Northland Power\Mapping\Design and Operations Report\Figure 4-3 Natural Features and REA Setbacks Site Plan.mxd

APPENDIX B

Environmental Noise Impact Assessment Report

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

McLEANS MOUTAIN WIND FARM
MANITOULIN ISLAND, ONTARIO

PREPARED FOR:

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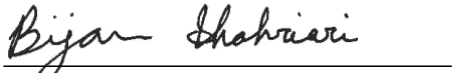
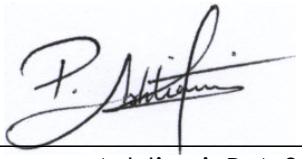


Bijan Shahriari



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22 July 2009
Revised 14 September 2011

Executive Summary

The purpose of this environmental noise impact assessment, prepared for the Northland Power Inc ("NPI") M1 Wind Project (the "Project"), is to fulfill NPI's requirements under Ontario Regulation 116/01 of the *Environmental Assessment Act* and to provide the basis for the Certificate of Approval – Air ["C of A (Air)"] under Section 9 of the *Environmental Protection Act* ("EPA"). The objective of this assessment is to demonstrate, by means of technical assessment, that the noise impact from the operation of the Project will comply with the Ministry of the Environment's ("MOE") environmental noise guidelines for wind turbines.

Building upon the project specific guidelines, noise impact prediction modelling was undertaken. The noise impact from the Project's wind turbine array and transformers and including neighbouring wind turbines operating at maximum rated power on the nearest points of reception was predicted using an acoustic model, ISO 9613, as required by the MOE.

The analysis shows that the noise impact from the Project does not exceed the most restrictive noise limits that apply for areas with acoustic designation of Class 3 (Rural) as defined by the MOE. Consequently, there is no need for the application of any additional mitigation measures and no further studies are contemplated for environmental noise in relation to the Project.

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GLOSSARY

agl	above ground level
C of A (Air)	Certificate of Approval – Air
Northland	Northland Power Inc.
M1	Northland Power McLean's Mountain Wind Farm
dBA	decibel A-weighted
ENIA	Environmental Noise Impact Assessment
EPA	*Environmental Protection Act*
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
kW	kilowatt
kV	kilovolt
LLA	Licence and Option to Lease Agreement
m	metre
m/s	metres per second
MOE	Ontario Ministry of the Environment
MW	Megawatt
PWL	Sound Power Level

1.0 INTRODUCTION

Northland Power Inc. ("NPI") has retained Aercoustics Engineering Limited ("Aercoustics") to prepare an environmental noise impact assessment ("ENIA") of the proposed 72 megawatt ("MW") M1 Manitoulin Island Wind Project ("Project"). The Project is situated near little current, in the Municipality of North-eastern Manitoulin and the Islands, Ontario.

The purpose of this ENIA is to fulfill NPI's requirements under Ontario Regulation 116/01 of the *Environmental Assessment Act* and to provide the basis for the Certificate of Approval – Air ["C of A (Air)"] under Section 9 of the *Environmental Protection Act* ("EPA"). Consequently, in fulfilling these requirements, the objective of this assessment is to:

> Predict the noise impacts from the Project at the nearest points of reception and to demonstrate, by means of technical assessment, that the noise impact from the operation of the Project will comply with the Ministry of the Environment's ("MOE") environmental noise guidelines for wind turbines.

The sound level limits and the noise assessment procedures are defined by the MOE in their October 2008 publication: "*Noise Guidelines for Wind Farms, Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities"* [17]. For continued reference, the MOE Interpretation (Attachment A) was prepared to assist proponents of wind turbine installations in determining what information should be submitted when applying for a C of A (Air), under the EPA.

The noise assessment was based on all of the recommended procedures outlined in the MOE's "Noise Guidelines for Wind farms, October 2008" [17].

2.0 DISCUSSION OF ACOUSTIC TERMINOLOGY

In order to fully understand the analysis presented in this ENIA, a brief discussion of the technical terms utilized throughout the report is included below.

The noise data presented in this report has been given in terms of sound pressure level. Sound pressure levels are measured in decibels ("dB"). It is common practice to sum sound pressure levels over the entire audible spectrum to give an overall sound pressure level.

The MOE requires that instantaneous sound pressure be processed by a special filter (i.e., A-weighting). As human hearing is less sensitive to low frequency sound, the weighting emphases the frequencies in the range 500 Hertz ("Hz") to 4000 Hz; while progressively diminishing the relative contributions at high and low frequencies. This corresponds approximately to the hearing response to humans at normal sound levels (e.g., 50 dB). The resulting "A-weighted" sound level is often used as a criterion to indicate a maximum allowable sound level.

The MOE defines a "point of reception" as any point on the premises of a person within 30 m of a dwelling or camping area, where sound or vibration originating from other than those premises is received. The MOE designates points of reception into three classes:

- Class 1 refers to an acoustical environment typical of a major population centre where the background noise is dominated by the urban hum. These areas are highly urbanized and have moderate to high noise levels throughout the day and night.
- Class 2 means an area with an acoustic environment that has low ambient sound levels between 19:00 hours and 07:00 hours; where the evening and night-time levels are defined by natural sounds and infrequent human activity and there are no clearly audible sounds from stationary sources (e.g., industrial, commercial, etc,).
- Class 3 refers to areas that are rural and/or small communities with a population of less than 1,000 with an acoustic environment that is dominated by natural sounds and has little or no road traffic during the night-time period.

3.0 DESCRIPTION OF WIND TURBINE SITE AND SURROUNDS

The Project is located near Little Current, in the town of North Eastern Manitoulin and the Islands, Ontario. The closest community in the vicinity of the Project is the Town of Little Current. The dominant environmental feature in the vicinity of the Project is the North Channel in Georgian Bay, located north and east of the study area. (Figure 1).

The wind plant will have a nominal rated nameplate capacity of 72 MW and will include one transformer at a substation near Green Bush Rd between McLean's Mountain Rd and Columbas Mountain Rd (Figure 2).

Within this agricultural / rural area, the main sources of ambient sound that currently exist include:

1. Vehicular traffic on County and Concession roads.
2. Sounds due to human activity as well as agricultural and rural activities.
3. Sounds due to human domestic activities such as property maintenance and recreation.
4. Natural sounds from wind noise, insects, wildlife, atmospheric effects, etc.

The acoustic classification of the area is generally Class 3 (rural).

3.1 Description of Receptors

Noise receptors have been selected for this analysis based on two criteria: i) their spatial proximity to the Project (i.e., receptors within about 1.5 kilometers of a wind turbine); and ii) level of benefit derived from the Project (e.g., participating or non-participating receptors). However, it should be noted that this project does not include any participating receptors. In addition, vacant lots have been considered as containing receptors if they are accessible – i.e., if they are adjacent to a road. The location of the receptor within each vacant lot has been chosen to be consistent with the typical building pattern in the area (e.g., close to adjacent roads) or at the centre of the vacant lot as per MOE documentation (see Attachment A). A total of 297 receptor dwellings and 49 vacant lots have been included as receptors for this assessment.

All receptors in the study area were provided to Aercoustics by NPI. Each receptor has been assigned a unique identifier for modelling and reporting purposes. Their locations relative to the wind turbines and transformer station are shown in Figure 2.

For the purposes of this ENIA, points of reception have been modelled at the worst case scenario of either two storey dwelling, or single storey dwelling with one point of reception 4.5m above the centre of the house.

3.2 MOE Environmental Noise Limits

The sound limit requirements for a wind turbine or an array of such units, termed a "wind plant", have been established in accordance with the existing MOE publications (NPC-205/232/233) as well as the wind induced background noise level. The specific definition of sound limits, expressed as a function of wind speed and ambient noise levels, as outlined in the MOE Interpretation, includes the following:

3.2.1 Wind Turbine Installations in Class 1 & 2 Areas (Urban): Wind Speeds Below 8m/s

The lowest sound level limit at a Point of Reception in Class 1 and 2 Areas (Urban), under conditions of average wind speed up to 8 m/s (i.e., 29km/h), expressed in terms of the hourly L_{eq} is 45.0 dBA or the minimum hourly background sound level established in accordance with requirements in Publications NPC-205/NPC-233, whichever is higher.

3.2.2 Wind Turbine Installations In Class 3 Areas (Rural): Wind Speeds Below 6m/s

The lowest sound level limit at a Point of Reception in Class 3 Areas (Rural), under conditions of average wind speed up to 6 m/s (i.e., 22km/h), expressed in terms of the hourly L_{eq} is 40.0 dBA or the minimum hourly background sound level established in accordance with requirements in Publications NPC-232/NPC-233, whichever is higher.

3.2.3 Wind Turbine Installations In Class 1 & 2 and Class 3 Areas: Wind Speeds Above 8m/s and 6m/s Respectively

The sound level limit at a Point of Reception in Class Areas 1 & 2 (Urban) or in Class 3 Areas (Rural), under conditions of average wind speed above 8 m/s and 6m/s respectively, expressed in terms of the hourly L_{eq}, is the wind induced background sound level, expressed in terms of ninetieth percentile sound level (L_{A90}) plus 7 dB, or the minimum hourly background sound level established in accordance with requirements in Publications NPC-205/NPC-232/NPC-233, whichever is higher. A summary of the above limits is shown in Table 1 for continued reference.

Table 1: MOE Sound Level Limits at Points of Reception for Wind Plants

Wind Speed (m/s)	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
Wind Turbine Noise Criterion NPC-232 (dBA) Class 3	40.0	40.0	40.0	43.0	45.0	49.0	51.0
Wind Turbine Noise Criterion NPC-205 (dBA) Class 1 & 2	45.0	45.0	45.0	45.0	45.0	49.0	51.0

Notes:

1. The measurement of wind induced background sound level is not required to establish the applicable criterion. The wind induced background sound level reference curve was determined by correlating the ninetieth percentile sound level (L_{A90}) with the average wind speed measured at a particularly quiet site.
2. If the existing minimum hourly background sound level, established in accordance with requirements in Publications NPC-205/NPC-232/NPC-233, is selected as the sound level limit, the measurement of wind speed (for the purpose of determination of wind induced background sound level) is not required. The selected limit applies in the entire range of wind speed under consideration from 4m/s to 11m/s with the exception of wind turbine noise criterion values higher than the existing minimum hourly background sound level.
3. Wind Turbine Noise Criterion at wind speeds expressed as fractional values of m/s should be interpolated from the above table.

The Project sound limits are ultimately a function of several variables:
1. Current ambient levels due to sound levels caused by both natural and human activity (e.g., traffic) sounds.
2. Acoustic classification of the study area (e.g., Class 2 and/or Class 3 as defined by MOE).
3. Wind induced background sound levels.

It should be noted that the ENIA has opted to apply the more conservative Class 3 (Rural) values to all territories within the study area. Table 2 summarizes the sound level limits for Class 3 areas.

Table 2: Sound Level Limits for Class 3 Areas							
Wind Speed (m/s)	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
Wind Turbine Sound Level Limit (dBA) (Class 3 Area, NPC-232)	40.0	40.0	40.0	43.0	45.0	49.0	51.0

4.0 DESCRIPTION OF SOURCES

4.1 M1 Transformer Station

NPI plans to build a transformer substation near Green Bush Rd between McLean's Mountain Rd and Columbas Mountain Rd as part of the Project. This substation will contain one transformer unit.

The transformer proposed to be used is a unit rated at 66 MVA (ONAF). The overall dimension of the unit is 8.9m x 6.1m x 3.9m (length x width x height), and drawings are included in Figure 3 The sound power level of this unit has been determined to be 89.4 dBA, based on IEEE standard C57.12.90-1993 – Part I [15].

Transformer noise is comprised of casing noise emitted from the operating transformer itself and cooling fan noise. Transformer noise has a pronounced audible tonal quality and therefore incurs a 5dB penalty, as per MOE publication NPC-104[7]. The overall sound power level of the transformer, including this penalty, is 94.4 dBA.

The noise contribution from the substation is calculated using the DataKustik CadnaA version 3.7 environmental noise prediction software. The calculations are based on established prediction methods approved by the MOE: ISO 9613-2 standard entitled "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation". For this analysis, the noise contribution from the substation was added to the noise contributions of the wind turbines to assess the total cumulative effect of the Project.

Table 3 lists the location of the transformer.

Table 3: Transformer Location

Identifier	UTM Coordinates		Remarks
	X (m)	Y (m)	
Xfrmr	423616	5087363	M1 Windfarm

4.2 Wind Turbine Generators

The Project will utilize GE model 2.5-103 2.5MW wind turbines. Each turbine has three blades, a 103m rotor diameter, and a hub height of 100m.

The turbines are capable of operating in seven modes – Normal Operation (NO) mode and Noise Reduced Operation (NRO) mode 103 to 100. Normal Operation corresponds to the most favourable power curve, but also the highest nominal sound power level at 104 dBA. NRO 103 to 100 corresponds to nominal calculated sound power levels from 103 dBA to 100 dBA. All turbines in the Project will operate using NO mode, corresponding to a nominal sound power level of 104 dBA.

Additional information on the GE 2.5-103 turbines is provided in Attachment B. Turbine coordinates are listed in Table 4.

4.2.1 Potential Sources of Noise

There are several sources that contribute to the sound emitted by a typical wind turbine. As the rotating blades of the turbine extract power from the air-stream, the blades experience lift and drag forces. These forces generate sound, much in the same manner as a rotating propeller or fan – also known as aerodynamic noise

INFRASOUND

Sounds with frequency contents below 20 Hz are referred to as infrasound. There are many other sources of infrasound such as those generated by winds, waterfalls, and the sound of waves breaking on the beach. Measurements at 200 m from typical units have shown that the infrasound levels are well below the level of perceptibility [1], [2]. As noted above, there are no non-participating Points of Reception within 400 m of a wind turbine and thus the potential effect of infrasound is not anticipated.

AMPLITUDE MODULATION

Perceptible sounds are generated predominantly by mechanical bearings, the electric generator and a characteristic “swoosh” which is essentially higher frequency broadband noise that is amplitude modulated at a low frequency [3]. In contrast to the first-generation wind turbines, some 30 years ago, innovations in blade geometry, materials, and mechanical systems have significantly lowered the sound power levels of present generation wind turbines. A recent study of wind turbine noise amplitude modulation [3] by the University of Salford, UK found that

amplitude modulation occurs between 7% and 15% of the time, but the causes of amplitude modulation are still open to debate therefore the causes are not fully understood and that amplitude modulation cannot be fully predicted by current state of the art. The Salford study concludes that further research is recommended to improve understanding of amplitude modulation. The MOE does not impose a penalty applied to wind turbine noise due to amplitude modulation [17].

WIND SHEAR EFFECTS

Vertical Wind shear, sometimes referred to as wind shear or wind gradient, is a vertical difference in wind speed and direction over a relatively short distance in the atmosphere. For acoustic purposes, vertical wind shear is used as a measure of the change in wind speed at various vertical heights above ground level. Wind shear has been accounted for in the M1 noise assessment by adjusting the standard neutral stability wind turbine emission to an emission which accounts for the site specific average summer night time wind shear exponent. This approach is consistent with the recommendations of the MOE's Noise Guidelines for Wind Farms [17].

4.2.2 M1 Wind Turbine Noise Emission Rating

GE has provided NPI with noise emission performance for the GE 2.5-103 wind turbines (NO mode) for wind speeds of 6ms/ to 10m/s at a reference height of 10m. See Attachment B and Table 4 below.

Table 4: GE 2.5-103, Sound Power Spectrums at wind speeds from 6m/s to 10m/s

GE 2.5-103
Electrical Rating: 2.5 MW
Hub Height (m): 100m
Wind Shear coefficient: 0.435

	Octave Band Sound Power Level (dB)									
	Manufacturer's Emission Levels					Adjusted Emission Levels**				
Wind Speed* (m/s)	6	7	8	9	10-cutout	6	7	8	9	10
Frequency (Hz)										
31.5	78.4	80.8	80.9	81.1	81.1	81.1	81.1	81.1	81.1	81.1
63	88.1	90.5	90.5	90.7	90.8	90.8	90.8	90.8	90.8	90.8
125	92.3	94.6	94.7	94.9	94.9	94.9	94.9	94.9	94.9	94.9
250	94.7	96.4	95.7	95.9	95.9	95.9	95.9	95.9	95.9	95.9
500	95.7	97.3	96.2	95.4	95.2	95.2	95.2	95.2	95.2	95.2
1000	96.6	98.4	98.7	98.6	98.4	98.4	98.4	98.4	98.4	98.4
2000	93.2	95.7	96.9	97.3	97.6	97.6	97.6	97.6	97.6	97.6
4000	86.2	87.5	88.1	89.0	89.4	89.4	89.4	89.4	89.4	89.4
8000	70.3	71.6	71.4	71.4	71.0	71.0	71.0	71.0	71.0	71.0
Total dBA	**102.1**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**

* At 10m reference height.

** The site specific average summer night time wind shear exponent was provided by AWS Truewind, wind engineering consultants for Northland Power Inc on this project. Given the wind shear coefficient of 0.435, the cut-out sound power level of 104 dBA corresponding to a wind speed of 10 m/s was used for all wind speeds. i.e. the highest noise emission from the turbines is used for all the wind speed cases. It should be

noted that the overall total sound emission is guaranteed by GE. The spectral data is for modelling purposes only and is not explicitly guaranteed.

Table 5 shows the proposed wind turbine locations.

Table 5: Wind Turbine Locations

Identifier	Equipment Make, Model	UTM Coordinates		Remarks
		X (m)	Y (m)	
T05	GE 2.5-103 2.5MW	425967	5088867	M1 Windfarm
T06	GE 2.5-103 2.5MW	425374	5088648	M1 Windfarm
T09	GE 2.5-103 2.5MW	426960	5088349	M1 Windfarm
T10	GE 2.5-103 2.5MW	426243	5088273	M1 Windfarm
T11	GE 2.5-103 2.5MW	423155	5087692	M1 Windfarm
T12	GE 2.5-103 2.5MW	424685	5087875	M1 Windfarm
T13	GE 2.5-103 2.5MW	425578	5087836	M1 Windfarm
T14	GE 2.5-103 2.5MW	424005	5087874	M1 Windfarm
T15	GE 2.5-103 2.5MW	426514	5087605	M1 Windfarm
T16	GE 2.5-103 2.5MW	423976	5085277	M1 Windfarm
T17	GE 2.5-103 2.5MW	421160	5086508	M1 Windfarm
T18	GE 2.5-103 2.5MW	423020	5086314	M1 Windfarm
T19	GE 2.5-103 2.5MW	426002	5086354	M1 Windfarm
T20	GE 2.5-103 2.5MW	425263	5086379	M1 Windfarm
T21	GE 2.5-103 2.5MW	420869	5086170	M1 Windfarm
T23	GE 2.5-103 2.5MW	423091	5085958	M1 Windfarm
T25	GE 2.5-103 2.5MW	415729	5084615	M1 Windfarm
T28	GE 2.5-103 2.5MW	424742	5084943	M1 Windfarm
T29	GE 2.5-103 2.5MW	423719	5084978	M1 Windfarm
T30	GE 2.5-103 2.5MW	424258	5084654	M1 Windfarm
T31	GE 2.5-103 2.5MW	416174	5082550	M1 Windfarm
T34	GE 2.5-103 2.5MW	423970	5084235	M1 Windfarm
T35	GE 2.5-103 2.5MW	415668	5083842	M1 Windfarm
T36	GE 2.5-103 2.5MW	416181	5083552	M1 Windfarm
T38	GE 2.5-103 2.5MW	415679	5083197	M1 Windfarm
T39	GE 2.5-103 2.5MW	417095	5082519	M1 Windfarm
T40	GE 2.5-103 2.5MW	416441	5082915	M1 Windfarm
T42	GE 2.5-103 2.5MW	415354	5082675	M1 Windfarm
T43	GE 2.5-103 2.5MW	416653	5082179	M1 Windfarm

4.2.3 Providence Bay Wind Farm

The Providence Bay Wind Farm is an operating 1.6 MW wind farm located near the towns of Providence Bay and Spring Bay, in the Township of Central Manitoulin, Manitoulin Island Ontario. Two Enercon E-48 800 kW wind turbine generators were commissioned and put into operation at Providence Bay on March 25, 2007. The related Providence Bay Expansion Project is in the Advanced-Stage of development.

As the Providence Bay is located more than 10km away from boundary of M1 wind farm, the total noise impact assessment on the M1 wind farm points of reception does not include the noise impact from Providence Bay wind farm

5.0 NOISE ASSESSMENT RESULTS

5.1 Transformer Station Impact Assessment

The overall sound power level of the transformer unit, including 5dB tonality penalty, is 94.4 dBA. DataKustik CadnaA environmental noise model generated the worst-case results shown in Table 6. These results include contributions of the wind turbines. As indicated in the table, and applying the conservative application of Class 3 (rural) areas to all Points of Reception, the transformer are expected to meet the applicable noise guidelines. The receptor identified in Table 6 is the worst-case receptor, closest to the transformer.

Table 6: Total Noise Impact, 6m/s wind speed

Receptor	Description	Distance to Transformer (m)	Calculated Sound Level (dBA)	Allowable Level
R289	Residence, (on Green Bush Road)	405	40.0 dBA	40.0 dBA

5.2 Wind Turbine Impact Assessment

The noise impact at 297 receptor dwellings and 49 vacant lots has been predicted using a formula based on ISO 9613-2 Part 2; consistent with the MOE's modelling requirements. The locations and sound power levels of all the wind turbine sources, the transformer station sources and the location of the receptors were integrated into a master data file.

Noise was predicted based on the following noise modelling protocol:

- Temperature = 10C
- Humidity = 70%
- G = 0.70 global ground attenuation factor
- Sound Level Limit = 40.0 dBA at 6m/s wind at 10m agl, i.e. precision to 1/10th of decibel
- Turbine noise emission corresponding to the manufacturer's cut-out sound power level at a wind speed of 10m/s at 10m agl, to account for M1 specific conditions of average summer night time wind shear exponent = 0.435
- Analysis to include only turbines within 5km of a receptor for those receptors whose closest turbine is within 1.5km
- Two storey dwelling = 4.5m receptor height at center of dwelling
- Single storey dwelling = 4.5m receptor height at center of dwelling
- Vacant lot = 4.5m receptor height at position described in section 3.1: Description of Receptors

The highest noise level for each receptor, which represents the worst-case prediction, is outlined in the assessment summary table at the end of this report.

The noise modelling software computes the octave band levels at the receptors from all the sound sources, including the transformer. The resultant A-weighted sound pressure levels are then transferred as a noise contour to the site map that shows both source and receiver locations. Refer to Figure 5 for the noise contour.

Worst-case sound levels have been predicted at all 297 dwellings and 49 vacant lots. A Sample detailed calculation is provided in Attachment C. The worst-case predicted sound levels at all receptors are predicted to be within the MOE environmental noise limits for Class 3 (rural) areas.

5.3 Wind Turbine Summary Tables

The sound power emitted by the wind turbines and transformer station, as well as their location with respect to the receptors determines the sound pressure levels induced by the operation of all Project components. The acoustic power of each wind turbine as provided by the manufacturer is shown in Attachment B.

The total noise impact at each receptor, including all wind turbines and transformer stations, has been summarized in the noise assessment summary table below for all 297 dwellings and 49 vacant lots. The noise impact from the simultaneous operation of all wind turbines and transformers is less than or equal to the sound level limit associated with NPC 232 (i.e., 40.0 dBA).

The closest receptor to a proposed M1 wind turbine is V229, which is located 562m from turbine T17. All other receptors are more than 562m from a turbine. The closest receptor dwelling (non-vacant lot) is R289 which is located 669m from turbine T11.

6.0 CONCLUSION

The project site is rural: therefore the MOE's Class 3 (rural) designation applies.

Building upon the project specific sound limit guidelines, noise impact prediction modelling was undertaken. The noise impact on the nearest points of reception was predicted using an acoustic model, ISO 9613, as required by the MOE, based on noise from the Project's wind turbine array, coupled with transformers with transformer tonality penalty.

The noise assessment was based on all of the recommended procedures outlined in the MOE's "Noise Guidelines for Wind farms, October 2008" [17].

The analysis shows that the cumulative noise impact from the Project does not exceed the most restrictive noise limits that apply for areas with an acoustic designation of Class 3 (Rural) as defined by the MOE. Consequently, there is no need for the application of any additional mitigation measures and no further studies are contemplated for environmental noise in relation to the Project.

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18. *Environmental Noise Impact Assessment, Port Alma Wind Power Project,* Aercoustics Engineering Limited, 31 March 2008

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R001	4.5	Residence	425848	5083118	2134	T28	28.9	28.9	28.9	28.9	28.9	40	43	45	49	51	Yes
R002	4.5	Residence	425770	5083073	2134	T28	29.0	29.0	29.0	29.0	29.0	40	43	45	49	51	Yes
R003	4.5	Residence	425207	5083180	1626	T34	31.1	31.1	31.1	31.1	31.1	40	43	45	49	51	Yes
R004	4.5	Residence	424906	5082966	1577	T34	30.9	30.9	30.9	30.9	30.9	40	43	45	49	51	Yes
R005	4.5	Residence	424795	5083040	1452	T34	31.5	31.5	31.5	31.5	31.5	40	43	45	49	51	Yes
R006	4.5	Residence	424422	5082993	1322	T34	32.1	32.1	32.1	32.1	32.1	40	43	45	49	51	Yes
R007	4.5	Residence	424307	5083188	1100	T34	33.5	33.5	33.5	33.5	33.5	40	43	45	49	51	Yes
R008	4.5	Residence	423155	5083142	1363	T34	31.7	31.7	31.7	31.7	31.7	40	43	45	49	51	Yes
R009	4.5	Residence	422309	5083084	2021	T34	28.3	28.3	28.3	28.3	28.3	40	43	45	49	51	Yes
R010	4.5	Residence	421365	5083081	2849	T34	24.5	24.5	24.5	24.5	24.5	40	43	45	49	51	Yes
R011	4.5	Residence	414344	5081036	1925	T42	29.3	29.3	29.3	29.3	29.3	40	43	45	49	51	Yes
R012	4.5	Residence	414311	5081196	1810	T42	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R013	4.5	Residence	414299	5081242	1779	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R014	4.5	Residence	414412	5081942	1194	T42	32.9	32.9	32.9	32.9	32.9	40	43	45	49	51	Yes
R015	4.5	Residence	414235	5081847	1392	T42	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
R016	4.5	Residence	414339	5082499	1030	T42	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	Yes
R017	4.5	Residence	414409	5082880	967	T42	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	Yes
R018	4.5	Residence	414380	5082933	1008	T42	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
R019	4.5	Residence	414270	5083098	1164	T42	33.9	33.9	33.9	33.9	33.9	40	43	45	49	51	Yes
R020	4.5	Residence	413725	5082956	1653	T42	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R021	4.5	Residence	413701	5082942	1674	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R022	4.5	Residence	413750	5082896	1619	T42	27.4	27.4	27.4	27.4	27.4	40	43	45	49	51	Yes
R023	4.5	Residence	413784	5082742	1571	T42	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R024	4.5	Residence	413775	5082673	1579	T42	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R025	4.5	Residence	413675	5082506	1687	T42	25.0	25.0	25.0	25.0	25.0	40	43	45	49	51	Yes
R026	4.5	Residence	413581	5082369	1799	T42	27.0	27.0	27.0	27.0	27.0	40	43	45	49	51	Yes
R027	4.5	Residence	413606	5082202	1811	T42	24.3	24.3	24.3	24.3	24.3	40	43	45	49	51	Yes
R028	4.5	Residence	413448	5082021	2015	T42	24.8	24.8	24.8	24.8	24.8	40	43	45	49	51	Yes
R029	4.5	Residence	413396	5081968	2082	T42	24.5	24.5	24.5	24.5	24.5	40	43	45	49	51	Yes
R030	4.5	Residence	413345	5081912	2149	T42	25.2	25.2	25.2	25.2	25.2	40	43	45	49	51	Yes
R031	4.5	Residence	413290	5081850	2223	T42	23.9	23.9	23.9	23.9	23.9	40	43	45	49	51	Yes
R032	4.5	Residence	413255	5081810	2270	T42	23.8	23.8	23.8	23.8	23.8	40	43	45	49	51	Yes
R033	4.5	Residence	413185	5081718	2371	T42	23.4	23.4	23.4	23.4	23.4	40	43	45	49	51	Yes
R034	4.5	Residence	413172	5081643	2414	T42	22.4	22.4	22.4	22.4	22.4	40	43	45	49	51	Yes
R035	4.5	Residence	413128	5081605	2470	T42	22.2	22.2	22.2	22.2	22.2	40	43	45	49	51	Yes
R036	4.5	Residence	413108	5081561	2507	T42	22.1	22.1	22.1	22.1	22.1	40	43	45	49	51	Yes
R037	4.5	Residence	413089	5081537	2535	T42	22.0	22.0	22.0	22.0	22.0	40	43	45	49	51	Yes
R038	4.5	Residence	413062	5081495	2578	T42	21.8	21.8	21.8	21.8	21.8	40	43	45	49	51	Yes
R039	4.5	Residence	413030	5081446	2629	T42	21.6	21.6	21.6	21.6	21.6	40	43	45	49	51	Yes
R040	4.5	Residence	413002	5081405	2673	T42	21.5	21.5	21.5	21.5	21.5	40	43	45	49	51	Yes
R041	4.5	Residence	412988	5081382	2696	T42	21.4	21.4	21.4	21.4	21.4	40	43	45	49	51	Yes
R042	4.5	Residence	412964	5081349	2733	T42	21.3	21.3	21.3	21.3	21.3	40	43	45	49	51	Yes
R043	4.5	Residence	412949	5081327	2757	T42	21.2	21.2	21.2	21.2	21.2	40	43	45	49	51	Yes
R044	4.5	Residence	412942	5081315	2769	T42	21.2	21.2	21.2	21.2	21.2	40	43	45	49	51	Yes
R045	4.5	Residence	413762	5083132	1656	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R046	4.5	Residence	413720	5083178	1710	T42	30.0	30.0	30.0	30.0	30.0	40	43	45	49	51	Yes
R047	4.5	Residence	413696	5083199	1739	T42	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R048	4.5	Residence	413683	5083273	1775	T42	30.1	30.1	30.1	30.1	30.1	40	43	45	49	51	Yes
R049	4.5	Residence	413601	5083352	1879	T42	30.1	30.1	30.1	30.1	30.1	40	43	45	49	51	Yes
R050	4.5	Residence	413574	5083324	1895	T42	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R051	4.5	Residence	413495	5083401	1996	T42	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R052	4.5	Residence	413491	5083827	2177	T35	29.4	29.4	29.4	29.4	29.4	40	43	45	49	51	Yes
R053	4.5	Residence	413825	5084524	1906	T25	30.0	30.0	30.0	30.0	30.0	40	43	45	49	51	Yes
R054	4.5	Residence	414213	5084742	1521	T25	31.3	31.3	31.3	31.3	31.3	40	43	45	49	51	Yes
R055	4.5	Residence	414370	5083886	1299	T35	33.9	33.9	33.9	33.9	33.9	40	43	45	49	51	Yes
R056	4.5	Residence	414371	5083958	1302	T35	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	Yes
R057	4.5	Residence	414879	5085178	1020	T25	32.6	32.6	32.6	32.6	32.6	40	43	45	49	51	Yes
R058	4.5	Residence	414972	5085133	917	T25	33.1	33.1	33.1	33.1	33.1	40	43	45	49	51	Yes
R059	4.5	Residence	414307	5085243	1554	T25	30.3	30.3	30.3	30.3	30.3	40	43	45	49	51	Yes
R060	4.5	Residence	414272	5085861	1917	T25	28.0	28.0	28.0	28.0	28.0	40	43	45	49	51	Yes
R061	4.5	Residence	414215	5085774	1907	T25	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R062	4.5	Residence	414183	5085687	1881	T25	28.3	28.3	28.3	28.3	28.3	40	43	45	49	51	Yes
R063	4.5	Residence	414143	5085669	1904	T25	28.2	28.2	28.2	28.2	28.2	40	43	45	49	51	Yes
R064	4.5	Residence	414087	5085618	1924	T25	28.2	28.2	28.2	28.2	28.2	40	43	45	49	51	Yes
R065	4.5	Residence	414056	5085605	1944	T25	27.2	27.2	27.2	27.2	27.2	40	43	45	49	51	Yes
R066	4.5	Residence	415497	5086237	1639	T25	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R067	4.5	Residence	415594	5086574	1964	T25	24.9	24.9	24.9	24.9	24.9	40	43	45	49	51	Yes
R068	4.5	Residence	415432	5086625	2032	T25	24.5	24.5	24.5	24.5	24.5	40	43	45	49	51	Yes
R069	4.5	Residence	415396	5086649	2061	T25	24.4	24.4	24.4	24.4	24.4	40	43	45	49	51	Yes
R070	4.5	Residence	415344	5086540	1963	T25	24.9	24.9	24.9	24.9	24.9	40	43	45	49	51	Yes
R071	4.5	Residence	415301	5086495	1928	T25	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R072	4.5	Residence	415476	5086730	2130	T25	24.1	24.1	24.1	24.1	24.1	40	43	45	49	51	Yes
R073	4.5	Residence	415503	5086756	2153	T25	24.0	24.0	24.0	24.0	24.0	40	43	45	49	51	Yes
R074	4.5	Residence	415549	5086772	2164	T25	23.9	23.9	23.9	23.9	23.9	40	43	45	49	51	Yes
R075	4.5	Residence	415571	5086817	2208	T25	23.7	23.7	23.7	23.7	23.7	40	43	45	49	51	Yes
R076	4.5	Residence	415627	5086826	2213	T25	23.7	23.7	23.7	23.7	23.7	40	43	45	49	51	Yes
R077	4.5	Residence	415617	5086891	2279	T25	23.4	23.4	23.4	23.4	23.4	40	43	45	49	51	Yes
R078	4.5	Residence	415731	5086962	2347	T25	23.1	23.1	23.1	23.1	23.1	40	43	45	49	51	Yes
R079	4.5	Residence	415781	5087030	2416	T25	22.9	22.9	22.9	22.9	22.9	40	43	45	49	51	Yes
R080	4.5	Residence	415836	5087086	2473	T25	22.6	22.6	22.6	22.6	22.6	40	43	45	49	51	Yes
R081	4.5	Residence	415995	5087198	2597	T25	22.2	22.2	22.2	22.2	22.2	40	43	45	49	51	Yes
R082	4.5	Residence	415941	5087220	2614	T25	22.0	22.0	22.0	22.0	22.0	40	43	45	49	51	Yes
R083	4.5	Residence	415453	5087273	2672	T25	22.9	22.9	22.9	22.9	22.9	40	43	45	49	51	Yes
R084	4.5	Residence	416012	5087285	2685	T25	21.8	21.8	21.8	21.8	21.8	40	43	45	49	51	Yes
R085	4.5	Residence	416038	5087334	2737	T25	21.7	21.7	21.7	21.7	21.7	40	43	45	49	51	Yes
R086	4.5	Residence	416093	5087356	2765	T25	21.6	21.6	21.6	21.6	21.6	40	43	45	49	51	Yes
R087	4.5	Residence	416094	5087400	2809	T25	21.4	21.4	21.4	21.4	21.4	40	43	45	49	51	Yes
R088	4.5	Residence	416150	5087427	2843	T25	21.1	21.1	21.1	21.1	21.1	40	43	45	49	51	Yes
R089	4.5	Residence	416234	5087588	3016	T25	20.4	20.4	20.4	20.4	20.4	40	43	45	49	51	Yes
R090	4.5	Residence	419777	5089027	2874	T17	21.0	21.0	21.0	21.0	21.0	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R091	4.5	Residence	419708	5089143	3009	T17	19.9	19.9	19.9	19.9	19.9	40	43	45	49	51	Yes
R092	4.5	Residence	419681	5089119	3001	T17	19.9	19.9	19.9	19.9	19.9	40	43	45	49	51	Yes
R093	4.5	Residence	419277	5090192	4137	T17	19.2	19.2	19.2	19.2	19.2	40	43	45	49	51	Yes
R094	4.5	Residence	419206	5090217	4192	T17	19.1	19.1	19.1	19.1	19.1	40	43	45	49	51	Yes
R095	4.5	Residence	418890	5089158	3489	T17	17.1	17.1	17.1	17.1	17.1	40	43	45	49	51	Yes
R096	4.5	Residence	418649	5089115	3620	T17	16.7	16.7	16.7	16.7	16.7	40	43	45	49	51	Yes
R097	4.5	Residence	418572	5089260	3778	T17	16.3	16.3	16.3	16.3	16.3	40	43	45	49	51	Yes
R098	4.5	Residence	418439	5089067	3735	T17	16.3	16.3	16.3	16.3	16.3	40	43	45	49	51	Yes
R099	4.5	Residence	418387	5089036	3752	T17	16.2	16.2	16.2	16.2	16.2	40	43	45	49	51	Yes
R100	4.5	Residence	418218	5088922	3806	T17	14.2	14.2	14.2	14.2	14.2	40	43	45	49	51	Yes
R101	4.5	Residence	418170	5088875	3814	T17	14.2	14.2	14.2	14.2	14.2	40	43	45	49	51	Yes
R102	4.5	Residence	418135	5088810	3801	T21	14.3	14.3	14.3	14.3	14.3	40	43	45	49	51	Yes
R103	4.5	Residence	418091	5088876	3876	T17	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R104	4.5	Residence	418054	5088846	3884	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R105	4.5	Residence	418002	5088790	3884	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R106	4.5	Residence	417938	5088736	3896	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R107	4.5	Residence	417895	5088692	3899	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R108	4.5	Residence	417814	5088726	3983	T21	13.9	13.9	13.9	13.9	13.9	40	43	45	49	51	Yes
R109	4.5	Residence	417813	5088662	3943	T21	14.1	14.1	14.1	14.1	14.1	40	43	45	49	51	Yes
R110	4.5	Residence	417775	5088658	3970	T21	14.0	14.0	14.0	14.0	14.0	40	43	45	49	51	Yes
R111	4.5	Residence	417685	5088674	4051	T21	13.8	13.8	13.8	13.8	13.8	40	43	45	49	51	Yes
R112	4.5	Residence	417653	5088682	4081	T21	13.8	13.8	13.8	13.8	13.8	40	43	45	49	51	Yes
R113	4.5	Residence	417684	5088577	3992	T21	14.0	14.0	14.0	14.0	14.0	40	43	45	49	51	Yes
R114	4.5	Residence	417611	5088617	4075	T21	13.8	13.8	13.8	13.8	13.8	40	43	45	49	51	Yes
R115	4.5	Residence	417792	5088013	3587	T21	16.5	16.5	16.5	16.5	16.5	40	43	45	49	51	Yes
R116	4.5	Residence	417573	5088557	4070	T21	13.9	13.9	13.9	13.9	13.9	40	43	45	49	51	Yes
R117	4.5	Residence	417528	5088537	4095	T21	13.9	13.9	13.9	13.9	13.9	40	43	45	49	51	Yes
R118	4.5	Residence	417399	5088504	4182	T21	14.6	14.6	14.6	14.6	14.6	40	43	45	49	51	Yes
R119	4.5	Residence	417294	5088398	4094	T25	17.6	17.6	17.6	17.6	17.6	40	43	45	49	51	Yes
R120	4.5	Residence	417204	5088344	4010	T25	17.8	17.8	17.8	17.8	17.8	40	43	45	49	51	Yes
R121	4.5	Residence	417184	5088328	3988	T25	17.8	17.8	17.8	17.8	17.8	40	43	45	49	51	Yes
R122	4.5	Residence	416992	5088231	3830	T25	18.0	18.0	18.0	18.0	18.0	40	43	45	49	51	Yes
R123	4.5	Residence	417136	5088293	3938	T25	17.9	17.9	17.9	17.9	17.9	40	43	45	49	51	Yes
R124	4.5	Residence	417278	5088168	3876	T25	15.9	15.9	15.9	15.9	15.9	40	43	45	49	51	Yes
R125	4.5	Residence	417267	5088106	3815	T25	16.0	16.0	16.0	16.0	16.0	40	43	45	49	51	Yes
R126	4.5	Residence	416826	5088186	3736	T25	18.1	18.1	18.1	18.1	18.1	40	43	45	49	51	Yes
R127	4.5	Residence	416752	5088186	3715	T25	18.2	18.2	18.2	18.2	18.2	40	43	45	49	51	Yes
R128	4.5	Residence	416648	5087998	3506	T25	18.9	18.9	18.9	18.9	18.9	40	43	45	49	51	Yes
R129	4.5	Residence	416489	5087841	3314	T25	19.6	19.6	19.6	19.6	19.6	40	43	45	49	51	Yes
R130	4.5	Residence	416429	5087760	3222	T25	19.8	19.8	19.8	19.8	19.8	40	43	45	49	51	Yes
R131	4.5	Residence	416284	5087570	3007	T25	20.6	20.6	20.6	20.6	20.6	40	43	45	49	51	Yes
R132	4.5	Residence	416332	5087677	3121	T25	20.1	20.1	20.1	20.1	20.1	40	43	45	49	51	Yes
R133	4.5	Residence	428315	5088492	1363	T09	31.1	31.1	31.1	31.1	31.1	40	43	45	49	51	Yes
R134	4.5	Residence	427915	5089033	1175	T09	32.0	32.0	32.0	32.0	32.0	40	43	45	49	51	Yes
R135	4.5	Residence	427850	5089177	1216	T09	31.2	31.2	31.2	31.2	31.2	40	43	45	49	51	Yes

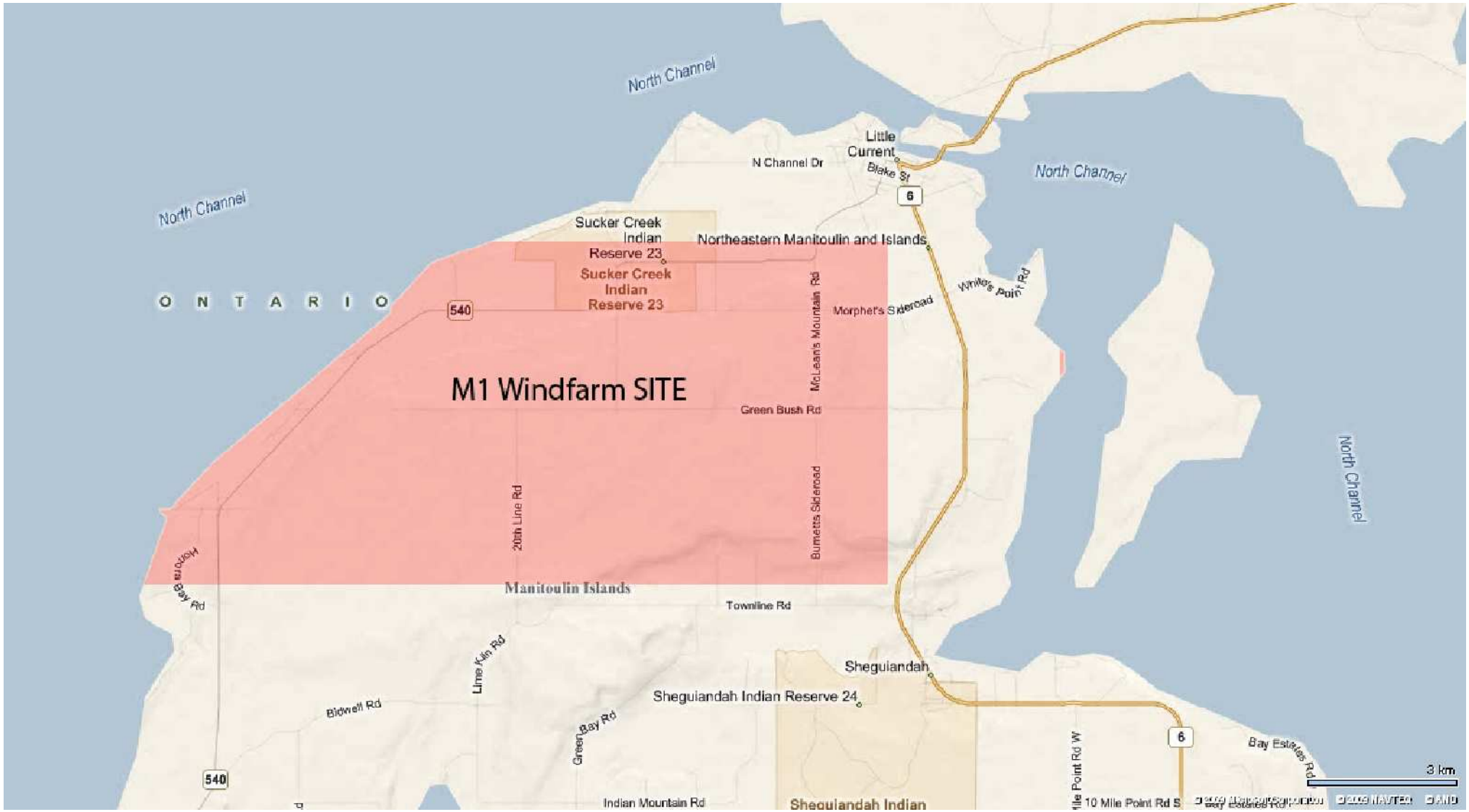
Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R136	4.5	Residence	427616	5089226	1095	T09	32.7	32.7	32.7	32.7	32.7	40	43	45	49	51	Yes
R137	4.5	Residence	427256	5087044	930	T15	35.8	35.8	35.8	35.8	35.8	40	43	45	49	51	Yes
R138	4.5	Residence	427499	5086978	1168	T15	34.3	34.3	34.3	34.3	34.3	40	43	45	49	51	Yes
R139	4.5	Residence	427540	5087122	1134	T15	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	Yes
R140	4.5	Residence	428065	5087013	1660	T15	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
R141	4.5	Residence	428189	5087035	1769	T15	31.0	31.0	31.0	31.0	31.0	40	43	45	49	51	Yes
R142	4.5	Residence	420751	5089072	2596	T17	21.9	21.9	21.9	21.9	21.9	40	43	45	49	51	Yes
R143	4.5	Residence	420871	5089092	2600	T17	22.1	22.1	22.1	22.1	22.1	40	43	45	49	51	Yes
R144	4.5	Residence	420985	5089087	2580	T11	22.1	22.1	22.1	22.1	22.1	40	43	45	49	51	Yes
R145	4.5	Residence	421348	5089190	2347	T11	22.8	22.8	22.8	22.8	22.8	40	43	45	49	51	Yes
R146	4.5	Residence	421557	5089211	2205	T11	23.2	23.2	23.2	23.2	23.2	40	43	45	49	51	Yes
R147	4.5	Residence	422092	5089042	1718	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R148	4.5	Residence	422176	5089170	1773	T11	25.1	25.1	25.1	25.1	25.1	40	43	45	49	51	Yes
R149	4.5	Residence	422257	5089097	1667	T11	25.5	25.5	25.5	25.5	25.5	40	43	45	49	51	Yes
R150	4.5	Residence	422606	5088962	1384	T11	32.1	32.1	32.1	32.1	32.1	40	43	45	49	51	Yes
R151	4.5	Residence	422536	5089145	1579	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R152	4.5	Residence	422516	5089548	1963	T11	25.0	25.0	25.0	25.0	25.0	40	43	45	49	51	Yes
R153	4.5	Residence	422511	5089612	2025	T11	24.8	24.8	24.8	24.8	24.8	40	43	45	49	51	Yes
R154	4.5	Residence	422460	5089645	2073	T11	24.6	24.6	24.6	24.6	24.6	40	43	45	49	51	Yes
R155	4.5	Residence	422502	5089691	2103	T11	25.2	25.2	25.2	25.2	25.2	40	43	45	49	51	Yes
R156	4.5	Residence	422501	5089754	2163	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R157	4.5	Residence	422590	5089829	2210	T11	25.6	25.6	25.6	25.6	25.6	40	43	45	49	51	Yes
R158	4.5	Residence	422596	5089787	2168	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R159	4.5	Residence	422609	5089684	2065	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R160	4.5	Residence	422680	5089676	2040	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R161	4.5	Residence	422678	5089714	2078	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R162	4.5	Residence	422675	5089755	2118	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R163	4.5	Residence	422680	5089791	2152	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R164	4.5	Residence	422707	5089868	2222	T11	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R165	4.5	Residence	422748	5089886	2231	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R166	4.5	Residence	422800	5089905	2241	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R167	4.5	Residence	422731	5089673	2026	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R168	4.5	Residence	422731	5089718	2070	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R169	4.5	Residence	422731	5089757	2108	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R170	4.5	Residence	422732	5089824	2174	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R171	4.5	Residence	422788	5089835	2174	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R172	4.5	Residence	422789	5089778	2118	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R173	4.5	Residence	422789	5089728	2069	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R174	4.5	Residence	422791	5089680	2021	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R175	4.5	Residence	422788	5089603	1946	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R176	4.5	Residence	422782	5089544	1889	T11	25.6	25.6	25.6	25.6	25.6	40	43	45	49	51	Yes
R177	4.5	Residence	422786	5089501	1846	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R178	4.5	Residence	422837	5089596	1930	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R179	4.5	Residence	423019	5089466	1779	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R180	4.5	Residence	422713	5089969	2320	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R181	4.5	Residence	422729	5090005	2352	T11	26.7	26.7	26.7	26.7	26.7	40	43	45	49	51	Yes
R182	4.5	Residence	422810	5090000	2334	T11	26.0	26.0	26.0	26.0	26.0	40	43	45	49	51	Yes
R183	4.5	Residence	422847	5090085	2413	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R184	4.5	Residence	422929	5090093	2412	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R185	4.5	Residence	422011	5090004	2580	T11	25.3	25.3	25.3	25.3	25.3	40	43	45	49	51	Yes
R186	4.5	Residence	422479	5090116	2516	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R187	4.5	Residence	422506	5090166	2558	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R188	4.5	Residence	422513	5090218	2606	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R189	4.5	Residence	422602	5090178	2547	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R190	4.5	Residence	422663	5090181	2537	T11	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R191	4.5	Residence	422739	5090180	2523	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R192	4.5	Residence	422656	5090359	2713	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R193	4.5	Residence	422623	5090394	2754	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R194	4.5	Residence	422589	5090438	2804	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R195	4.5	Residence	422822	5090202	2532	T11	27.3	27.3	27.3	27.3	27.3	40	43	45	49	51	Yes
R196	4.5	Residence	422903	5090183	2504	T11	27.0	27.0	27.0	27.0	27.0	40	43	45	49	51	Yes
R197	4.5	Residence	422960	5090180	2496	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R198	4.5	Residence	423010	5090182	2494	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R199	4.5	Residence	423041	5090182	2493	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R200	4.5	Residence	423104	5090182	2478	T14	27.4	27.4	27.4	27.4	27.4	40	43	45	49	51	Yes
R201	4.5	Residence	423190	5090177	2443	T14	27.6	27.6	27.6	27.6	27.6	40	43	45	49	51	Yes
R202	4.5	Residence	423098	5090087	2392	T14	27.0	27.0	27.0	27.0	27.0	40	43	45	49	51	Yes
R203	4.5	Residence	423147	5090088	2374	T14	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R204	4.5	Residence	423094	5090033	2342	T11	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R205	4.5	Residence	422948	5089472	1792	T11	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R206	4.5	Residence	422895	5089462	1789	T11	25.7	25.7	25.7	25.7	25.7	40	43	45	49	51	Yes
R207	4.5	Residence	422844	5089599	1932	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R208	4.5	Residence	422845	5089639	1972	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R209	4.5	Residence	422845	5089691	2023	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R210	4.5	Residence	422846	5089739	2070	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R211	4.5	Residence	422844	5089791	2122	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R212	4.5	Residence	422845	5089844	2174	T11	26.1	26.1	26.1	26.1	26.1	40	43	45	49	51	Yes
R213	4.5	Residence	422892	5089867	2191	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R214	4.5	Residence	422889	5089810	2135	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R215	4.5	Residence	422890	5089736	2061	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R216	4.5	Residence	422890	5089639	1965	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R217	4.5	Residence	422890	5089639	1965	T11	26.2	26.2	26.2	26.2	26.2	40	43	45	49	51	Yes
R218	4.5	Residence	422890	5089590	1916	T11	26.3	26.3	26.3	26.3	26.3	40	43	45	49	51	Yes
R219	4.5	Residence	422889	5089547	1874	T11	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R220	4.5	Residence	422948	5089552	1871	T11	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R221	4.5	Residence	422946	5089602	1921	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R222	4.5	Residence	422948	5089653	1972	T11	26.5	26.5	26.5	26.5	26.5	40	43	45	49	51	Yes
R223	4.5	Residence	422948	5089704	2023	T11	26.7	26.7	26.7	26.7	26.7	40	43	45	49	51	Yes
R224	4.5	Residence	422948	5089749	2067	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R225	4.5	Residence	422948	5089815	2133	T11	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes

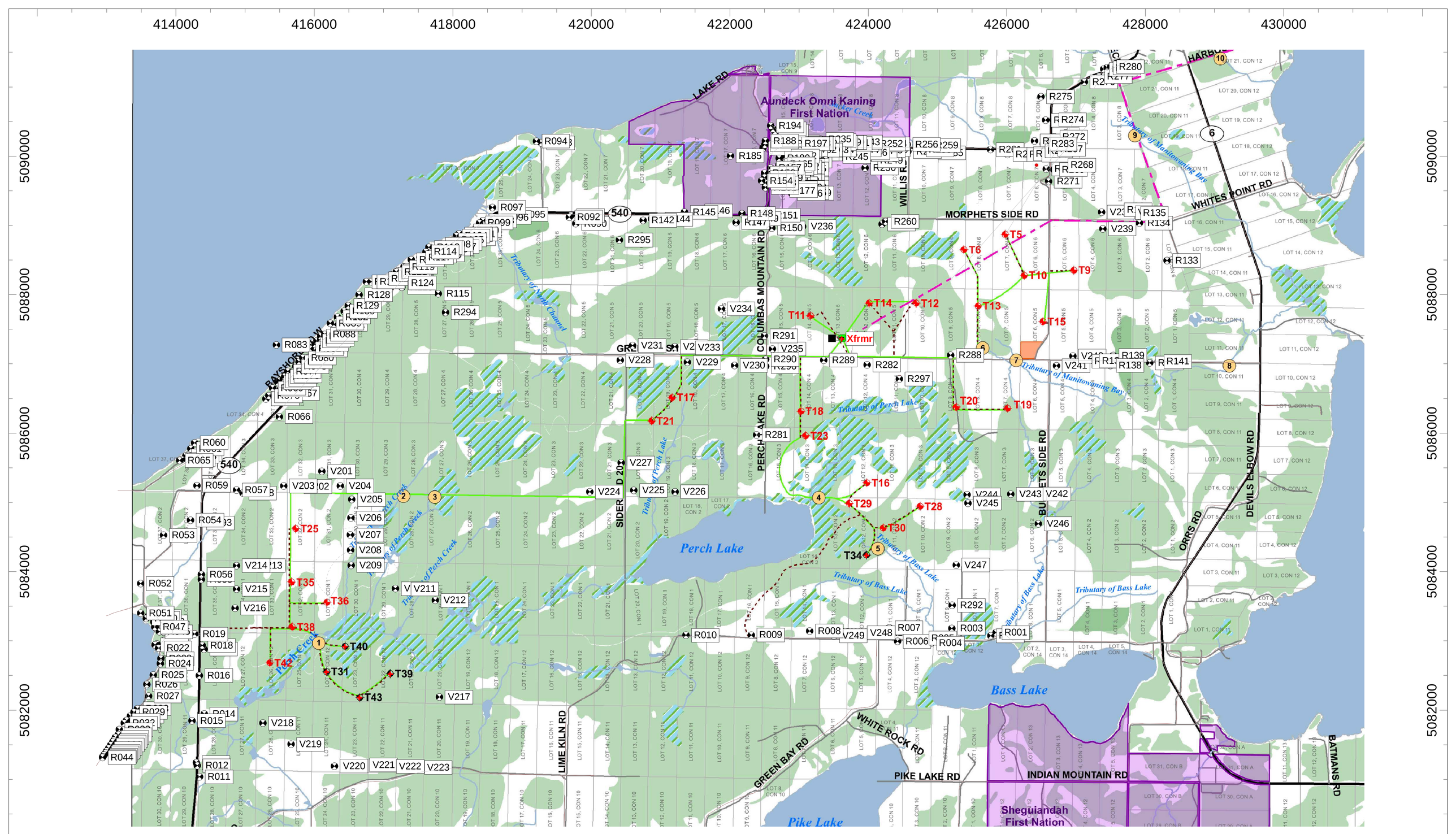
Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R226	4.5	Residence	422951	5089869	2187	T11	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R227	4.5	Residence	422995	5089931	2245	T11	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R228	4.5	Residence	422932	5089974	2293	T11	26.9	26.9	26.9	26.9	26.9	40	43	45	49	51	Yes
R229	4.5	Residence	423145	5090030	2321	T14	27.2	27.2	27.2	27.2	27.2	40	43	45	49	51	Yes
R230	4.5	Residence	423146	5090090	2377	T14	27.1	27.1	27.1	27.1	27.1	40	43	45	49	51	Yes
R231	4.5	Residence	423191	5090099	2369	T14	27.8	27.8	27.8	27.8	27.8	40	43	45	49	51	Yes
R232	4.5	Residence	423219	5090091	2352	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R233	4.5	Residence	423271	5090090	2334	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R234	4.5	Residence	423351	5090090	2310	T14	28.0	28.0	28.0	28.0	28.0	40	43	45	49	51	Yes
R235	4.5	Residence	423309	5090243	2469	T14	27.6	27.6	27.6	27.6	27.6	40	43	45	49	51	Yes
R236	4.5	Residence	423340	5090227	2445	T14	27.8	27.8	27.8	27.8	27.8	40	43	45	49	51	Yes
R237	4.5	Residence	423365	5090198	2411	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R238	4.5	Residence	423343	5090178	2397	T14	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R239	4.5	Residence	423451	5090198	2389	T14	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R240	4.5	Residence	423498	5090196	2377	T14	28.2	28.2	28.2	28.2	28.2	40	43	45	49	51	Yes
R241	4.5	Residence	423572	5090189	2355	T14	28.4	28.4	28.4	28.4	28.4	40	43	45	49	51	Yes
R242	4.5	Residence	423672	5090170	2283	T06	28.6	28.6	28.6	28.6	28.6	40	43	45	49	51	Yes
R243	4.5	Residence	423723	5090202	2267	T06	28.6	28.6	28.6	28.6	28.6	40	43	45	49	51	Yes
R244	4.5	Residence	423707	5090089	2203	T06	29.0	29.0	29.0	29.0	29.0	40	43	45	49	51	Yes
R245	4.5	Residence	423552	5089992	2166	T14	28.8	28.8	28.8	28.8	28.8	40	43	45	49	51	Yes
R246	4.5	Residence	423828	5090048	2086	T06	29.4	29.4	29.4	29.4	29.4	40	43	45	49	51	Yes
R247	4.5	Residence	423935	5090074	2026	T06	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R248	4.5	Residence	423960	5090021	1971	T06	30.1	30.1	30.1	30.1	30.1	40	43	45	49	51	Yes
R249	4.5	Residence	424053	5089936	1845	T06	30.5	30.5	30.5	30.5	30.5	40	43	45	49	51	Yes
R250	4.5	Residence	423953	5089829	1848	T06	30.8	30.8	30.8	30.8	30.8	40	43	45	49	51	Yes
R251	4.5	Residence	424006	5090163	2041	T06	29.5	29.5	29.5	29.5	29.5	40	43	45	49	51	Yes
R252	4.5	Residence	424053	5090175	2019	T06	29.6	29.6	29.6	29.6	29.6	40	43	45	49	51	Yes
R253	4.5	Residence	424051	5090082	1951	T06	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R254	4.5	Residence	424114	5090178	1982	T06	29.7	29.7	29.7	29.7	29.7	40	43	45	49	51	Yes
R255	4.5	Residence	424124	5090094	1911	T06	30.0	30.0	30.0	30.0	30.0	40	43	45	49	51	Yes
R256	4.5	Residence	424562	5090170	1725	T06	29.9	29.9	29.9	29.9	29.9	40	43	45	49	51	Yes
R257	4.5	Residence	424572	5090066	1629	T06	30.7	30.7	30.7	30.7	30.7	40	43	45	49	51	Yes
R258	4.5	Residence	424757	5090092	1570	T06	30.7	30.7	30.7	30.7	30.7	40	43	45	49	51	Yes
R259	4.5	Residence	424854	5090155	1594	T06	30.5	30.5	30.5	30.5	30.5	40	43	45	49	51	Yes
R260	4.5	Residence	424251	5089057	1195	T06	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
R261	4.5	Residence	425766	5090096	1245	T05	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
R262	4.5	Residence	426208	5090025	1183	T05	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R263	4.5	Residence	426302	5090035	1215	T05	27.9	27.9	27.9	27.9	27.9	40	43	45	49	51	Yes
R264	4.5	Residence	426427	5090016	1238	T05	27.8	27.8	27.8	27.8	27.8	40	43	45	49	51	Yes
R265	4.5	Residence	426470	5090076	1309	T05	27.3	27.3	27.3	27.3	27.3	40	43	45	49	51	Yes
R266	4.5	Residence	426400	5090220	1421	T05	29.1	29.1	29.1	29.1	29.1	40	43	45	49	51	Yes
R267	4.5	Residence	426654	5090101	1412	T05	26.8	26.8	26.8	26.8	26.8	40	43	45	49	51	Yes
R268	4.5	Residence	426803	5089870	1306	T05	27.7	27.7	27.7	27.7	27.7	40	43	45	49	51	Yes
R269	4.5	Residence	426680	5089805	1178	T05	28.5	28.5	28.5	28.5	28.5	40	43	45	49	51	Yes
R270	4.5	Residence	426571	5089815	1124	T05	28.7	28.7	28.7	28.7	28.7	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
R271	4.5	Residence	426605	5089636	999	T05	29.8	29.8	29.8	29.8	29.8	40	43	45	49	51	Yes
R272	4.5	Residence	426686	5090278	1584	T05	28.0	28.0	28.0	28.0	28.0	40	43	45	49	51	Yes
R273	4.5	Residence	426560	5090519	1755	T05	28.8	28.8	28.8	28.8	28.8	40	43	45	49	51	Yes
R274	4.5	Residence	426669	5090525	1800	T05	28.6	28.6	28.6	28.6	28.6	40	43	45	49	51	Yes
R275	4.5	Residence	426494	5090859	2061	T05	28.1	28.1	28.1	28.1	28.1	40	43	45	49	51	Yes
R276	4.5	Residence	427119	5091071	2487	T05	26.6	26.6	26.6	26.6	26.6	40	43	45	49	51	Yes
R277	4.5	Residence	427330	5091149	2658	T05	26.4	26.4	26.4	26.4	26.4	40	43	45	49	51	Yes
R278	4.5	Residence	427400	5091255	2785	T05	25.9	25.9	25.9	25.9	25.9	40	43	45	49	51	Yes
R279	4.5	Residence	427452	5091277	2831	T05	25.8	25.8	25.8	25.8	25.8	40	43	45	49	51	Yes
R280	4.5	Residence	427503	5091292	2871	T05	25.6	25.6	25.6	25.6	25.6	40	43	45	49	51	Yes
R281	4.5	Residence	422388	5085974	703	T23	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	Yes
R282	4.5	Residence	423985	5086985	889	T14	38.8	38.8	38.8	38.8	38.8	40	43	45	49	51	Yes
R283	4.5	Residence	426527	5090176	1424	T05	26.7	26.7	26.7	26.7	26.7	40	43	45	49	51	Yes
R284	4.5	Residence	426010	5090024	1158	T05	31.1	31.1	31.1	31.1	31.1	40	43	45	49	51	Yes
R285	4.5	Residence	424926	5090047	1469	T06	31.2	31.2	31.2	31.2	31.2	40	43	45	49	51	Yes
R286	4.5	Residence	424200	5089019	1161	T14	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
R287	4.5	Residence	427148	5087039	850	T15	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	Yes
R288	4.5	Residence	425189	5087124	749	T20	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	Yes
R289	4.5	Residence	423357	5087054	669	T11	40.0	40.0	40.0	40.0	40.0	40	43	45	49	51	Yes
R290	4.5	Residence	422517	5087064	895	T11	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	Yes
R291	4.5	Residence	422500	5087404	716	T11	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	Yes
R292	4.5	Residence	425210	5083512	1435	T34	32.5	32.5	32.5	32.5	32.5	40	43	45	49	51	Yes
R293	4.5	Residence	414364	5084702	1367	T25	32.2	32.2	32.2	32.2	32.2	40	43	45	49	51	Yes
R294	4.5	Residence	417895	5087741	3363	T21	17.2	17.2	17.2	17.2	17.2	40	43	45	49	51	Yes
R295	4.5	Residence	420407	5088789	2402	T17	21.2	21.2	21.2	21.2	21.2	40	43	45	49	51	Yes
R296	4.5	Residence	422517	5086964	822	T18	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	Yes
R297	4.5	Residence	424447	5086782	910	T20	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	Yes
V201	4.5	Vacant Lot	416111	5085448	916	T25	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
V202	4.5	Vacant Lot	415772	5085228	614	T25	37.1	37.1	37.1	37.1	37.1	40	43	45	49	51	Yes
V203	4.5	Vacant Lot	415560	5085236	644	T25	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	Yes
V204	4.5	Vacant Lot	416378	5085236	898	T25	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	Yes
V205	4.5	Vacant Lot	416543	5085041	919	T25	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
V206	4.5	Vacant Lot	416530	5084775	817	T25	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	Yes
V207	4.5	Vacant Lot	416522	5084529	797	T25	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	Yes
V208	4.5	Vacant Lot	416526	5084309	831	T36	38.2	38.2	38.2	38.2	38.2	40	43	45	49	51	Yes
V209	4.5	Vacant Lot	416531	5084090	642	T36	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	Yes
V210	4.5	Vacant Lot	417174	5083754	1013	T36	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	Yes
V211	4.5	Vacant Lot	417314	5083750	1150	T36	35.9	35.9	35.9	35.9	35.9	40	43	45	49	51	Yes
V212	4.5	Vacant Lot	417746	5083584	1248	T39	34.2	34.2	34.2	34.2	34.2	40	43	45	49	51	Yes
V213	4.5	Vacant Lot	415097	5084087	621	T35	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	Yes
V214	4.5	Vacant Lot	414878	5084087	827	T35	37.1	37.1	37.1	37.1	37.1	40	43	45	49	51	Yes
V215	4.5	Vacant Lot	414878	5083745	796	T35	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	Yes
V216	4.5	Vacant Lot	414857	5083473	867	T38	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	Yes
V217	4.5	Vacant Lot	417808	5082187	786	T39	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	Yes
V218	4.5	Vacant Lot	415257	5081810	870	T42	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	Yes

Point of Reception ID	Receptor Height [m]	Receptor Description			Distance to nearest Turbine [m]	Turbine ID	Calculated Sound Pressure Level [dBA] at Selected Windspeed [m/s]					Sound Level Limit [dBA] at Selected Windspeed [m/s]					Compiance with Limit [Yes/No]
			Easting	Northing			<=6	7	8	9	10	<=6	7	8	9	10	
V219	4.5	Vacant Lot	415663	5081506	1162	T31	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	Yes
V220	4.5	Vacant Lot	416293	5081191	1051	T43	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	Yes
V221	4.5	Vacant Lot	416719	5081207	974	T43	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
V222	4.5	Vacant Lot	417104	5081186	1090	T43	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	Yes
V223	4.5	Vacant Lot	417509	5081170	1323	T43	32.6	32.6	32.6	32.6	32.6	40	43	45	49	51	Yes
V224	4.5	Vacant Lot	419978	5085151	1354	T21	31.3	31.3	31.3	31.3	31.3	40	43	45	49	51	Yes
V225	4.5	Vacant Lot	420615	5085171	1031	T21	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	Yes
V226	4.5	Vacant Lot	421208	5085154	1071	T21	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	Yes
V227	4.5	Vacant Lot	420433	5085569	742	T21	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	Yes
V228	4.5	Vacant Lot	420419	5087052	920	T17	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	Yes
V229	4.5	Vacant Lot	421390	5087021	562	T17	38.4	38.4	38.4	38.4	38.4	40	43	45	49	51	Yes
V230	4.5	Vacant Lot	422068	5086978	1022	T17	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	Yes
V231	4.5	Vacant Lot	420597	5087265	943	T17	34.3	34.3	34.3	34.3	34.3	40	43	45	49	51	Yes
V232	4.5	Vacant Lot	421205	5087247	741	T17	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	Yes
V233	4.5	Vacant Lot	421420	5087234	771	T17	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	Yes
V234	4.5	Vacant Lot	421881	5087794	1278	T11	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	Yes
V235	4.5	Vacant Lot	422617	5087216	719	T11	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	Yes
V236	4.5	Vacant Lot	423052	5088985	1297	T11	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	Yes
V237	4.5	Vacant Lot	427368	5089192	937	T09	34.2	34.2	34.2	34.2	34.2	40	43	45	49	51	Yes
V238	4.5	Vacant Lot	427775	5089185	1168	T09	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	Yes
V239	4.5	Vacant Lot	427385	5088950	736	T09	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	Yes
V240	4.5	Vacant Lot	426953	5087112	660	T15	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	Yes
V241	4.5	Vacant Lot	426719	5086974	664	T15	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	Yes
V242	4.5	Vacant Lot	426443	5085121	1309	T19	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	Yes
V243	4.5	Vacant Lot	426058	5085116	1239	T19	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	Yes
V244	4.5	Vacant Lot	425429	5085108	706	T28	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	Yes
V245	4.5	Vacant Lot	425439	5084988	699	T28	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	Yes
V246	4.5	Vacant Lot	426457	5084691	1724	T19	32.2	32.2	32.2	32.2	32.2	40	43	45	49	51	Yes
V247	4.5	Vacant Lot	425270	5084096	999	T28	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	Yes
V248	4.5	Vacant Lot	423904	5083118	1119	T34	33.1	33.1	33.1	33.1	33.1	40	43	45	49	51	Yes
V249	4.5	Vacant Lot	423503	5083074	1252	T34	32.5	32.5	32.5	32.5	32.5	40	43	45	49	51	Yes

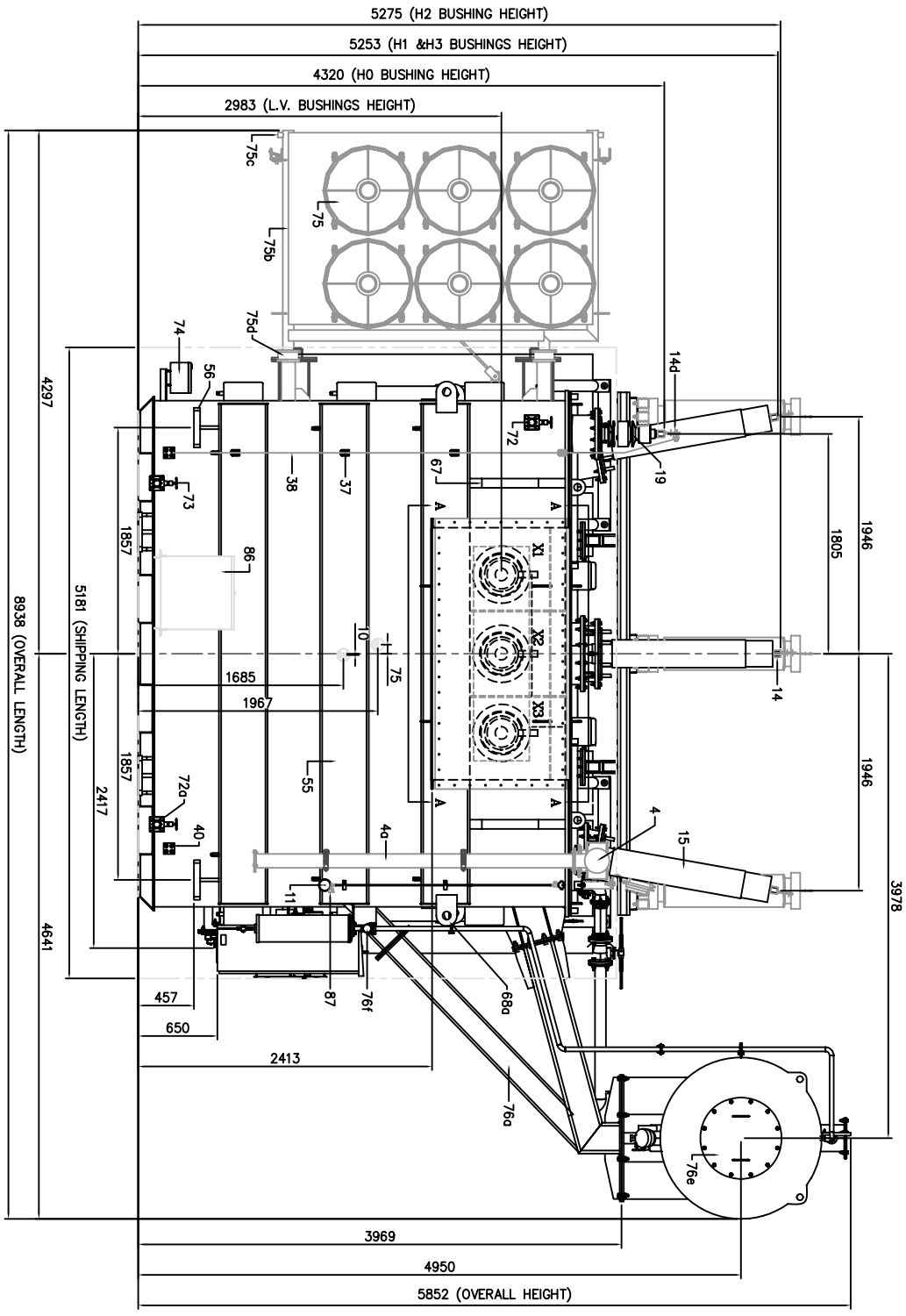


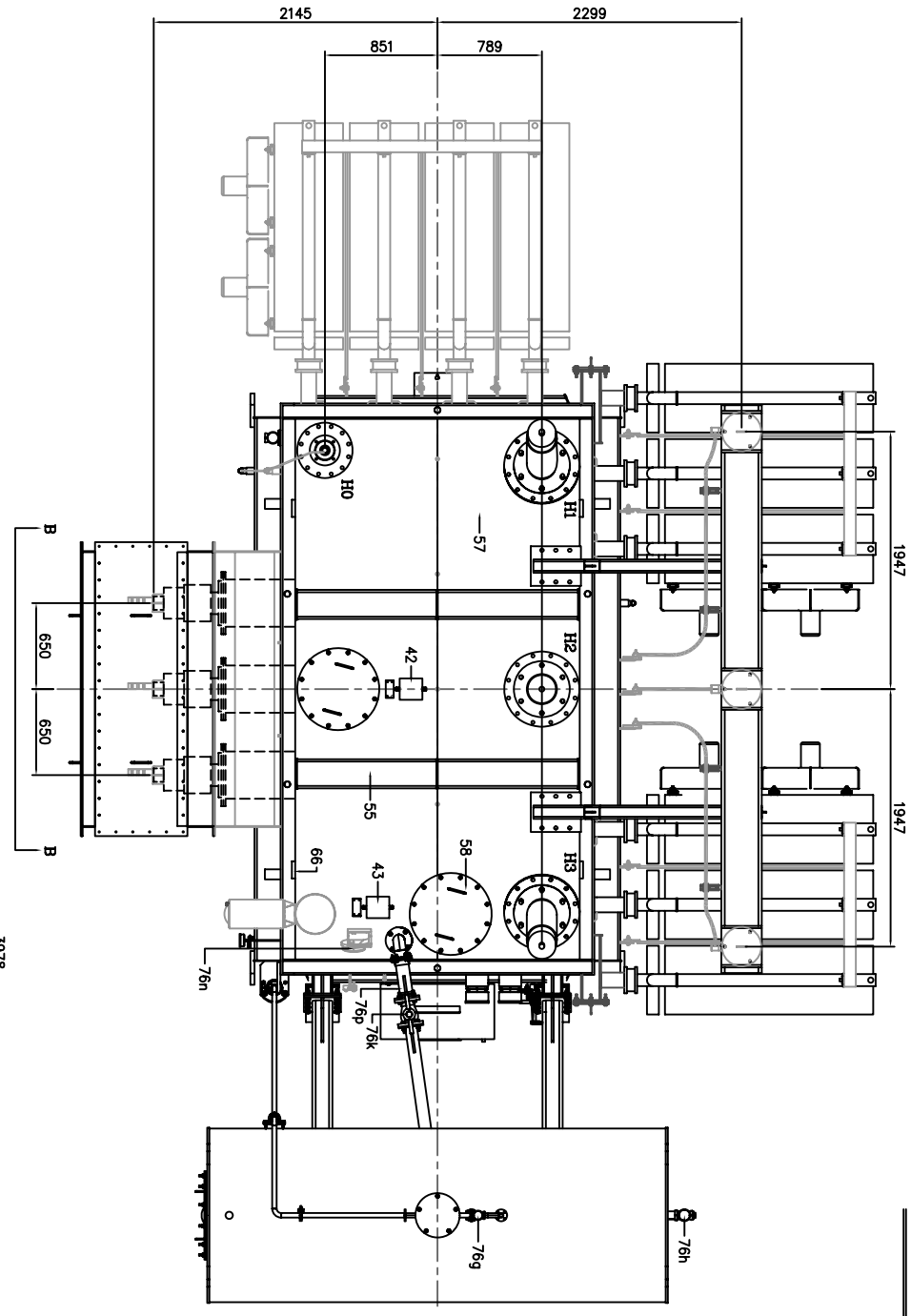
aercoustics engineering limited	M1 Manitoulin Island Wind Farm Key Plan	Drawn: BS	Eng: PA	Drawing: Key Plan	
	50 Ronson Drive Suite 165, Toronto, Canada M9W 1B3 T. 416 249 3361	Date: June 30, 2011		Scale: NTS	Fig: 1



aercoustics engineering limited	M1 Manitoulin Island Wind Farm Turbine, Transformer, and Receptor Layout GE 2.5-103 Turbines	Drawn: BS Eng: PA	Drawing: Turbine, Transformer, and Receptor Layout
	50 Ronson Drive Suite 165, Toronto, Canada M9W 1B3 T. 416 249 3361	Date: June 30, 2011	Scale: 1:25,000 if printed on A1 Fig: 2

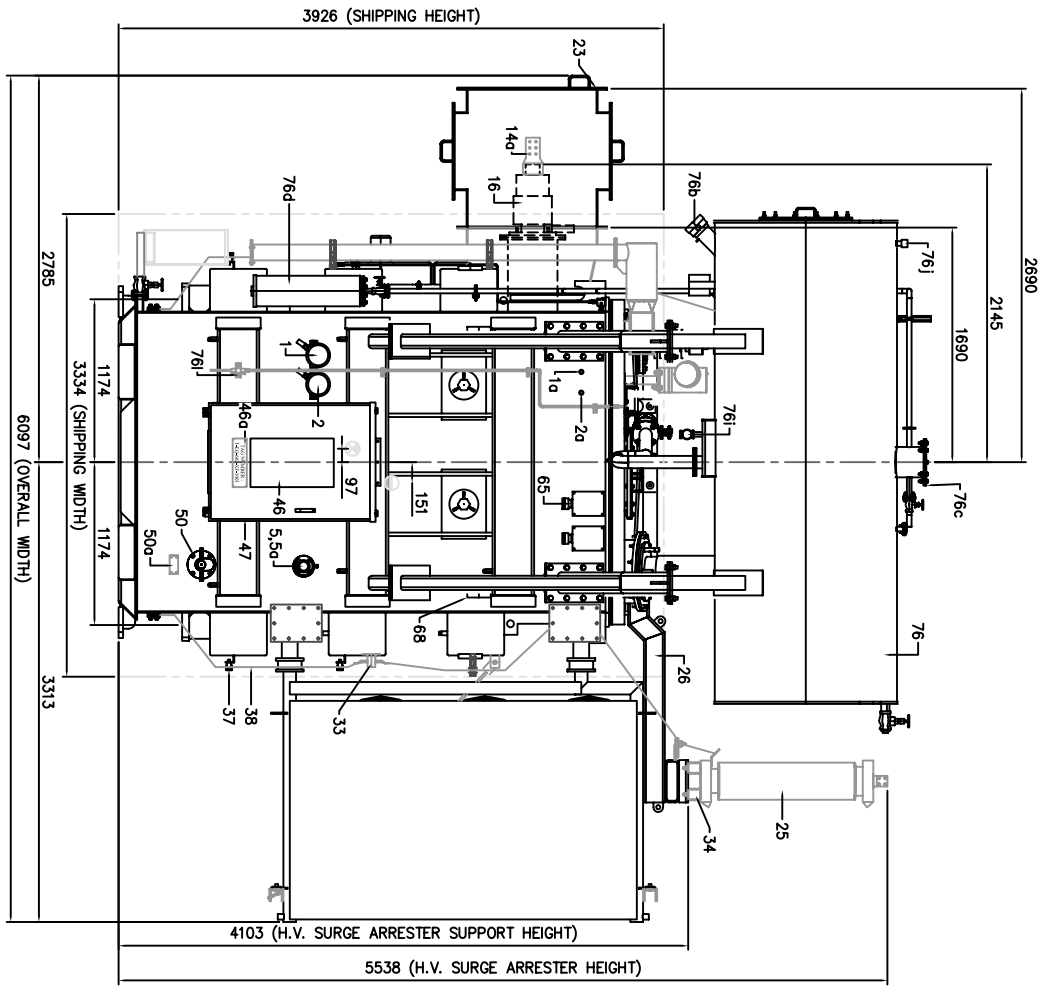
Figure 3 - Transformer Dimensions

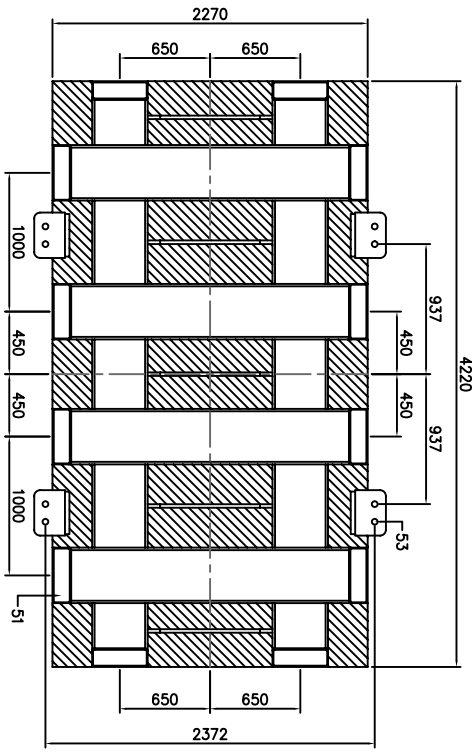




DETAIL "A-A"

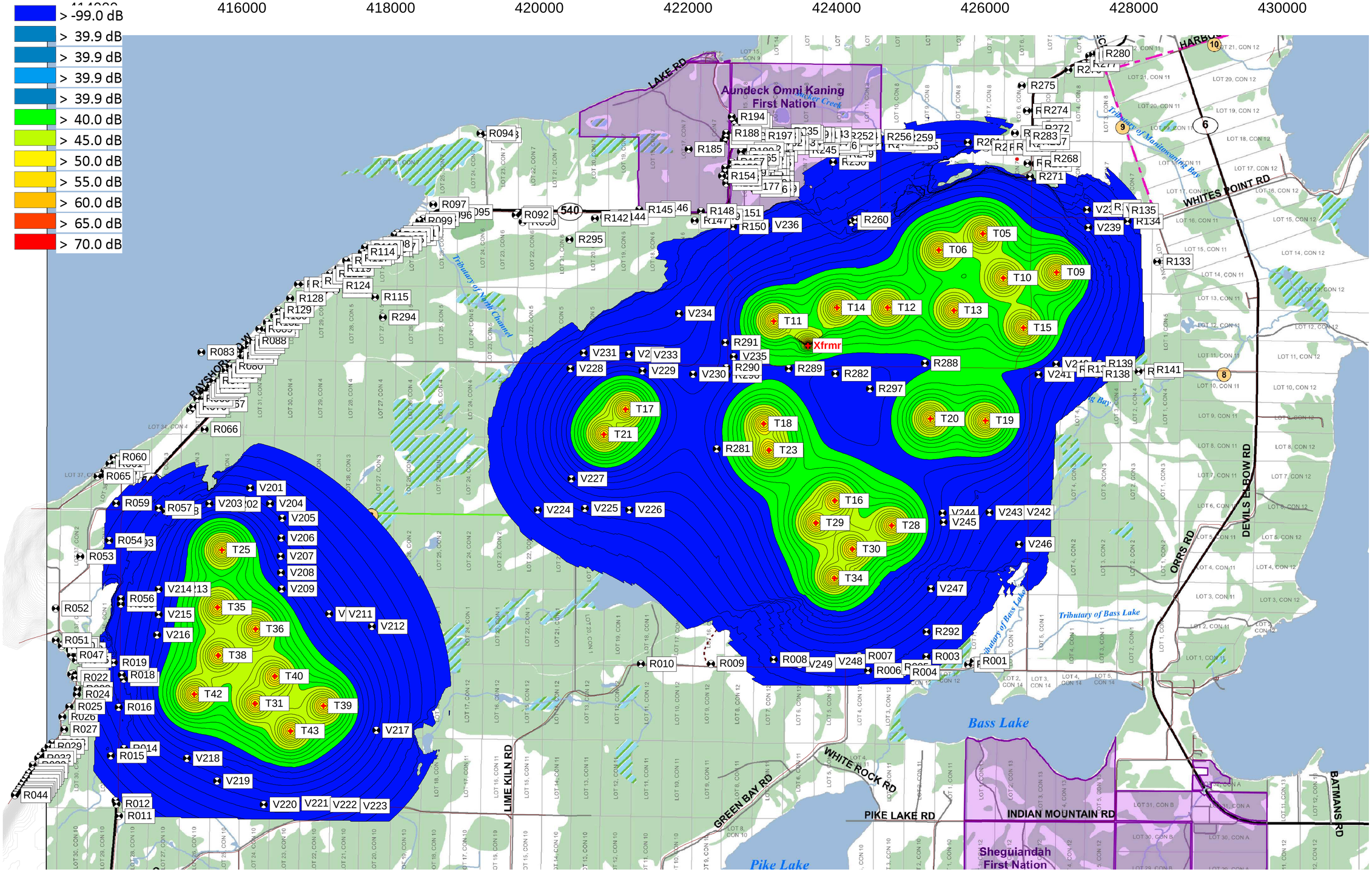
DETAIL "B-B"





"BOTTOM VIEW"

THE HATCHED AREA REPRESENT THE BOTTOM OF THE TRANSFORMER, THIS AREA DOESN'T SIT ON THE FLOOR.



aercoustics engineering limited

M1 Manitoulin Island Wind Farm
Noise Contour (4.5m high grid)
GE 2.5-103 Turbines

Windspeed: 6m/s Wind Shear = 0.435

50 Ronson Drive Suite 165, Toronto, Canada M9W 1B3 T. 416 249 3361

Drawn:	Eng:	Drawing:
BS	PA	Noise Contour (4.5m high grid)

Date:	Scale:	Fig:
June 30, 2011	1:25,000 if printed on A1	5

ATTACHMENT A

REPRINT OF MOE PUBLICATION, OCTOBER 2008

NOISE GUIDELINES FOR WIND FARMS
INTERPRETATION FOR APPLYING MOE NPC PUBLICATIONS TO
WIND POWER GENERATION FACILITIES

Noise Guidelines for Wind Farms

Interpretation for Applying MOE NPC Publications to
Wind Power Generation Facilities

Ministry of the Environment

October 2008

NOISE GUIDELINES FOR WIND FARMS

Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities

October 2008

This document establishes the sound level limits for land-based wind power generating facilities and describes the information required for noise assessments and submissions under the Environmental Assessment Act and the Environmental Protection Act. It replaces the document "Interpretation for Applying MOE NPC Technical Publications to Wind Turbine Generators," Version 1.0, July 6, 2004.

Table of Contents

TABLES

FIGURE

1. SCOPE

Noise impacts of proposed land-based wind power generation facilities, i.e. Wind Farms, are considered in the course of assessing an application for a Certificate of Approval (Air/Noise), in accordance with section 9 of the *Environmental Protection Act*. Wind Farms two megawatts or more are subject to review under the Environmental Screening Process, in accordance with Ontario Regulation 116/01 under the *Environmental Assessment Act*, and noise impacts are also considered during review under the screening process. The purpose of this document is to describe the applicable sound level limits and to specify the information proponents are to submit to the Ministry of the Environment when seeking approval for a proposed land-based Wind Farm. This document has been developed to provide consistency in the submissions and to streamline the review and approval process. Accordingly, the guidance contained herein is intended to provide uniformity in planning of Wind Farms in Ontario.

Proponents of Wind Farms are to prepare and submit to the Ministry of the Environment (MOE) a Noise Assessment Report that includes details of the wind turbine design and operation, location of the wind turbine(s) within the specific site and surrounding area, as well as summary of compliance with the applicable sound level limits. If applicable, the Noise Assessment Report must also include similar details of the Transformer Substation used for transforming the power from the wind turbine units. This document defines a template for the Noise Assessment Report to be submitted to the MOE.

This document also provides guidance on the assessment of the combined noise impact produced by the proposed Wind Farm in combination with the noise impact of approved Wind Farms or Wind Farms that are in the process of being planned.

2. REFERENCES

Reference is made to the following publications:

[1] NPC-104, “Sound Level Adjustments,” Ontario Ministry of the Environment

[2] NPC-205, “Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban),” Ontario Ministry of the Environment

[3] NPC-206, “Sound Levels due to Road Traffic,” Ontario Ministry of the Environment

[4] NPC-232, “Sound Level Limits for Stationary Sources in Class 3 Areas (Rural),” Ontario Ministry of the Environment

[5] CAN/CSA-C61400-11-07, “Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques”

[6] ISO 9613-2, “Acoustics-Attenuation of sound during propagation outdoors - Part 2: General method of calculation”

[7] ANSI/IEEE C57.12.90, “Distribution, Power, and Regulating Transformers”

3. DEFINITIONS

For the purpose of this document, the following definitions apply:

“Environmental Screening Process” is a prescribed planning process for electricity projects set out in Part B of the Guide to Environmental Assessment Requirements for Electricity Projects. As set out in Ontario Regulation 116/01 under the *Environmental Assessment Act*, certain electricity projects are subject to review under the Environmental Screening Process.

"Noise Assessment Report" means a report for wind power electricity generation projects, prepared in accordance with the guidance described in this document.

"Participating Receptor" means a property that is associated with the Wind Farm by means of a legal agreement with the property owner for the installation and operation of wind turbines or related equipment located on that property.

"Switching Station" means a collection point for the outputs of the wind turbine generators. Switching Stations are not significant noise sources.

"Transformer Substation" means a central facility comprised of power transformer(s) and associated equipment such as cooling fans for transforming the electrical outputs from the wind turbine generators to a higher voltage for input to the grid transmission system. Transformer Substations are significant noise sources.

"Wind Farm" means an electrical generating facility comprised of an array of wind turbine generators and a common electrical connection point such as a Transformer Substation or a Switching Station.

The following definitions are also included in the current Publications NPC-205 and NPC-232, References [2] and [4]:

"Class 1 Area" means an area with an acoustical environment typical of a major population centre, where the background noise is dominated by the urban hum.

"Class 2 Area" means an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring only between 23:00 and 07:00 hours in Class 1 Areas, will typically be realized as early as 19:00 hours.

Other characteristics which may indicate the presence of a Class 2 Area include:

i. absence of urban hum between 19:00 and 23:00 hours;
ii. evening background sound level defined by natural environment and infrequent human activity; and
iii. no clearly audible sound from stationary sources other than from those under consideration.

"Class 3 Area" means a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic, such as the following:

i. a small community with less than 1000 population;
ii. agricultural area;
iii. a rural recreational area such as a cottage or a resort area; or
iv. a wilderness area.

The following definition is also included in the current Publication NPC-232, Reference [4]:

"Point of Reception" means any point on the premises of a person within 30 m of a dwelling or a camping area, where sound or vibration originating from other than those premises is received.

For the purpose of approval of new sources, including verifying compliance with section 9 of the *Environmental Protection Act*, the Point of Reception may be located on any of the following existing or zoned for future use premises: permanent or seasonal residences,

hotels/motels, nursing/retirement homes, rental residences, hospitals, camp grounds, and noise sensitive buildings such as schools and places of worship.

For equipment/facilities proposed on premises such as nursing/retirement homes, rental residences, hospitals, and schools, the Point of Reception may be located on the same premises.

4. DESCRIPTION OF WIND FARM NOISE

A Wind Farm is a collection of wind turbines, located in the same area, used for the production of electric power. As the individual wind turbines are separated by several hundred metres from each other, a large wind farm covers an area of tens of square kilometres. Larger Wind Farms may include a Transformer Substation that collects and increases the voltage produced by the turbines to the higher voltage for the grid transmission system.

A typical wind turbine consists of a tall tower with a hub (nacelle or housing) containing the drive-train and generator mounted on top of the tower. Three rotating blades (typically) are connected to a horizontal hub. In general, the significant noise sources associated with the operation of a Wind Farm are the wind turbines and the Transformer Substation. Noise from wind turbines consists of the aerodynamic noise caused by blades passing through the air, and mechanical noise created by the operation of mechanical elements of the drive-train. Close to the turbine, the noise typically exhibits a swishing sound as the blades rotate; and the whirr of the drive-train and generator. However, as distance from the turbine increases, these effects are reduced. The wind turbine noise perceived at receptors is typically broadband in nature. Any tonal character associated with the wind turbine noise is generally associated with maintenance issues.

The Transformer Substation noise is produced by the vibration of the transformer core and associated components, and by the operation of other equipment such as cooling fans. The noise produced by a Transformer Substation generally exhibits a pronounced hum, associated with the fundamental electrical frequency and its harmonics. Consequently, the Transformer Substation noise perceived at receptors is typically tonal.

The noise produced by wind turbines, as well as the background noise, typically increases with wind speed. The noise produced by a Transformer Substation is unaffected by the wind speed.

5. SOUND LEVEL LIMITS FOR WIND FARMS

5.1 Limits for Wind Turbine Generators

The sound level limits for wind turbines are set relative to the existing MOE Noise Guidelines in Publications NPC-205 and NPC-232, References [2] and [4], as well as to a reference wind induced background sound level. Consistent with these guidelines, the sound level limits, expressed in terms of the hourly, “A-weighted,” equivalent sound level (L_{eq}), apply at Points of Reception.

a) Receptors in Class 1 & 2 Areas (Urban)

The sound level limits at a Point of Reception in Class 1 & 2 Areas (Urban) are given by the applicable values in Table 1 and Figure 1, or by the sound level limits, established in accordance with requirements in Publication NPC-205.

b) Receptors in Class 3 Areas (Rural)

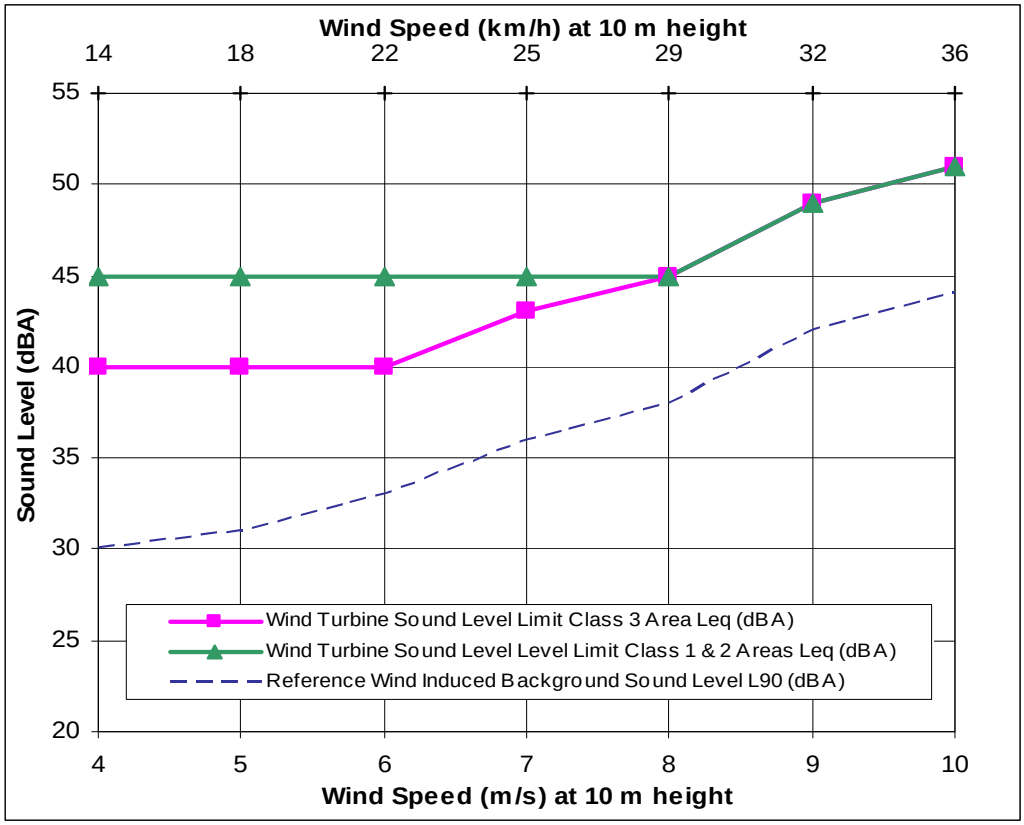
The sound level limits at a Point of Reception in Class 3 Areas (Rural) are given by the applicable values in Table 1 and Figure 1, or by the sound level limits, established in accordance with requirements in Publication NPC-232.

The wind turbine sound level limits are given at integer values of the wind speed and are shown as the solid lines in Figure 1. The dashed line in Figure 1 does not represent a limit and is included only for information purposes[1]. These sound level limits range from the lowest value of 40 dBA for Class 3 Areas and wind speeds at or below 4 m/s to the maximum value of 51 dBA for wind speeds at or above 10 m/s.

Table 1 Summary of Sound Level Limits for Wind Turbines

Wind Speed (m/s) at 10 m height	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Wind Turbine Sound Level Limits Class 3 Area, dBA	40.0	40.0	40.0	43.0	45.0	49.0	51.0
Wind Turbine Sound Level Limits Class 1 & 2 Areas, dBA	45.0	45.0	45.0	45.0	45.0	49.0	51.0

Figure 1 Summary of Sound Level Limits for Wind Turbines



[1] The measurement of wind induced background sound level is not required to establish the applicable limit. The wind induced background sound level reference curve, dashed line in Figure 1, was determined by correlating the A-weighted ninetieth percentile sound level (L_{90}) with the average wind speed measured at a particularly quiet site. The applicable L_{eq} sound level limits at higher wind speeds are given by adding 7 dB to the wind induced background L_{90} sound level reference values, using the principles for establishing sound level limits described in Publication NPC-232, Reference [4].

5.2 Limits for Wind Turbine Generators and Transformer Substations

In cases where the noise impact at a Point of Reception is composed of combined contributions due to the Transformer Substation as well as the wind turbine generators, the applicable limits are those shown in Table 1 and Figure 1, as described in Section 5.1.

The combined noise impact must comply with the limits at all the wind speeds from 0 m/s to 10 m/s. It should be noted that the acoustic emissions from a Transformer Substation are independent and unrelated to the wind speed, unlike the acoustic emissions from wind turbine generators which are wind speed dependent.

In determining the combined impact, a 5 dB adjustment must be added to the Transformer Substation noise in accordance with Publication NPC-104, Reference [1].

5.3 Limits for Transformer Substations

In unique cases where the noise impact assessment at a Point of Reception is limited to the operation of the Transformer Substation, as in a case described in Section 6.4.1, the sound level limit at a Point of Reception is given in the Publication NPC-205, Reference [2] or Publication NPC-232, Reference [4], whichever is applicable. The limit is independent of wind induced noise.

In order to account for the tonal characteristics of Transformer Substation noise, a 5 dB adjustment must be added to the acoustic emissions in accordance with Publication NPC-104, Reference [1].

6. NOISE ASSESSMENT REPORT

A Noise Assessment Report must be prepared for all proposed Wind Farms. The requirements for a detailed noise impact assessment depend on the proximity of the Wind Farm to receptors and are described in Section 6.4. The report must be submitted in a hard copy as well as in an electronic format.

The Noise Assessment Report must demonstrate compliance with the applicable sound level limits and the supporting information must be organized in a clear and concise manner. The report must be prepared by a qualified acoustical consultant and the cover document must be signed by the proponent for the project.

The Noise Assessment Report should be performed early in the planning of the project, as part of the Environmental Screening Process. The expectation of the MOE is that the submitted Noise Assessment Report be complete and accurate. Results of the Noise Assessment Report should be included in the Screening Report or Environmental Review Report prepared under the Environmental Screening Process. Any revisions to the Noise Assessment Report following the completion of the Environmental Screening Process should be very limited and clearly identified. In cases where complete information about the Wind Farm (e.g., information relating the transformer equipment) was not available at the environmental screening stage, such information must be provided to the MOE with the application for the Certificate of Approval under section 9 of the *Environmental Protection Act* for the Wind Farm.

As a minimum, the report must include the following sections in the given sequence:

6.1 Project Layout

The overall plan of the Wind Farm must be described in detail for the purpose of supporting the noise impact assessment calculations and for demonstrating compliance with the sound level

limits. General project layout description must be supported with clear maps of the site and surrounding area, complete with scale, northing, and legend information. A suitable minimum drawing scale for the overall plan of the project is 1 cm : 500 m.

The following details must be included:

a) Geographic location of the project study area;
b) Locations of wind turbines;
c) Location of Transformer Substation or Switching Station;
d) Locations of all receptors including buildings, dwellings, campsites, places of worship, and institutions, up to 2000 m from any wind turbine location; and
e) Property boundaries of lands associated with the project and location of dwellings therein.

The following additional information must be included, if applicable:

f) Municipal zoning and land-use plans;
g) Topographical features including roadways, terrain elevations, and ground cover; and
h) Available information regarding the location and scope of other approved[2] Wind Farms, and Wind Farms in the process of being planned[3], located within 5 km of any wind turbine generators of the proposed Wind Farm.

6.2 Noise Sources

For the purposes of this document, noise sources mean land-based wind turbine generators and Transformer Substations.

6.2.1 Description

The Noise Assessment Report must include the description of the wind turbine generators, including: manufacturer's make and model, maximum electrical output rating, hub height above grade, range of rotational speeds, and mode of operation.

The Noise Assessment Report must also include the description of the Transformer Substation, including all available information at the time of submission on the manufacturer's make and model designations, maximum electrical output rating, primary and secondary voltages, method of cooling, physical dimensions, drawing showing elevation and plan views of the unit, and any noise abatement measures.

Manufacturer's specifications should be included in an Appendix.

6.2.2 Wind Turbines

The acoustic emissions of the wind turbine must be specified by the manufacturer for the full range of rated operation and wind speeds. As a minimum, the information must include the sound power levels, frequency spectra in octave bands (63 to 8000 Hz), and tonality at integer

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[2] For the purposes of this document, a Wind Farm is considered to be "approved" if a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has been issued.

[3] For the purposes of this document, a Wind Farm is considered to be "in the process of being planned" if a Notice of Commencement has been issued for the project in accordance with the Environmental Screening Process prescribed under Ontario Regulation 116/01 under the *Environmental Assessment Act*, but for which a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has not yet been issued.

wind speeds from 6 to 10 m/s. The acoustic emission information must be determined and reported in accordance with the international standard CAN/CSA-C61400-11-07, Reference [5].

6.2.3 Adjustment to Wind Turbine Generator Acoustic Emissions for Wind Speed Profile

The wind speed profile on site of the Wind Farm may have an effect on the manufacturer's wind turbine acoustic emission data and, consequently, on the sound levels predicted at a Point of Reception. Therefore, the wind turbine generator acoustic emission levels must be consistent with the wind speed profile of the project area.

To address this issue, the assessment must use manufacturer's acoustic emission data adjusted for the average summer night time wind speed profile, representative of the site.

The adjusted acoustic emissions data must be used in the noise impact assessment at each receptor. The manufacturer's acoustic emissions data and the adjusted acoustic emission data used in the noise impact assessment must be tabulated in Table 3.

6.2.4 Transformer Substation

The acoustic emissions of each transformer unit must be specified by the manufacturer and conform to the standard ANSI/IEEE C57.12.90, Reference [7]. In cases where the specific information is not available in the early stages of planning the proposed Wind Farm, as described in the introduction to Section 6, proponents must submit a maximum rated value of the transformer acoustic emissions.

The requirements do not apply to the small transformer units attached to each wind turbine. These small transformers are insignificant noise sources and, therefore, their contributions do not require assessment.

The acoustic emissions data must be used in the noise impact assessment at each receptor.

6.2.5 Noise Sources and Locations

All wind turbine units and Transformer Substations must be assigned a unique source identification and must be listed along with their Universal Transverse Mercator (UTM) coordinates in a table in the report. The table should be provided in electronic form along with the report. A sample table format is shown in Table 4.

The source identifications should remain consistent throughout the submission and review process. Any changes to source identifications in revised versions of the Noise Assessment Report should be explicitly stated.

6.3 Receptors

For the purposes of this document, receptors mean Points of Reception and Participating Receptors, including vacant lots described in Section 6.3.3.

The definitions of a Point of Reception and a Participating Receptor are given in Section 3. The distance requirements for detailed noise assessments at receptors are described in Section 6.4.1. To provide clarity and consistency in the detailed noise assessments, the following describes the specific receptor locations for assessment purposes:

6.3.1 Wind Farm Does Not Include Transformer Substation

a) Single Storey Dwelling

- 4.5 m above grade at the centre of the dwelling; or
- 1.5 m above grade and 30 m horizontally from the façade of the dwelling in the direction of each wind turbine location. If the 30 m radius spans beyond the property line of the dwelling then the receptor location is at the property line.

Either of the two locations is acceptable for assessment[4].

b) Two Storey Dwelling (or Raised Bungalow)

- 4.5 m above grade at the centre of the dwelling.

c) Three Storey or Higher Dwelling

- at the centre of the highest storey of the dwelling.

6.3.2 Wind Farm Includes Transformer Substation

a) Dwellings up to Two Storey High

- 4.5 m above grade at the centre of the dwelling; or
- 1.5 m above grade and 30 m horizontally from the façade of the dwelling in the direction of each wind turbine location. If the 30 m radius spans beyond the property line of the dwelling then the receptor location is at the property line.

The location that results in the higher noise impact must be selected[5].

b) Three Storey or Higher Dwelling

- at the centre of the highest storey of the dwelling; or
- 1.5 m above grade and 30 m horizontally from the façade of the dwelling in the direction of each wind turbine location. If the 30 m radius spans beyond the property line of the dwelling then the receptor location is at the property line.

The location that results in the higher noise impact must be selected[6].

6.3.3 Vacant Lots

Receptors include vacant lots that have been zoned by the local municipality to permit residential or similar noise-sensitive uses, as described in the definition of a Point of Reception in Section 3.

The receptor location, if unknown at the time of the proposal, shall be based on a 1 hectare (10,000 m²) building envelope within the vacant lot property that would reasonably be expected to

[4] Assessment at the centre of the dwelling is simpler. The sound level at 4.5 m above grade at the centre of the dwelling is generally higher.

[5] Assessment at the centre of the dwelling is simpler. The sound level at 4.5 m above grade at the centre of the dwelling is generally higher except where transformer substation noise is a factor.

[6] Assessment at the centre of the dwelling is simpler. The sound level at the highest storey at the centre of the dwelling is generally higher except where transformer substation noise is a factor.

contain the use, and that conforms with the municipal zoning by-laws in effect. The specific receptor location for assessment purposes should be assumed to be 4.5 m above grade and:

- consistent with the typical building pattern in the area, or
- at the centre of the 1 hectare building envelope.

6.3.4 Area Classification of Receptors

Based on the rural nature of the areas surrounding most wind power projects, the Class 3 Area sound level limits shown in Table 1 and Figure 1 apply to all receptors, regardless of their proximity to a roadway, unless it can be shown clearly that less restrictive sound level limits are justified.

Less restrictive sound level limits for receptors within their designated area classification must be justified by analysis of hourly-traffic volumes data or by hourly acoustic monitoring results consistent with Publication NPC-206, Reference [3]. The use of general estimates, such as the Annual Average Daily Traffic data (AADT), is an insufficient method for determining the minimum hourly sound level of the background.

6.3.5 Receptors and Locations

All receptors must be assigned a unique receptor identification and must be tabulated along with their precise coordinates in the report. The table should be provided in electronic form along with the report. A sample table format is shown in Table 5 and Table 6.

The receptor identifications should remain consistent throughout the review process. Any changes to receptor identifications in revised versions of the Noise Assessment Report must be explicitly stated.

6.4 Detailed Noise Impact Assessment

Assessment of the sound levels produced by a Wind Farm, i.e. detailed noise impact assessment, must be made at each Point of Reception and Participating Receptor, within the distance requirements described in Section 6.4.1. In the event that all Points of Reception and Participating Receptors are outside the distance requirements described in Section 6.4.1, a detailed noise impact assessment is not required and the provisions contained in Sections 6.4.2 through to 6.4.10 are not applicable. Note that all proposals for Wind Farm projects must address the requirements described in Sections 6.1, 6.2 and 6.3, and Table 4, Table 5 and Table 6, even if a detailed noise assessment is not required.

The noise assessment must represent the maximum rated output of the Wind Farm, and reflect the principle of “predictable worst case” noise impact, Publications NPC-205 and NPC-232, References [2] and [4].

6.4.1 Distance Requirement

a) Wind Farm Does Not Include Transformer Substation

- A detailed noise impact assessment of the Wind Farm is required if one or more Points of Reception or Participating Receptors are located within 1500 m of a wind turbine generator.

b) Wind Farm Includes Transformer Substation

- A detailed noise impact assessment of the Wind Farm including a Transformer Substation is required if one or more Points of Reception or Participating Receptors are located within 1500 m of a wind turbine generator.
- A detailed noise impact assessment limited to the Transformer Substation is required if no Points of Reception or Participating Receptors are located within 1500 m of a wind turbine generator but a Point of Reception or a Participating Receptor is located within 1000 m of a Transformer Substation.

6.4.2 Whole Wind Farm Assessment

In the event that a detailed noise impact assessment is required, the assessment must not be limited to a 1500 m radius from a receptor, but must consider the impact of the whole Wind Farm subject to the limitations relating to very large distances described in Section 6.4.9.

6.4.3 Transformer Substation Assessment

In general, Transformer Substation noise impact must be assessed in combination with the noise impact from the wind turbine generators. In the unique case where the noise impact is caused only by the Transformer Substation, as described in Section 6.4.1 b), the detailed noise impact assessment is only required to consider the sound levels from the Transformer Substation.

6.4.4 Impact of Adjacent Approved Wind Farms

If a Point of Reception or a Participating Receptor is or can be affected by adjacent, approved[7] Wind Farms, the detailed noise impact assessment must address the combined impact of the proposed and the adjacent Wind Farms. The distance requirements described in Sections 6.4.1 and 6.4.9 apply.

Note that in accordance with Section 6.4.2, where a detailed noise impact assessment is required, it must consider all the wind turbine generators and Transformer Substations in the proposed as well as in the adjacent approved Wind Farms, subject to the limitations relating to very large distances described in Section 6.4.9.

6.4.5 Impact of Adjacent Wind Farms in the Process of Being Planned

If a Point of Reception or a Participating Receptor is or can be affected by adjacent Wind Farms in the process of being planned[8], the detailed noise impact assessment must address, subject to available information[9], the combined impact of the proposed and the adjacent Wind Farms. The distance requirements described in Sections 6.4.1 and 6.4.9 apply.

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[7] For the purposes of this document, a Wind Farm is considered to be "approved" if a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has been issued.

[8] For the purposes of this document, a Wind Farm is considered to be "in the process of being planned" if a Notice of Commencement has been issued for the project in accordance with the Environmental Screening Process prescribed under Ontario Regulation 116/01 under the *Environmental Assessment Act*, but for which a Certificate of Approval (Noise) under section 9 of the *Environmental Protection Act* has not yet been issued.

[9] The combined impact would be expected to be assessed if, for example, the information on turbine locations and models at an adjacent proposed Wind Farm is publicly available (e.g., through a Screening Report or Environmental Review Report under the Environmental Screening Process).

Note that in accordance with Section 6.4.2, where a detailed noise impact assessment is required, it must consider all the wind turbine generators and Transformer Substations in the proposed Wind Farm as well as in the adjacent Wind Farm in the process of being planned, subject to the limitations relating to very large distances described in Section 6.4.9.

6.4.6 Assessment of Participating Receptors

A receptor is a Participating Receptor and not considered as a Point of Reception if the property of the receptor is associated with the Wind Farm, see definition in Section 3. The sound level limits stated in Section 5 do not apply to Participating Receptors.

Despite this exemption, it is prudent to design Wind Farms so as to minimize the noise impact on all receptors, including Participating Receptors.

In some cases, a detailed noise assessment may be required of a receptor that was considered a Participating Receptor for an adjacent approved Wind Farm, or is being considered as a Participating Receptor for an adjacent Wind Farm in the process of being planned. Unless the property owner has also entered into an agreement with the proponent of the proposed Wind Farm, the receptor shall be considered a Point of Reception for the purposes of the detailed noise impact assessment for the proposed Wind Farm.

6.4.7 Prediction Method

Predictions of the total sound level at a Point of Reception or a Participating Receptor must be carried out according to the method described in the standard ISO 9613-2, Reference [6]. The calculations are subject to the specific parameters indicated in Section 6.4.10.

6.4.8 Adjustment for Special Quality of Sound

Should the manufacturer's data indicate that the wind turbine acoustic emissions are tonal, the acoustic emissions must be adjusted by 5 dB for tonality, in accordance with Publication NPC-104, Reference [1]. Otherwise, the prediction should assume that the wind turbine noise requires no adjustments for special quality of sound described in Publication NPC-104, Reference [1].

No special adjustments are necessary to address the variation in wind turbine sound level (swishing sound) due to the blade rotation, see Section 4. This temporal characteristic is not dissimilar to other sounds to which no adjustments are applied. It should be noted that the adjustments for special quality of sound described in Publication NPC-104, Reference [1], were not designed to apply to sounds exhibiting such temporal characteristic.

The calculations of the transformer noise must be consistent with the provisions of Section 6.2.4. Furthermore, since transformer acoustic emissions are tonal, an adjustment of 5 dB must be added to the specified acoustic emissions in accordance with Publication NPC-104, Reference [1].

6.4.9 Sound Level Contributions from Distant Wind Turbine Generators

The standard on which the noise impact prediction method is based, namely standard ISO 9613-2, Reference [6], is designed for source/receiver distances up to about 1000 m. Although the use of the standard may be extended to larger distances, other factors affecting sound level contributions from the distant sources may need to be considered. In practice, sound level contributions from sources such as wind turbines located at very large distances from receptors are affected by additional attenuation effects.

To address the above in a prediction method, contributions from sources located at very large distances from receptors, larger than approximately 5 km, do not need to be included in the calculation.

6.4.10 Specific Parameters

The assessment must use the following parameters that have been designed to provide clarity and consistency as well as reflect the principle of the "predictable worst case" noise impact.

a) All calculations must be performed in terms of octave band sound levels (63 to 8000 Hz) and for each integer wind speed from 6 to 10 m/s.

b) The attenuation due to atmospheric absorption must be based on the atmospheric attenuation coefficients for 10ºC temperature and 70% relative humidity, specifically:

Table 2 Atmospheric Absorption Coefficients

Centre Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Atmospheric Absorption Coefficient (dB/km)	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

c) The term for Ground Attenuation must be calculated using the "General" method in the standard ISO 9613-2, Reference [6]. For Class 2 and 3 Areas, the assessment must use ground factor values not exceeding the following:

$G_s = 1.0$
$G_m = 0.8$
$G_r = 0.5$

Where G_s is ground factor for the source region,
G_m is ground factor for the middle region, and
G_r is ground factor for the receiver region.

Alternatively, a global value ground factor not exceeding 0.7 may be used.

Ground factor values for assessments in Class 1 Areas are not specified in this document. The choice of the ground factor values for assessments in Class 1 Areas is site-specific.

6.5 Results and Compliance

6.5.1 Presentation of Results

Results of the noise impact assessment calculations must be presented in accordance with the Noise Impact Assessment Summary Tables, Table 7 and Table 8. In addition, the results should be plotted on drawings of the site plan, showing property boundaries, noise sources and receptor locations with their identifications. A suitable scale for these drawings is 1 cm : 250 m.

A separate drawing must be presented for each of the following wind speeds: 6, 8 and 10 m/s. The sound level scale should be the same on all drawings. If practical, each drawing should show the sound level contours for the 40 dBA level as well as the contour for the applicable sound level limit. The drawings should be included as an Appendix.

6.5.2 Assessment of Compliance

Compliance must be based on the comparison of the combined sound levels from all sources, described in Section 6, at each Point of Reception with the sound level limits stated in Section 5. All calculations and the determination of compliance with the sound level limits must be presented to a precision of one decimal place.

6.6 Summary Tables

6.6.1 Wind Turbine Acoustic Emissions Summary Table

The wind turbine acoustic emissions data used in the calculations must be presented as shown in Table 3. Separate tables should be used if the project involves different models of equipment.

Table 3 Wind Turbine Acoustic Emissions Summary

Make and Model: **Electrical Rating:** **Hub Height (m):** **Wind shear coefficient, as per Section 6.2.3[10]:**										
	Octave Band Sound Power Level (dB)									
	Manufacturer's Emission Levels					**Adjusted Emission Levels**				
Wind Speed[11] (m/s)	**6**	**7**	**8**	**9**	**10**	**6**	**7**	**8**	**9**	**10**
Frequency[12] (Hz)										
63										
125										
250										
500										
1000										
2000										
4000										
8000										
A-weighted										

[10] Adjustment based on the differences in wind shear factors reflecting manufacturer's data and on-site data.

[11] At 10 m reference height.

[12] Centre Octave Band Frequency.

6.6.2 Locations of Wind Turbine Generators, Transformer Substations and Receptors

Location coordinates of all wind turbine generators, Transformer Substations, Points of Reception and Participating Receptors must be given in accordance with Table 4, Table 5 and Table 6.

Table 4 Wind Turbine Locations

Project Name:				
Identifier	**Equipment Make & Model**	**UTM Coordinates**		**Remarks**
		X	**Y**	

Changes in ID or location in revised submissions must be clearly identified under the “Remarks” column.

Table 5 Point of Reception Locations

Project Name:			
Point of Reception ID	**Description**	**UTM Coordinates**	
		X	**Y**

Table 6 Participating Receptor Locations

Project Name:			
Receptor ID	**Description**	**UTM Coordinates**	
		X	**Y**

6.6.3 Noise Impact Assessment Summary Tables

Table 7 Combined Noise Impact Summary – Points of Reception

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6	7	8	9	10	6	7	8	9	10

Values in the table that exceed the applicable limit should be **Underlined and Bolded**.

Table 8 Combined Noise Impact Summary – Participating Receptors

Participating Receptor ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6	7	8	9	10

Table 9 Wind Turbine Noise Impact Summary – Points of Reception

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6	7	8	9	10	6	7	8	9	10

Values in the table that exceed the applicable limit should be **Underlined and Bolded**.

Table 10 Wind Turbine Noise Impact Summary – Participating Receptors

Participating Receptor ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6	7	8	9	10

6.7 Appendices

All information necessary to support the conclusions of the report, but not specifically described as required in Section 6, should be referenced and attached as Appendices to the report. Supporting information includes but is not limited to specifications, drawings, letters/agreements, photos, measurements and miscellaneous technical information.

In addition, sample calculation should be included in the Appendices. The sample calculation must include at least one detailed calculation for a source to receiver "pair," preferably addressing the closest wind turbine unit. The sample calculation must represent all other "pairs." If applicable, a sample calculation for the Transformer Substation is also required.

In cases where a Transformer Substation is part of the Wind Farm, Table 11 and Table 12 must be included in the Appendices:

Table 11 Transformer Substation Noise Impact Summary – Points of Reception

Point of Reception ID	Description	Distance to Transformer Substation (m)	Calculated Sound Level (dBA)	Sound Level Limit (dBA)

Values in the table that exceed the applicable limit should be **Underlined and Bolded**.

Table 12 Transformer Substation Noise Impact Summary – Participating Receptors

Point of Reception ID	Description	Distance to Transformer Substation (m)	Calculated Sound Level (dBA)

ATTACHMENT B

GE 2.5-103 TURBINE DATA

JULY, 2011

GE Energy

Commercial Documentation
Wind Turbine Generator Systems
2.5-103 - 60 Hz

Product Acoustic Specifications

Canada Specific
Normal Operation according to IEC 61400-11

imagination at work

GE Energy

Gepower.com

Visit us at
www.gewindenergy.com

All technical data is subject to change in line with ongoing technical development!

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Table of Contents

1 Introduction

This document defines the noise emission characteristics of the wind turbine series 2.5-103, 60 Hz version, equipped with 103 m rotor diameter (GE 50.2 type blade) operating in normal operation (NO).

General Electric continuously verifies specifications with measurements, including those performed by independent institutes.

The calculated apparent sound power level $L_{WA,k}$ as function of v_{10m} (reference wind speed 10 m above ground level) is provided for **normal operation** (**NO**) over cut-in to cut-out wind speed range.

The corresponding wind speeds at hub height v_{HH} are provided assuming different standard hub heights and a logarithmic wind profile**.**

If a wind turbine noise performance test is to be carried out, it needs to be done in accordance with both IEC 61400-11 and GE's "Machine noise performance test" reference guidelines.

Paragraph §2 provides **nominal calculated acoustic performance** for:

- 2.5-103 (60 Hz) calculated apparent sound power level $L_{WA,k}$ as function of v_{10m} and at **95% rated electrical power** per IEC 61400-11.
- 2.5-103 (60 Hz) tonality level $\Delta L_{a,k}$ per IEC 61400-11

Paragraph §3 provides 2.5-103 acoustic performances additional data:

- The wind speeds at reference height v_{10m} extrapolated to v_{HH} (wind speed at hub height)
- Uncertainty information
- IEC 61400-11 and IEC/TS 61400-14 additional information

2 2.5-103 Product Normal Operation Acoustic Performance

2.1 2.5-103 Normal Operation Calculated Apparent Sound Power Level

The Table 1 provides nominal acoustic specifications for 2.5-103 equipped with 103 m rotor diameter (GE 50.2 type blade) and 100 m hub height as function of wind speed v_{10m} (reference wind speed 10 m above ground level), operating at normal operation (NO) per IEC 61400-11 standard and GE's "Machine noise performance test" reference guidelines:

Wind speed at v_{10m} [m/s]	**$L_{WA,k}$* Apparent sound power level [dB]**
≤ 5	≤ 97.1
5.5	99.7
6	≤ 102.0
6.5	≤ 103.4
7	≤ 104.0
8	≤ 104.0
9	≤ 104.0
10-cut-Out	≤ 104.0

Table 1: Normal operations, 2.5-103 wind turbine, 50.2 m blades (103 m rotor), 100 m hub height, apparent sound power level at wind speed v_{10m}.

At wind speeds lower than 5 m/s the sound power levels decreases, and may get so low that the wind turbine noise becomes indistinguishable from the background noise. For a conservative calculation the data at 5 m/s may be used.

At wind speeds above 9 m/s turbine has reached rated power and the increasing pitch angle decreases the noise level. For a conservative calculation the data at 9 m/s may be used.

The nominal acoustic performances for **2.5-103**, 60 Hz version, equipped with 103 m rotor diameter (GE 50.2 type blade) operating in **normal operation** (NO), specified at **95 % rated electrical power**:

- The calculated apparent sound power level is $L_{WA,k}$ ≤ 104.0dBA.

* $L_{WA,k}$ indicates apparent sound power level per IEC-61400-11 standard measured in dB, A-weighted 10 base logarithmic value of apparent sound power relative to reference sound power of 10^{-12} W.

2.2 2.5-103 Normal Operation Calculated Tonality

The nominal acoustic performance for **2.5-103**, 60 Hz version, equipped with 103 m rotor diameter (GE 50.2 type blade) operating in **normal operation** (NO), specified at reference ground measuring distance $\mathbf{R_o}$ measurement position #1 per both IEC 61400-11 and GE's "Machine noise performance test" reference guidelines:

- Tonal audibility $\mathbf{\Delta L_{a,k} < 2\ dB}$.

3 2.5-103 Product Additional Information

3.1 2.5-103 Wind Speeds at Reference Height extrapolated to Hub Height

The wind speeds v_{10m} at reference height (10 m above ground) can be extrapolated from v_{10m} to v_{HH} (wind speed at hub height), per IEC 61400-01, assuming surface roughness of $z_{0, ref}$ = 0.05 m typical average condition and using:

$$V_{10m\ height} = V_{hub} \frac{\ln\left(10m / z_{0ref}\right)}{\ln\left(hub\ height / z_{0ref}\right)}$$

Meaning wind speeds from Table 1 can be extrapolated to 100 m hub height using $\mathbf{v_{HH} = v_{10m}}$ * 1.43 and to 85 m hub height using $\mathbf{v_{HH} = v_{10m}}$ * 1.40 per Table 2.

Wind speed at 10 m reference height v_{10m} [m/s]	Wind speed at 85 m hub height $V_{HH=85}$ [m/s]	Wind speed at 100 m hub height $v_{HH=100}$ [m/s]
≤ 5	≤ 7.0	≤ 7.2
5.5	7.7	7.9
6	8.4	8.6
6.5	9.1	9.3
7	9.8	10.0
8	11.2	11.5
9	12.6	12.9
10-cut-out	13.7-cut-out	14-cut-out

Table 2: Relation between wind speed at reference height v_{10m} and wind speeds at different hub heights v_{HH} for $z_{0, ref}$ = 0.05 m

3.2 2.5-103 Testing Uncertainty and Product Variation per IEC/TS 61400-14

Per IEC/TS 61400-14, $\mathbf{L_{WAd}}$ is the maximum apparent sound power level resulting from ***n*** measurements performed according to IEC 61400-11 standard for 95 % confidence level: $L_{WAd} = \overline{L_{WA}} + K$, where $\overline{L_{WA}}$ is the mean apparent sound power level from ***n*** IEC 61400-11 testing reports and $\mathbf{K = 1{,}645 \cdot \sigma_T}$.

The testing standard deviation values σ_T, σ_R and σ_P for measured apparent sound power level are described by IEC/TS 61400-14, where σ_T is the total standard deviation, σ_P is the standard deviation for product variation and σ_R is the standard deviation for test reproducibility.

Assuming σ_R **< 0.8 dB** and σ_P **< 0.8 dB** typical values, leads to calculated **K < 2 dB** for 95 % confidence level.

3.3 IEC 61400-11 and IEC/TS 61400-14 Terminology

- $L_{WA,K}$ is wind turbine apparent sound power level (referenced to 10^{-12}W) measured with A-weighting as function of reference wind speed v_{10m}. Derived from multiple measurement reports per IEC 61400-11, it is considered as a mean value
- σ_P is the product variation i.e. the 2.5-103 unit-to-unit product variation; typically < 0.8 dB
- σ_R is the overall measurement testing reproducibility as defined per IEC 61400-11; typically < 0.8 dB with adequate measurement conditions and sufficient amount of data samples
- σ_T is the total standard deviation combining both σ_P and σ_R
- $K = 1{,}645 \cdot \sigma_T$ is defined per IEC/TS 61400-14 for 95 % confidence level
- R_o is the ground measuring distance from the wind turbine tower axis per IEC 61400-11
- $\Delta_{La,k}$ is the audibility according to IEC 61400-11, described as potentially audible narrow band sound

References:

- IEC 61400-1, Wind turbines – part 1: Design requirements, ed. 3, 2005-08
- IEC 61400-11, wind turbine generator systems part 11: Acoustic noise measurement techniques, ed. 2.1, 2006-11
- IEC/TS 61400-14, Wind turbines – part 14: Declaration of apparent sound power level and tonality values, ed. 1, 2005-03
- MNPT – Machine Noise Performance Test, Technical documentation, GE 2007

Technical Documentation

Wind Turbine Generator Systems

2.5-103 – 60 Hz

Detailed Acoustic Data Addendum

Normal Operation according to IEC 61400-11

Canada Specific

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1 Introduction

This document is intended to meet country specific regulations which require more specific octave band power spectra from wind turbines, in order to support detailed acoustic data input for the purpose of wind park detailed acoustic assessment.

In addition to the 2.5-103 wind turbine product acoustic specifications the following detailed data are provided:

Calculated octave band apparent sound power level LWA**,k**

2 2.5-103 Calculated Octave Band Spectra – Canada Specific

The table below provides simulated, A-weighted octave band spectra as a function of standardized wind speed at 10 m height, and expressed as apparent sound power levels.

The uncertainties for octave sound power levels are generally higher than for total sound power levels.

Guidance is given in IEC 61400-11, Annex D.

2.5-103 – A-Weighted Octave Spectra (dB)

Standard WS at 10m [m/s]	**5**	**5.5**	**6**	**6.5**	**7**	**8**	**9**	**10-Cutout**
Hub Height WS @ 100m [m/s]	7.2	7.9	8.6	9.3	10.0	11.5	12.9	14-Cutout
Frequency [Hz]								
32	72.9	75.7	78.4	80.6	80.8	80.9	81.1	81.1
63	82.6	85.4	88.1	90.2	90.5	90.5	90.7	90.8
125	86.9	89.7	92.3	94.5	94.6	94.7	94.9	94.9
250	89.7	92.3	94.7	96.6	96.4	95.7	95.9	95.9
500	90.7	93.3	95.7	97.5	97.3	96.2	95.4	95.2
1000	91.0	94.2	96.6	98.4	98.4	98.7	98.6	98.4
2000	88.2	90.7	93.2	95.3	95.7	96.9	97.3	97.6
4000	82.2	84.3	86.2	87.7	87.5	88.1	89.0	89.4
8000	65.8	68.2	70.3	71.9	71.6	71.4	71.4	71.0
Lwa [dBA]	96.9	99.6	102.1	104.0	104.0	104.0	104.0	104.0

Table 1: Octave Spectra for 2.5-103 - hub height wind speeds were calculated based on equation (7) from IEC standard 61400-11:2002, using a representative roughness height of 0.05 m

ATTACHMENT C

SAMPLE CALCULATION FOR NIGHT TIME NOISE IMPACT ON R288

SEPTEMBER, 2011

ISO 9613-2 Sample Calculation

Receiver: R288

Project: McLean's Mountain Wind Farm

Project Number: 8020

Time Period	Total (dBA)
Day	39.9
Night	39.9

Receiver Name	Receiver ID	X	Y	Z	Ground
R288	R288	425189	5087124	293.5	289.02

Source Name	Source ID	X	Y	Z	Ground	ReflOrd	LxT	LxN	L/A	Dist.	hm	Freq	Adiv	KOb	Agr	Abar	z	Aatm	Afol	Ahous	Cmet	CmetN	Dc	RL	LtotT	LtotN
T20	T20	425263	5086379	392.2	293.85	0	104.0	104.0	1.0	755	51.7	0	68.6	0	-0.6	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	33.6	33.6
T13	T13	425578	5087836	384.8	286.47	0	104.0	104.0	1.0	817	51.2	0	69.2	0	-0.5	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	32.8	32.8
T12	T12	424685	5087875	412.9	314.62	0	104.0	104.0	1.0	912	50.3	0	70.2	0	-0.5	0.0	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	31.6	31.6
T19	T19	426002	5086354	368.4	270.11	0	104.0	104.0	1.0	1123	52.2	0	72.0	0	-0.5	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	29.4	29.4
T14	T14	424005	5087874	417.0	318.69	0	104.0	104.0	1.0	1407	44.3	0	74.0	0	-0.5	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	26.9	26.9
T15	T15	426514	5087605	373.6	275.27	0	104.0	104.0	1.0	1412	53.5	0	74.0	0	-0.5	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	26.9	26.9
T06	T06	425374	5088648	389.7	291.39	0	104.0	104.0	1.0	1538	49.0	0	74.7	0	-0.5	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	25.9	25.9
T10	T10	426243	5088273	381.9	283.64	0	104.0	104.0	1.0	1562	54.1	0	74.9	0	-0.5	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	25.7	25.7
T05	T05	425967	5088867	388.3	290	0	104.0	104.0	1.0	1911	51.8	0	76.6	0	-0.5	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	23.5	23.5
T11	T11	423155	5087692	418.3	320	0	104.0	104.0	1.0	2115	43.4	0	77.5	0	-0.5	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	22.3	22.3
T09	T09	426960	5088349	377.5	279.21	0	104.0	104.0	1.0	2155	54.1	0	77.7	0	-0.5	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	22.1	22.1
T16	T16	423976	5085277	395.1	296.76	0	104.0	104.0	1.0	2212	46.8	0	77.9	0	-0.5	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	21.8	21.8
T28	T28	424742	5084943	381.3	283	0	104.0	104.0	1.0	2228	44.8	0	78.0	0	-0.5	0.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	21.7	21.7
T18	T18	423020	5086314	408.6	310.31	0	104.0	104.0	1.0	2318	47.5	0	78.3	0	-0.4	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	21.3	21.3
T23	T23	423091	5085958	401.3	303.04	0	104.0	104.0	1.0	2402	47.3	0	78.6	0	-0.4	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	20.9	20.9
T29	T29	423719	5084978	391.2	292.92	0	104.0	104.0	1.0	2603	45.3	0	79.3	0	-0.4	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	19.9	19.9
T30	T30	424258	5084654	384.0	285.68	0	104.0	104.0	1.0	2641	45.2	0	79.4	0	-0.4	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	19.8	19.8
T34	T34	423970	5084235	376.0	277.67	0	104.0	104.0	1.0	3137	42.0	0	80.9	0	-0.5	0.0	-1.3	5.8	0.0	0.0	0.0	0.0	0.0	0.0	17.8	17.8
T17	T17	421160	5086508	414.3	316.03	0	104.0	104.0	1.0	4077	44.0	0	83.2	0	-0.9	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	15.1	15.1
T21	T21	420869	5086170	411.3	313	0	104.0	104.0	1.0	4425	43.6	0	83.9	0	-1.0	0.0	0.0	6.9	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3
Xfrmr	Xfrmr	423616	5087363	323.0	320	0	94.4	94.4	1.0	1591	2.1	0	75.0	0	0.6	4.2	0.1	3.7	0.0	0.0	0.0	0.0	0.0	0.0	10.9	10.9

APPENDIX C

Environmental Management and Protection Plan (EMPP)

McLean's Mountain Wind Farm
Draft Environmental Management and Protection Plan

Supplementary Information for the Design and Operations Report Under the Renewable Energy Approval (REA) Requirements, Ontario Regulation 359/09 for Class 4 Wind Facility

Final

Prepared by:

Dillon Consulting Limited
September 2011

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A. INTRODUCTION

The Environmental Management and Protection Plan ("EMP" or "the Plan") is intended to identify key project environmental information, instructions and mitigation measures specific to the McLean's Mountain Wind Farm Project. This Plan fulfills the requirements of both: the Design and Operations Report as well as the Construction Report under the Ontario Regulation 359/09 – Renewable Energy Approval (REA) under the *Green Energy Act*. This Plan will ensure that the relevant permitting conditions, environmental mitigation and enhancement measures identified in the Environmental Screening Report/Environmental Impact Statement ("ESR") and the Renewable Energy Approvals (REA) submission, the consenting permitting conditions and requirements of any legal agreements (including landowner agreements) are established and implemented in the pre-construction, construction and subsequent operation & maintenance phase of the wind farm.

This Plan is applicable to Northland Power Inc.'s ("NPI")/ McLean's Mountain Wind Limited Partnership (MMWLP) or the project owner's (owners) employees working on the pre-construction, construction, and operation & maintenance phases of the McLean's Mountain Wind Farm Project.

The Plan will be adhered to, the relevant section completed and the document signed off, issued and handed over to the relevant Manager (detailed below in brackets) at the end of the following stages:

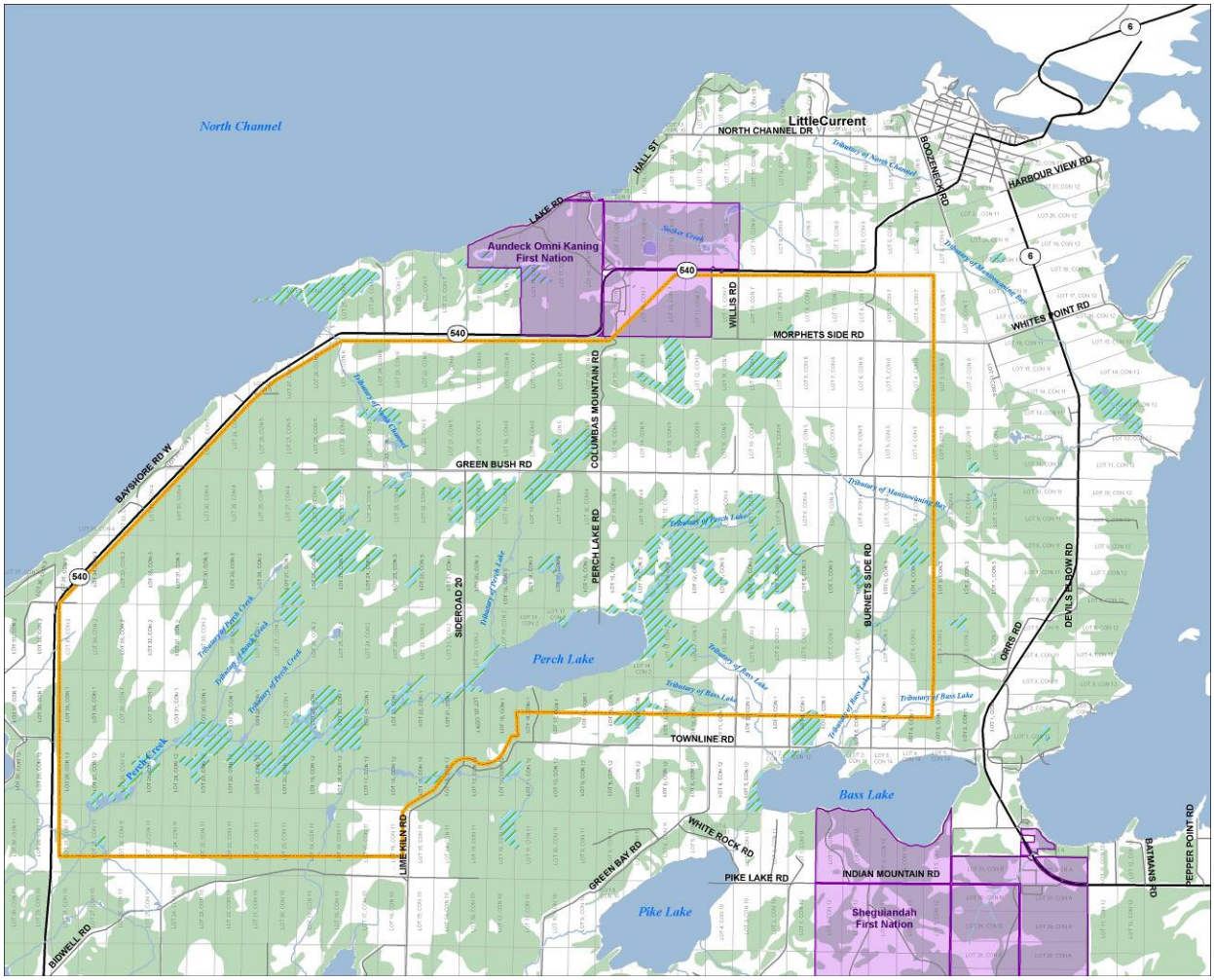
- *Pre-construction (Development Project Manager DPM) – Issue 01*
- *Construction (Construction Project Manager CPM) – Issue 02*
- Operation (Operations Manager OM/Wind Farm Owner) – Issue 03

This Plan also provides general guidance to the owner's subcontractors on environmentally safe working procedures and standards for particular operations that are to be implemented during the construction phase of this wind project

B. PROJECT DESCRIPTION

NPI is proposing to develop and construct the McLean's Mountain Wind Farm ("MMWF" or "the project") to generate electricity in Ontario. The project is located approximately three (3) kilometers southwest of the Town of Little Current and lies within the Municipality of Northeastern Manitoulin and the Islands ("NEMI"), Ontario. The wind farm is expected to consist of approximately 24 wind turbines that will generate about 60 megawatt (MW) of electricity. Thirty (30) potential turbines sites have been studied and are being permitted although only 24 wind turbines will be constructed. In addition to the wind turbines, the project will require a 10.3 km 115 kV power transmission line to be constructed to the north-east of the study area to connect the MMWF to the Hydro One Transmission grid on Goat Island (located just north of Little Current). **Figure 1** presents the project location and study area.

Figure 1:
Project Location



The project components include:

- 24 wind turbines;
- 690V /34 kV pad-mount transformers;
- 34 kV collection system to link the wind turbines to the substation. While these lines are to be primarily above ground there will be sections of the line where buried cables would be preferable. The buried cable will extend out from the base of the wind turbine tower for a minimum distance of 100 meters.
- Transformer substation (to step up the electric output from 34 kV to 115 kV);
- A 10.3 km, 115 kV single circuit transmission line, including a submerged crossing to Goat Island;
- A switching station at the point of connection with the provincial grid;
- Turbine access roads;
- Four (4) meteorological towers (which are already installed and operating);
- Staging areas for assembly of wind turbines, only required during construction; and
- An Operations and Maintenance Building.

Foundations for the wind turbines shall be constructed with poured concrete. Construction is anticipated to take approximately 12 to 15 months.

At each wind turbine location, a lay-down area will be provided adjacent to the access road of sufficient area to permit any Turbine Equipment being delivered to the Crane Pad to be offloaded and stored pending erecting and installation of the same. Vegetation from this area will be cut short and a graded working area will be provided.

C. EMPLOYMENT & AUTHORITY OF ENVIRONMENTAL MONITOR

The owners will appoint an Environmental Monitor ("EM") to observe all aspects of site construction work throughout the construction phase of the project.

The EM will ensure that owners own environmental management system, as set down in **Section D. Environmental Monitoring,** is being observed and will ensure compliance with all site permits and mitigation measures required by local, provincial or national law or applicable Contracts.

Reporting: The EM will report on a weekly basis with respect to any environmental problems identified or discovered as well as corrective actions taken to resolve the problem. In the event of a noncompliance issue, the EM will work directly with those contractors and individuals involved to correct the violation. Weekly reports to be prepared and sent to the Owners and will include:

- *Period covered by the report;*
- *Construction Activities observed;*
- *Compliance with applicable SCA conditions; and,*
- *Details of any corrective action that becomes necessary.*

The EM will co-ordinate activities with the Archaeological Monitor who will be working in accordance with the requirements of the "Cultural Resources Construction Monitoring and Construction Plan".

Stop Work Criteria: The EM will have authority to stop work in the location of the non-compliance and/or stop the activity causing the non-compliance, until such time as satisfactory measures are taken to stop continuing non-compliance. The following are considered "stop work" criteria:

- *Failure of best industry practices which result in off-site sedimentation that violates applicable water quality standards.*
- *The failure of pollution prevention control measures designed to prevent the discharge of hazardous substances or oil in storm water discharges from the site which causes a release to the environment.*
- *The presence of unidentified hazardous materials as evidenced by significant soil staining, odor, or oil in ground water.*
- *Failure to take corrective action within an acceptable time period following a non-compliance with Applicable permits & legislation, the Site Certification Agreement or restrictions in respect of archaeologically sensitive areas.*

In the event of any work stoppage or in response to any emergency situation the EM must promptly inform the owners site management, (who will inform the Owner), and any appropriate local authorities, either by phone or in person with facsimile (fax) confirmation as required. The EM shall observe implementation of the corrective actions to determine whether and when compliance is achieved. As soon as compliance is achieved the EM shall withdraw the stop-work notice.

D. ENVIRONMENTAL MONITORING

To aid all parties involved, an environmental checklist has been created (**Appendix A**). This covers all environmental risks commonly experienced during wind project construction. It is vital that this checklist is reviewed to ensure that all environmental risks for this particular project location are included.

The following sections refer to the numbered checklist and provide minimum requirements to address each environmental hazard.

E. OBJECTIVES AND PHILOSOPHY

NPI's reputation for developing, constructing and operating wind farms is well regarded and follow best practices to ensure that projects are compatible with existing land uses, minimize impact of the environment and are well accepted by local communities.

This EMP has been developed by Dillon Consulting Limited ("Dillon") to provide the required protection measures for the activities associated with the construction, maintenance and operation phases of the McLean's Mountain Wind Farm, as such these are long term initiatives. The purpose of the EMP is to further expand on the environmental protection and management measures that were committed in Northland's McLean's

Mountain Wind Farm Environmental Screening Report/Environmental Impact Statement (ESR Dillon, July 2009) and the McLean Mountain Wind Farm Renewable Energy Approvals submission (Dillon, September 2011).

This EMP forms an integral component of all construction work to be done on this project. The purpose of the EMP is to:

- *Ensure that the Municipality of Northeastern Manitoulin and the Islands'("NEMI") commitments to minimize environmental effects in general, and specific regulatory requirements, will be met;*
- *Provide concise and clear instructions regarding measures for protecting the environment and archaeological resources, and minimizing potential adverse environmental effects;*
- *Document environmental concerns and describe appropriate protection measures associated with Project construction;*
- *Provide a reference document for planning and/or conducting specific activities that may have an effect on the environment;*
- *Function as a training aid for environmental education and orientation; and,*
- *Communicate changes in the program through a revision process.*

Through field directives and advice offered by trained and experienced personnel, all users of the EMP will apply appropriate environmental protection practices. The EMP is a standalone document that provides guidance for the implementation of sound environmental protection practices, though it can be read in conjunction with other environmental regulatory documents such as the ESR (Dillon July, 2009) and Renewable Energy Approvals submission document (Dillon, July 2011) as well as other approval applications for further detail and background.

F. A *LIVING* PLAN

NPI recognizes the importance of the EMP and its execution during all phases of the project. Many of the commitments and construction measures discussed in the plan were done with the latest information and with best industry practices. NPI realizes that during the construction, operation and maintenance of the project new and innovative techniques may be developed which are more beneficial to the protection of the natural environment.

As such, the owners will encourage the investigation and use of these new techniques should they improve upon the ones discussed in the following EMP. This *Living* approach to the EMP will ensure that these new techniques can be used to improve our performance and to further mitigate any potential impacts to the natural environment.

1.0 ENVIRONMENTAL PROTECTION AND CONSTRUCTION MEASURES

Site development and road construction projects require a variety of construction practices to complete the work. Potential environmental interactions related to these construction practices are identified in this section. Environmental management measures, designed to reduce potential for environmental effects, are included within each subsection. General environmental protection measures are listed below.

1.1 General Measures

- *Environmentally sensitive areas will be staked out prior to work operations so that these areas are protected.*
- *Work will comply with conditions outlined in the Approval-to-Proceed and any associated permits/approvals.*
- *A Setback has been provided for the following natural or sensitive feature:*
    - *30 m Watercourse Setback;*
    - *120 m River/Stream Setback;*
    - *60 m Non Participating Lot Setback;*
    - *55 m Road Setback;*
    - *120 m Wetland Setback (in the majority of cases);*
    - *120 m Life Science ANSI Setback;*
    - *305 m Perch Lake Setback; and*
    - *550 m Residence Setback*
- *Work conducted in the vicinity of wetlands/watercourses will be conducted in a manner which ensures that erosion and sedimentation of wetlands/watercourses is minimized.*
- *Erodible soils will not remain exposed for longer than absolutely necessary. In areas where extensive erosion occurs (e.g., along steep slopes) or in environmentally sensitive areas, an active re-vegetation program will be implemented as soon as possible following disturbance to ensure rapid re-vegetation.*
- *Appropriate erosion control measures will be installed prior to conducting the work. Work will be completed as soon as possible, and will be suspended during and immediately after intense rainstorms and during periods of high runoff.*
- *The area of disturbance will be limited to that which is absolutely necessary to conduct the work.*
- *Necessary means will be undertaken to ensure that work does not intrude on property outside the project boundary. This may include staking out private property prior to work operations.*

Activity-specific environmental protection measures are provided in the following subsections.

1.2 Vegetation Clearing and Disposal

Outline of Procedure

Vegetation clearing consists of the removal and disposal of all trees, shrubs, fallen timber, logs and other surface litter within the work area as directed and designated by the plans/drawings or the Environmental Monitor. Vegetation clearing will be required for each turbine location including a lay-down area. Clearing of

a right-of-way will be required for some sections of the turbine access roads and sections of the 115 kV transmission line.

Principal Environmental Concerns

Cut vegetation piled near or in a watercourse could degrade aquatic habitat or obstruct fish passage. Other potential environmental effects include altering wildlife habitat. Over-cutting exposes remaining trees to an increased risk of blow down. Removal of forest or hedgerow vegetation can result in wind stress, desiccation, and increased soil erosion.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of vegetation clearing and disposal.

- *Clearing will be minimized to that necessary to construct and operate the proposed turbines, install collector lines and transmission lines and implement access roads.*
- *Best efforts will be made to schedule clearing of land outside of the sensitive bird breeding and nesting season, which is considered to be May 9 to July 23.*
- *Hedgerows will be left intact, where possible.*
- *Slash and any other construction material or debris will not be permitted to enter any watercourse.*
- *Slash will be piled outside the buffer zone of a wetland or watercourse (i.e., greater than 30 m from a wetland or watercourse) for subsequent chipping. In cases where maintaining a 30 m buffer around watercourses would interfere with the landowner's agricultural operations, temporary storage of slash may occur within the 30 m buffer but not within 10 m of a watercourse.*
- *Slash will not be burned.*

1.3 Ditching

Outline of Procedure

Ditching consists of excavation and grading to construct a new ditch or to re-establish an existing, deteriorated ditch. Ditching is undertaken to affect drainage and to correct deficiencies such as erosion, non-conformity in grade and restrictive vegetative growth that impedes drainage.

Principal Environmental Concerns

Where ditching is undertaken, potential runoff of sediment-laden water could result in effects on water quality, aquatic ecosystems or other environmentally sensitive areas.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of ditching:

- *Ditching will proceed in the upslope direction.*
- *Trapezoidal ditches result in less erosion of the ditch bottom and will be installed where space requirements allow. In cases where the available right-of-way is insufficient in width to achieve the desired cross-section, the alternative V-bottom ditch will be constructed.*
- *Where ditching takes place near a watercourse, no ditching will be done within 30 m of the watercourse. Vegetation located in this 30 m buffer area acts to filter any sediment laden runoff water prior to entering the watercourse.*
- *Within a week of doing ditching work, or as directed by the Environmental Monitor, all exposed soils will be either seeded with non-invasive, herbaceous, native species or receive straw/hay mulch application.*
- *Ditching will not be done within an existing ditch prior to July 1 or after September 30, unless a letter of advice has been obtained from the Department of Fisheries and Oceans.*
- *If ditching prior to July 1 or after September 30, mulch or an erosion control blanket (i.e., jute mat, erosion control mat) must be applied overtop of the seed.*
- *If seeding is not possible due to lateness of the season, the exposed soils will be completely covered for "overwintering" with either mulch or an erosion control blanket.*
- *Erosion control material will be removed during the following spring, and the area will be prepared for seeding.*
- *The Environmental Monitor will direct additional seeding or erosion control requirements within this 30 m zone, as appropriate.*
- *A check dam will be installed at the end of the ditch where it meets the Buffer Zone or other environmentally sensitive area. Additional erosion control structures will be installed further up the ditch as required or as directed by the Environmental Monitor.*
- *Natural drainage will be maintained whenever practical.*
- *Ditches will be directed into surrounding vegetation where possible, or a sediment collection pond, rather than emptying into a natural wetland/watercourse.*
- *Depending on the erosion potential or to ensure stabilization, the ditch may be hay mulched, hand seeded, hydro seeded or lined with an erosion control mat (i.e., jute mat and/or vegetative erosion control blanket).*
- *Rip-rap or an erosion control blanket designed for high flows will be used to line the bottom of ditches that have steep grades and/or excessive erosion as directed by the Environmental Monitor.*
- *Petroleum, septic wastes or otherwise contaminated material encountered in the ditch will be reported to the Environmental Monitor and to the Emergency Response.*

1.4 Grubbing, Stripping, and Excavation

Outline of Procedure

Grubbing refers to the removal of all stumps, roots, root mat and other debris, while stripping refers to the removal of topsoil. Materials excavation refers to the excavation of all other soil materials as included in earthworks, preparation of roadbed, site development, trenches, drains, borrow from adjacent land or pits, intersections, private entrances and other similar works. Soil will be stripped at the turbine foundation locations. Grading will be conducted on irregular surfaces, if any, to provide a safe and clean work surface.

Principal Environmental Concerns

The principal concern associated with these activities is the potential for erosion due to exposed soil areas and the associated sediment-laden runoff effects on water quality, aquatic ecosystems and environmentally sensitive areas.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of grubbing, stripping, and excavation:

- *Erosion control measures are to be in place prior to any grubbing activities if site conditions warrant or as directed by the Environmental Monitor.*
- *Topsoil and excavated overburden and bedrock will be stored in separate stockpiles for later use during rehabilitation.*
- *Dewatering of excavated areas will make use of measures to minimize and control the release of sediment laden water through the use of filtration through erosion control devices, settling ponds, straw bales, geotextiles or other devices as necessary.*
- *Water from dewatering will not be permitted to directly enter a watercourse or wetland.*
- *Watercourse culvert crossings as required for access roads for the turbine locations will span the watercourses in accordance with MOE and MNR practices.*

1.5 Disposal of Excavated Waste Materials

Outline of Procedure

Waste materials are generated during excavations involved with site development and road construction practices. Suitable excavation materials will be utilized in backfill and unsuitable excavated materials will be disposed of off-site at a licensed facility.

Principal Environmental Concerns

The principal concern associated with this activity is the potential for erosion of disposed materials and the associated sediment-laden runoff effects on water quality, aquatic ecosystems and environmentally sensitive areas.

Environmental Protection Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of the disposal of excavated waste materials. It is important to note that, once material is deemed to be waste material, it may become the property of the Contractor or other party. Where this occurs, these same protective measures are recommended to be followed by the user of the material once removed from the site:

- *If the excavated waste material is to remain in one disposal location for extended periods of time, appropriate protection measures will be taken such as stabilization of the material and/or perimeter sediment control.*
- *Excavated waste materials will not be disposed of in an environmentally sensitive area or in the Buffer Zone of a watercourse/wetland.*
- *Excavated materials will largely be used on original clearing sites, where appropriate.*

1.6 Infilling and Grading

Outline of Procedure

Infilling consists of placing soil and/or rock for site development and construction purposes. This includes preparation and construction of roadbeds, embankments, and slopes. Placing material in depressions to level them off helps to minimize ponding. Grading consists of shaping the unpaved road or site surface and is used to stabilize a surface, improve surface drainage and to provide for runoff in a controlled manner.

Principal Environmental Concerns

The principal concern associated with these activities is the potential for erosion due to exposed soil areas and the associated sediment-laden runoff effects on water quality, aquatic ecosystems and environmentally sensitive areas.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of infilling and grading:

- *When grassed areas are encountered during grading, every effort will be made to leave such grassed areas intact.*

- *Areas where little or no vegetation exists can be graded after a light rain when the surface is in an optimum state for compaction, but not after heavy rains which promote runoff conditions.*
- *The elevation of the in filled or graded area will be maintained higher than the ditch it is draining into.*

1.7 Culvert Installation and Stabilization

Outline of Procedure

Culvert construction will include the installation of a steel, concrete or plastic culvert, backfilling around the culvert, construction of the roadbed, and stabilization of culvert inlets and outlets.

Principal Environmental Concerns

The principal concerns associated with culvert installation and stabilization include the potential erosion of material around the culvert, sedimentation of the water, alteration of the hydraulic regime leading to streambed or bank scouring, and disruption of fish habitat and migration patterns.

Access roads will be approximately 10 m wide to accommodate the turbine erection cranes, maintenance vehicles and heavy equipment for larger repairs/replacements. In order to access the wind turbine sites, it will be necessary to construct access roads across various open drains. Some drains/watercourses will need to be crossed by the turbine access roads. Culverts of various sizes will be required to accommodate the crossing of the watercourses/drains by the access roads. In some cases to accommodate a wider turning radius for the cranes, larger culverts may be required in order to accommodate vehicular access and construction traffic across the drain while maintaining unimpeded flow within the drain.

There will be the need to cross the North Channel with a submarine cable to facilitate the transmission line connection. A navigable waterway will be traversed and a determination by Transport Canada will be sought prior to construction.

Environmental Management Measures

Where there is the potential for effects to watercourses including drains from the construction of the turbines and watercourse crossings, the following will be taken into consideration:

- the *Ontario MOE Stormwater Management Planning and Design Manual* (2003);
- the *Ontario Provincial Standards and Specifications (OPSS 182, 518 & 577)*;
- the *Ontario MOE Stormwater Pollution Prevention Handbook (Part I);* and the *Part II – Pollution Prevention and Flow Reduction Measures Fact Sheets*;
- the *Ontario MNR Guidelines on Erosion Control for Urban Construction Sites* (1989); and
- the *MNR Technical Guidelines- Erosion and Sediment Control* (1989).

To provide source controls and minimize adverse impacts, the following drainage mitigation will be followed:

- *Minimize disturbance of existing vegetation outside ditching and grassed slopes where regrading is required;*
- *Minimize time exposure of un-vegetated soils;*
- *Maximize length of overland flow through to points where storm water leaves the site;*
- *Complete an erosion assessment on all new and existing ditches to determine the need for additional erosion protection;*
- *Top of bank barriers (e.g. silt fencing) are to be put in place for any construction activity that is in proximity to watercourses;*
- *Where ditch regrading is required, where appropriate, utilize flat bottom ditches in lieu of 'V' ditches to reduce velocities and erosion potential, promote peak flow attenuation and provide short-term storm water storage;*
- *Use of in-line erosion control measures such as erosion blanket, rip rap, straw bale, rock flow checks and vegetated buffers, thereby mitigating high flow velocities and excessive erosion/sedimentation;*
- *Stream banks are to be stabilized and restored to their pre-construction condition immediately following construction activity. This is particularly important in erosion prone areas such as steep sloped stream banks;*
- *Each watercourse crossing is to be assessed in advance and the most appropriate mitigative measures determined. Alternative watercourse crossing locations should be considered it the proposed crossing location appears to be particularly sensitive to erosion;*
- *Any stockpiled materials are to be stored and stabilized away from watercourses;*
- *Ensure all materials placed within the flood line are clean and free of silt and clay size particles. All materials must meet applicable regulations governing placement of fill in water bodies;*
- *Ensure that all materials and equipment used for the purpose of site preparation and the completion of any work is operated and stored in a manner that prevents any deleterious substance from entering the water;*
- *Refuelling and handling of potential hazardous substances are to be done away from watercourses;*
- *Sediment and erosion control measures are to be left in place until all disturbed areas have been stabilized;*
- *The sediment control plan be designed and implemented to mitigate impacts associated with construction of the project - to prevent suspended sediment, mud, debris, fill, rock dust, etc. from entering downstream watercourses. Areas disturbed by work must be minimized. Silt fences/curtains, sediment traps, check dams must be installed as appropriate;*
- *Measures are to be in place to minimize mud tracking by construction vehicles, and to ensure timely cleanup of any tracked mud, dirt and debris along local roads and areas outside of the immediate work area where the above sediment controls would not be in place;*
- *Work is to be suspended if excessive flows of sediment discharges occur, and, any appropriate action should be immediately taken to reduce sediment loading;*
- *If it is necessary to de-water foundation excavations, prior to its discharge to a watercourse, the water is to be discharged to a settling pond, filter bag, or vegetated buffer strip of adequate size, to filter out suspended sediment;*
- *Temporary mitigation measures are to be installed prior to commencement of any site clearing, grubbing, excavation, filling or grading works and maintained on regular basis, prior to and after*

runoff events. Any accumulated materials are to be cleaned out during maintenance and prior to their removal. All disturbed areas on land to be restored to natural conditions should be re-vegetated as soon as conditions allow preventing erosion, and restoring habitat functions. Land based measures must not be removed until vegetation has been re-established to a sufficient degree (or surface soils stabilized using other measures) so as to provide adequate erosion protection to disturbed work areas; and

- *Timbers spaced to allow water flow and then covered with mats will be used for wet water crossings. This process will not hinder or block natural water flow.*

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of culvert installation and stabilization:

- *Culverts will be installed parallel to the watercourse, and located along a section of the watercourse that is straight and of uniform gradient.*
- *Culvert size and design will be based on peak flows, and will allow for sufficient depth of flow and appropriate water velocities for fish passage.*
- *Fill slopes will be stabilized to ensure that roadbed materials do not enter the watercourses.*
- *Gabions, rip rap, or rocks of sufficient size to prevent erosion, will be placed around culvert inlets and outlets.*
- *Gabions, rip rap, filter fabric, or rocks used for stabilization will completely cover road fill, gravel and other unstabilized materials around culvert inlets and outlets.*
- *Stabilization material will be clean and non erodible.*

1.8 Installation of Underground Collection Cables

Outline of Procedure

Electrical collection lines connecting the wind turbines to the substation will be overhead until within 100 m (or some suitable distance) of the turbine whereby an overhead to underground terminal pole will be placed and the underground electrical lines will be placed in trenches approximately 1 m deep where possible and covered with fill.

Principal Environmental Concerns

The principal concern associated with the installation of underground cables is the potential for erosion due to exposed soil areas and the effects of sediment-laden runoff on surface water quality. This could disturb fish habitat through the removal of riparian vegetation that provides shade, food and cover. There is also the potential for fuel and oil/lubricant spills, which could potentially contaminate nearby water bodies. Impacts related to spills are discussed in Section 4.1.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will provide the erosion control measures for streamside activities:

- *Any excavation or grading during the construction of the site will be conducted in a manner that ensures the minimum amount of disturbance necessary.*
- *Access roads will be used, where possible, for all equipment, including cable reels, line trucks, and tensioning equipment.*
- *Erosion and sedimentation control measures will be in place prior to any grubbing activity.*
- *In extremely erodible areas, hay or straw mulch will be used as required for protection.*
- *Silt or sediment control fences will consist of woven synthetic fiber fabric attached to wooden posts.*
- *Silt fences will not be used in watercourses.*
- *Where a vegetation buffer between erodible slopes and water bodies is less than 15 m, an engineered silt fence will be constructed to control silt runoff and the silt fence will be placed along the down gradient perimeter of the construction area.*
- *Replanting will occur upon completion of cable-laying operations to maintain bank stabilization.*

1.9 Handling, Storage, and Use of Aggregate Materials

Outline of Procedure

Handling of aggregate materials is required for the foundation construction of each turbine. Outdoor storage piles are often used in operations that use minerals in aggregate form, largely due to the need for frequent material transfers.

Principal Environmental Concerns

The principal concern associated with these activities is the potential for erosion due to exposed soil areas and the associated sediment-laden runoff effects on water quality, aquatic ecosystems and environmentally sensitive areas. Storage piles can be left uncovered and dust emissions may occur from disturbances to the piles. Handling, storage, and use of aggregate materials can result in any of the following environmental impacts:

- *Cross-contamination can occur if adjacent aggregate stockpiles are allowed to overlap.*
- *Underlying soil may be disturbed with the use of a front-end loader for moving aggregates from a stockpile.*
- *Mixing of aggregates can result from dumping the wrong size aggregate in a bin or pile.*
- *Leaves and other contaminants may also fall into the stockpile.*
- *Leakage can occur through or around bulkheads in storage bins.*
- *Vegetation may grow in the stockpile if left alone and unused for an extended period of time.*
- *Soil admixing, compaction, and stoniness can occur as a result of grading, heavy traffic, and excavation activities.*

Environmental Management Measures

These measures apply to the handling, storage and use of aggregate material. The following conditions apply:

- *Aggregate will not be stored within the buffer zone of a wetland or watercourse (i.e., aggregate will not be stored within 30 m of a wetland or watercourse). In circumstances where landowners will not permit the use of alternate locations the buffer zone will be reduced to a minimum of 10 m.*
- *All sand, aggregate, soil, or other materials in place or in stockpiles must be contained to prevent materials from producing dusty conditions and from cross contamination, as determined necessary by the Environmental Monitor.*
- *Sand and soil stockpiles will be bermed and sloped (and seeded with non-invasive, herbaceous, native species, if abandoned) to minimize runoff. If stockpiles are not needed immediately, temporary erosion and sediment control devices will be installed and regularly maintained.*
- *Stripping of topsoil separately from the subsoil, approximately 10-15 cm, will occur to minimize the potential for soil admixing.*
- *Soil compaction will be avoided by limiting the traffic flow on access roads.*
- *Stoniness will be avoided by removing any noticeable stone concentration to an approved location.*

1.10 Concrete Pouring Operations

Outline of Procedure

Concrete will be required to construct the foundations of the turbines, approximately 15-17 m in diameter, and 1-1.5 m thick. This section contains measures to minimize adverse effects that may result from concrete pouring activities.

Principal Environmental Concerns

Liquid wastes from uncontrolled release of wash water which may contain hazardous materials such as cement, concrete additives and form oil. This wash water may be harmful to fish. Cement is alkaline and wash water from spoiled concrete or from the cleaning of the mixer trucks and pipe delivery systems can be expected to have high pH and high total suspended solids ("TSS") concentration. Similarly, spoiled concrete or wash water would contain additives and agents, some of which are toxic to aquatic species. Aggregates, particularly the finer sand fractions, washed from spoiled concrete or discharged in water to the environment may result in direct fish and wildlife mortality and/or habitat destruction.

Environmental Management Measures

The following measures are intended to minimize the potential for wash water and uncured concrete to enter water bodies:

- *Form oil may be used sparingly to allow forms to separate from concrete following curing.*

- *Only the chutes of concrete trucks will require on-site cleaning of wet concrete to permit their storage for transport. The volume of water used and extent of washing will be kept to a minimum.*
- *Washing of chutes on-site will occur at a designated location that will permit containment of the wash water in a settling pond away from any subsurface drains, streams or storm drains. If such a system cannot be located on-site, then the wash area should permit containment of the wash water so that it can be disposed of off-site at the ready mix plant.*
- *Washing of the drum at the end of a day's delivery will occur at the ready-mix concrete plant.*
- *No chemicals will be used in the washing of concrete trucks or forms on-site.*
- *Aggregate used in the production of concrete will not be stored on-site and concrete will not be produced on-site.*
- *In the event that water from the wash water containment area requires release to the environment, the effluent will be tested prior to release as required by applicable regulations.*
- *If concrete is mixed on site, drainage from the concrete production area and aggregate storage area, and wash water from the cleaning of batch plant mixers, mixer trucks, conveyors, and pipe delivery systems will be directed to a settling pond for control and treatment, as appropriate. Effluent will be treated as appropriate before release to receiving waters, or alternatively, effluent will be recycled for reuse after treatment. Solids which accumulate in a settling pond will be removed on a regular basis to ensure the settling pond remains effective.*

1.11 Surveying

Outline of Procedure

Surveying includes gathering all the information required for the design and identification of a property or the right-of-way of a specific section of road. This includes cutting centerline and cross-section offsets of sufficient width to provide a clear line of sight for survey equipment and access to the site for soils testing equipment.

Principal Environmental Concerns

Disturbance to terrestrial and watercourse/wetland habitats and species are the primary environmental concerns associated with surveying.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of surveying:

- *The cutting of survey lines will be kept to a minimum. Where possible, alternate areas not requiring cut lines will be used.*
- *Whenever possible, cutting lines to the boundary between treed and open areas will be avoided.*
- *Survey lines will be limited in width to that which is absolutely necessary for line of sight and not more than 1.5 m.*
- *As required, trees and shrubs will be cut no more than 300 mm above the ground.*

- *All trees not exactly on survey lines will be left standing and trees partly on line will be notched (notch not to exceed 1/3 tree diameter) instead of removal, to allow sighting.*
- *Trees will be felled in a way that damage to standing trees adjacent to the survey line is minimized. Trees will be felled away from and not into or over a wetland/watercourse.*
- *Slash will not be placed or left in wetlands/watercourses. Any debris material removed from a wetland/watercourse and adjacent areas will be disposed of, or placed in a manner such that it cannot enter a wetland/watercourse.*
- *Felled trees having a top diameter of 8 cm or more will be cut in lengths and piled for reuse as merchantable timber. Non-merchantable timber will be chipped and spread outside the buffer zone of a wetland or watercourse (i.e., greater than 30 m from a wetland or watercourse). In circumstances where landowners will not permit the use of alternate locations the buffer zone will be reduced to a minimum of 10 m.*
- *When surveying construction layouts, areas that will be cleared do not require strict adherence to the above, except trees, shrubs and areas to be saved or left natural as noted on the plans or marked in the field.*
- *Vehicles will yield the right-of-way to wildlife and no attempt to harass or disturb wildlife will be made by any person.*
- *There will be no cutting in areas designated as environmentally sensitive by the Environmental Monitor.*
- *ATVs will remain within the right-of-way except as approved by the Environmental Monitor.*
- *No heavy equipment or motorized vehicles will enter the areas designated as environmentally sensitive by the Environmental Monitor.*
- *The extent of activities in environmentally sensitive areas will be minimized, including the restriction of walking to established walking paths if available.*
- *Petroleum products will be handled, stored, and disposed of in a manner that will minimize the potential for spills.*
- *Fuelling of equipment will not occur within the Buffer Zone of a watercourse/wetland or other environmentally sensitive areas.*

1.12 Equipment Movement

Outline of Procedure

A variety of equipment is required to complete the many components of site development and road construction.

Principal Environmental Concerns

The environmental concerns associated with equipment movement are the potential impacts on aquatic ecosystems and water quality, as well as disturbance to environmentally sensitive areas.

Environmental Management Measures

In addition to the general environmental protection measures described above, the following protection measures will minimize the potential environmental effects of equipment movement:

- *Imported equipment will be thoroughly cleaned before it arrives into Ontario in order to prevent the introduction of exotic plant species.*
- *Equipment and vehicles will only operate on cleared right-of-ways or areas designated for construction activities in the Plans/Drawings.*
- *Routine maintenance of machinery will be performed off-site as much as possible. Some heavy equipment, such as the cranes, will be maintained on-site due to the challenges involved in moving the equipment.*
- *The Contractor will make daily inspections of hydraulic and fuel systems on machinery, and leaks will be repaired immediately. All leaks will be reported to the Environmental Monitor and the Construction Manager.*
- *Construction equipment will not enter Buffer Zones of wetlands/watercourses or environmentally sensitive areas.*
- *If there is soil (not rock) in the lay-down areas used for storage of turbine parts adjacent to the turbine foundations, the soil will be aerated and loosened after use to counteract the compaction caused by the equipment. The vegetation will be allowed to return to a natural state.*
- *Erosion control measures will be monitored during construction activities within the right-of-way and any areas associated with Project construction activities. Where damage to these erosion control measures is observed, they will be promptly repaired to prevent siltation of wetlands/watercourses or other environmentally sensitive areas.*

2.0 ENVIRONMENTAL PROTECTION MEASURES - MAINTENANCE ACTIVITIES

2.1 Structure Maintenance and Cleaning

Outline of Procedure

Repair and replacement of damaged or deteriorated superstructure and substructure components are undertaken as required to ensure their structural integrity. Cleaning is undertaken to prevent the accumulation of dirt and debris which may restrict normal movement on the structure and/or retain moisture or chemicals, leading to structural component deterioration. Potential activities could include cleaning, lubrication, and painting.

Principal Environmental Concerns

There is concern for aquatic species due to direct mortality and loss of aquatic habitat. The primary concern is the release of materials and siltation into the aquatic environment such as abrasives and protective coatings. Lubrication materials may contain petroleum compounds, which are potentially toxic to aquatic species.

Environmental Management Measures

In addition to the general environmental protection measures described in Section 3.0, the following protection measures will minimize the potential environmental effects of structure maintenance and cleaning:

- *All waste generated in the removal of damaged and deteriorated components will be collected for proper disposal.*
- *All materials, where possible, will be reused. Non-salvageable materials will be disposed of at a provincially approved location.*
- *All necessary precautions will be taken to prevent discharge or loss of any harmful material or substance into a watercourse.*
- *All empty containers of paint, solvents, and cleaners will be disposed of in an appropriate manner at a provincially approved location.*
- *If sandblasting is required, it will be done in an off-site maintenance shop.*
- *If on-site sandblasting is necessary, screens or traps will enclose the area to be sandblasted. Sandblasting will be performed over a surface which allows the sand or residue to be collected upon completion of sandblasting (i.e. plastic or plywood).*
- *Sandblasting will not be performed in high wind conditions.*
- *Sensitive features (i.e. rare plants, watercourses, environmentally sensitive habitats) identified during construction will be protected during maintenance activities.*

2.2 Road Maintenance

2.2.1 Grading

Outline of Procedure

Grading is used to reshape unpaved roads to maintain a proper crown and remove ruts, potholes and washboard conditions. Grading helps to maintain proper drainage and keeps road surfaces stable.

Principal Environmental Concerns

Grading loosens the top of the exposed road, leaving more potential for erosion of the surface. If not conducted properly, grading can inhibit controlled drainage of runoff. Dust is generated during grading processes.

Environmental Management Measures

Grading measures as outlined earlier in this EMP will be implemented.

2.2.2 Ditch Maintenance and Shouldering

Outline of Procedure

Ditching is undertaken to affect drainage of the roadbed and to correct deficiencies such as erosion; nonconformity in grade, line, or cross section of ditch; water ponding on road; and restrictive vegetative growth that impedes drainage of the roadbed.

Principal Environmental Concerns

The principal concern associated with these activities is the potential for erosion due to exposed soil areas and the associated sediment-laden runoff effects on water quality, aquatic ecosystems and environmentally sensitive areas.

Environmental Management Measures

In addition to the general environmental protection measures described earlier in this EMP, the following protection measures will minimize the potential environmental effects of ditch maintenance and shouldering:

- *A Buffer Zone will be maintained between the end of ditching and all wetlands/watercourses.*
- *A check dam will be maintained at the end of the ditch (where the ditch meets the Buffer Zone). Additional erosion control structures will be installed further up the ditch as required.*
- *Natural drainage will be maintained whenever practical.*
- *Sediment deposited in the ditch will be removed when it reduces the capacity of the channel. Removed material and sediment will be disposed of at a location outside the Buffer Zone of a*

wetland/watercourse or other environmentally sensitive area, and such that it cannot wash into a wetland/watercourse.

- *Suitable material will be used when needed to fill in washouts, depressions, and the like on foreslopes or backslopes. To ensure stabilization, the ditch may be hay mulched, hand seeded, hydroseeded or lined with jute matting, depending on the erosion potential.*
- *Petroleum contaminated material encountered in the ditch will be reported to the Environmental Monitor and the Construction Manager.*
- *Sensitive features (i.e. rare plants, watercourses, environmentally sensitive habitats) identified during construction will be protected during maintenance activities.*

2.2.3 Surfacing

Outline of Procedure

For the purposes of this EMP, surfacing refers to the placement of aggregate on an unsealed road surface for stabilization or to restore grades, and to shape shoulders.

Principal Environmental Concerns

When handling and placing aggregate, there is potential for sedimentation of the aquatic environment and for dust impacts on air quality.

Environmental Management Measures

In addition to the general environmental protection measures, the following protection measures will minimize the potential environmental effects of surfacing:

- *Any aggregate placement will be conducted in such a manner to ensure road surface drainage flows from the centre of the surface to the drainage control structures (i.e., ditching), as appropriate.*
- *Any aggregate materials placed must be compacted to reduce moisture penetration.*
- *As required, dust will be controlled.*
- *Sensitive features (i.e. rare plants, watercourses, environmentally sensitive habitats) identified during construction will be protected during maintenance activities.*

2.3 Snow Removal

Outline of Procedure

Snow removal and application of sand and/or de-icing agents (i.e., salt) may be required during the winter months to maintain safe conditions for maintenance activities.

Principal Environmental Concerns

Excessive salt use can cause saline runoff into watercourses. Excessive sand use can contribute to sediment-laden runoff into watercourses and may cause blockages in drainage structures.

Environmental Management Measures

In addition to the general environmental protection measures described earlier in this EMP, the following protection measures will minimize the potential environmental effects of Snow Removal, Sanding and De-icing.

- *A service provider will be used for snow and ice removal on roads. Best Management Practices as described in Environment Canada's "Best Management Practices for Salt Use on Private Roads, Parking Lots and Sidewalks" will be followed.*
- *The use of sand, salt and combinations thereof, will be minimized to that which is necessary to ensure the safety of the maintenance staff. Sand application will be the primary means of maintaining safe driving conditions. Salt will only be used as necessary.*
- *Prior to salt application, as much snow as possible will be removed from the road through plowing.*
- *Salt application will be targeted to areas requiring treatment in order to minimize the volume of salt used and the amount of salt lost to adjacent areas.*
- *Snow removed from access roads and site surfaces will not be dumped within the Buffer Zone of a watercourse/wetland or other environmentally sensitive area.*

3.0 SPECIFIC ENVIRONMENTAL PROTECTION MEASURES

3.1 Erosion Control

The study area contains many small lakes and streams. In general, the majority of watercourses flowing off McLean's Mountain within the study area flow to the Sucker Creek and/or the Perch Creek systems, which both flow to the North Channel of Lake Huron. Watercourses flowing easterly from the east side of McLean's Mountain flow toward Strawberry Channel. On the south side of the study area, westerly watercourses generally flow toward the North Channel via Perch Lake and easterly watercourses generally flow toward Bass Lake near Sheguiandah.

It will be necessary to cross several watercourses with the turbine access roads and electrical lines. For the roads crossings, culverts will need to be installed so as to not obstruct the flow of water from access road construction. Various sized culverts will be required to accommodate the crossing of the watercourses/drains by the access roads. In some cases to accommodate a wider turning radius for the cranes, larger culverts may be required.

There is also the potential for the movement of construction equipment across the water courses and erosion effects from construction activity in the vicinity of surface water (e.g. to construct the 115 kV transmission line). These temporary disturbances may include downstream sediment transport and bed and bank disturbance and will be minimized as much as possible through the selection of the appropriate crossing techniques and culvert design determined in consultation with the DFO and MNR.

There will be the need to cross the North Channel with a submarine cable to facilitate the transmission connection. A navigable waterway will be traversed and a determination by Transport Canada will be sought prior to construction.

Mitigation Measures

Timing: Attempts will be made to construct new crossings and improve existing drain crossings when the ditch is dry. For applicable coldwater watercourses, crossings will be consistent with the coldwater timing restrictions. For ditches which have standing water at the time of construction, in stream sediment control will be installed prior to any construction equipment initiating work. These features should be removed immediately following completion of all in stream or stream bank disturbance, including installation of the culvert and revetment. Vegetation removal should be kept to a minimum to provide bank stability following culvert installation.

Sediment: Adequate sediment and erosion control during construction along with re-vegetation of disturbed areas will be necessary to avoid potential effects of construction to downstream habitat. Sediment and erosion control systems should be maintained repaired and not removed until the site is suitably stabilized.

Equipment: All equipment for culvert installation should arrive on site in a clean condition and maintained to prevent fluid leaks (gas, oil, lubricants, hydraulic fluids). All equipment should operate on the land with

minimal disturbance to the ditch banks. Refueling, servicing, equipment maintenance and associated materials for equipment operation should be stored away from the ditch bank with appropriate containment systems in the event of accidental spills.

Placement: Culverts should be embedded in the substrate, a minimum 10% embedment of the pipe diameter below the drain bottom, to ensure there is no loss of habitat through the culvert section. The culvert will eventually silt into match upstream and downstream grades as this area is extremely flat. In an open water course setting, culverts will provide refuge in low flow and cover from predators for any of the resident fish population.

Approvals: Any work within waterways that contain fish habitat or potential fish habitat will require a letter of advice notifying the Department of Fisheries and Oceans when work is to be initiated and completed.

Outline of Procedure

During construction, site preparation work and use of heavy construction vehicles at the site will result in exposed solids, susceptible to erosion. Control of erosion and potential sedimentation of receiving water bodies is one of the most critical environmental management concerns for this Project. Erosion control is first priority in preventing these impacts. The amount and duration of exposed soil will be kept to a minimum. Erosion control methods will be applied where there is the potential for erosion due to rain, flowing water, steep slopes, and highly erodible soils. Preventing erosion at the source reduces the amount of sediment that needs to be managed by downstream sediment control measures. It is also important that sediment controls are in place to prevent sediment from leaving the site.

Principal Environmental Concerns

Exposed soil will result from site preparation activities such as clearing, grubbing, grading and ditching. Precipitation, flowing water, steep slopes, or highly erodible soils will increase the potential for erosion. The principal environmental concern is the associated sediment-laden runoff and the resulting effects on water quality, aquatic ecosystems and environmentally sensitive areas such as wetlands.

Environmental Management Measures

In addition to the general environmental protection measures described earlier in this EMP, the following protection measures will provide the erosion control measures.

General

Where there is the potential for effects to watercourses including drains from the construction of the turbines and watercourse crossings, the following will be taken into consideration:

- *the Ontario MOE Stormwater Management Planning and Design Manual (2003);*
- *the Ontario Provincial Standards and Specifications (OPSS 182, 518 & 577);*

- *the Ontario MOE Stormwater Pollution Prevention Handbook (Part I); and the Part II – Pollution Prevention and Flow Reduction Measures Fact Sheets; the Ontario MNR Guidelines on Erosion Control for Urban Construction Sites (1989); and*
- *the MNR Technical Guidelines- Erosion and Sediment Control (1989).*

To provide source controls and minimize adverse impacts, the following drainage mitigation will be followed:

- *Minimize disturbance of existing vegetation outside ditching and grassed slopes where re-grading is required;*
- *Minimize time exposure of un-vegetated soils;*
- *Maximize length of overland flow through to points where stormwater leaves the site;*
- *Complete an erosion assessment on all new and existing ditches to determine the need for additional erosion protection;*
- *Top of bank barriers (e.g. silt fencing) are to be put in place for any construction activity that is in proximity to watercourses;*
- *Where ditch re-grading is required, where appropriate, utilize flat bottom ditches in lieu of 'V' ditches to reduce velocities and erosion potential, promote peak flow attenuation and provide short-term storm water storage;*
- *Use of in-line erosion control measures such as erosion blanket, rip rap, straw bale, rock flow checks and vegetated buffers, thereby mitigating high flow velocities and excessive erosion/sedimentation;*
- *Stream banks are to be stabilized and restored to their pre-construction condition immediately following construction activity. This is particularly important in erosion prone areas such as steep sloped stream banks;*
- *The watercourse crossing is to be assessed in advance and the most appropriate mitigative measures determined. Alternative watercourse crossing locations should be considered it the proposed crossing location appears to be particularly sensitive to erosion;*
- *Any stockpiled materials are to be stored and stabilized away from watercourses;*
- *Ensure all materials placed within the flood line are clean and free of silt and clay size particles. All materials must meet applicable regulations governing placement of fill in water bodies;*
- *Ensure that all materials and equipment used for the purpose of site preparation and the completion of any work is operated and stored in a manner that prevents any deleterious substance from entering the water;*
- *Refuelling and handling of potential hazardous substances are to be done away from watercourses;*
- *Sediment and erosion control measures are to be left in place until all disturbed areas have been stabilized;*
- *The sediment control plan be designed and implemented to mitigate impacts associated with construction of the project - to prevent suspended sediment, mud, debris, fill, rock dust, etc. from entering downstream watercourses. Areas disturbed by work must be minimized. Silt fences/curtains, sediment traps, check dams must be installed as appropriate;*
- *Measures are to be in place to minimize mud tracking by construction vehicles, and to ensure timely cleanup of any tracked mud, dirt and debris along local roads and areas outside of the immediate work area where the above sediment controls would not be in place;*

- *Work is to be suspended if excessive flows of sediment discharges occur, and, any appropriate action should be immediately taken to reduce sediment loading;*
- *If it is necessary to de-water foundation excavations, prior to its discharge to a watercourse, the water is to be discharged to a settling pond, filter bag, or vegetated buffer strip of adequate size, to filter out suspended sediment (this activity would require a Certificate of Approval under the OWRA from MOE. In addition, should dewatering activities exceed a rate of 50,000 litres per day, a PTTW would be required as well);*
- *Temporary mitigation measures are to be installed prior to commencement of any site clearing, grubbing, excavation, filling or grading works and maintained on regular basis, prior to and after runoff events. Any accumulated materials are to be cleaned out during maintenance and prior to their removal. All disturbed areas on land to be restored to natural conditions should be re-vegetated as soon as conditions allow preventing erosion and restoring habitat functions. Land based measures must not be removed until vegetation has been re-established to a sufficient degree (or surface soils stabilized using other measures) so as to provide adequate erosion protection to disturbed work areas;*
- *The OMNR in-water construction-timing window (July 1 to September 30) should be implemented for the summer months when work can be completed in the dry or when resident fish communities in permanent systems have completed their annual reproductive activities; and*
- *Compensation measures, where required, should involve riparian plantings, bank stabilization through bioengineering, or the construction of in-stream fish habitat features and/or the removal of blockages/barriers (this is a possibility along the shoreline at the mouths of some tributaries).*

The majority of road crossings over small creeks and/or drains are handled by installing an appropriately-sized culvert by open cutting creek/drain beds to properly install at an acceptable elevation to ensure proper fluvial function and fish passage. Standard mitigation measures to address typical negative impacts resulting from construction activities of these kinds are presented above.

For reference, please refer to the Department of Fisheries and Oceans' ("DFO") Operational Statements for "Overhead Line Construction" and "Isolated or Dry Open-Cut Stream Crossings" for more detailed information on environmental mitigation and protection appropriate to these types of watercourse crossing. Provided the listed conditions in the Operational Statements are met, review and approval by DFO is not likely required.

The aquatic features within the study area are generally a mixture of natural and altered channel systems, low-lying wet pockets/wetlands and overland swales and drainage ditches. Many of them are considered coldwater systems; however, a few are significantly degraded by unrestricted cattle access and poorly installed/degraded road/farm path culverts.

Structures/Products

- *Silt or sediment control fences will consist of woven synthetic fibre fabric attached to wooden posts.*
- *Erosion control structures or check dams will be constructed in accordance with Ontario Provincial Standards for Roads and Public Works in partnership with the Ontario Ministry of Transportation (MTO).*
- *In extremely erodible areas, hay or straw mulch will be used as required for protection.*
- *Erosion and sedimentation control measures will be in place prior to any grubbing activity.*
- *Erosion control structures will be installed as directed by the Environmental Monitor, Site Supervisor or Construction Manager.*
- *Silt fences will not be used to control sedimentation within a ditch or watercourse.*
- *Where erosion control within a drainage ditch is required, geotextile wrapped straw bales will be installed to provide a check dam and prevent downstream sedimentation. Some rock fill or rip rap may be installed of the downstream side of the check dam to secure the structure during heavy rainfall events.*

Maintenance

- *The Contractor will maintain the erosion control structures in a functional condition as long as necessary to contain sediment from run-off, from time of installation until a sufficient vegetative cover growth (>90% cover) has been established.*
- *All erosion control structures and sediment control fences will be inspected before, during and following each rainfall event and at least daily during periods of prolonged rainfall. Any damage arising from major storm events will be repaired as soon as possible to the satisfaction of the Site Supervisor.*
- *Retained sediment will be removed when it has accumulated to a level of half the height of the fence/barrier and disposed at least 30 m away from any wetland or watercourse in a manner that prevents it from entering a wetland or watercourse. In circumstances where landowners will not permit the use of alternate locations the buffer zone will be reduced to a minimum of 10 m.*

3.2 Air Quality and Dust Control

Outline of Procedure

The construction phase of the project consists mainly of heavy construction work. There can be significant dust generation that may have a substantial temporary impact on local air quality. Dust emissions often vary substantially on a daily basis at construction-sites depending on the level of activity, the specific operations, and the prevailing meteorological conditions. In addition, to a lesser degree emissions during construction will be associated with combustion gases from heavy vehicles, which produce particulate-containing exhaust consisting of a variety of contaminants. The typical contaminants associated with construction activities include carbon monoxide (CO), nitrogen oxides (NO_x), carbon (CO_2), hydrocarbons (HC), total suspended particulate (TSP), and fine and respirable particulates (PM_{10} and $PM_{2.5}$).

Principal Environmental Concerns

The on-site construction activities could impact ambient air quality due to vehicular emissions. There are a variety of activities that can lead to the generation of contaminant emissions, primarily of particulate matter, on the construction-site. The primary potential sources include exhaust gas emissions due to incomplete combustion from diesel compression engine, road dust, wind erosion on storage piles, material handling, material transport; and truck loading / truck unloading. There are also emissions of combustion gases and products of incomplete combustion from the exhaust of on-site vehicles and equipment. The table below shows typical output ranges of emissions from diesel engines, depending on the age and technology of the engines.

Typical Emissions from Diesel Engines (Nett Technologies)

CO vppm	**HC** vppm	**PM** vppm	**NO_X** vppm	**SO_2** vppm
5 - 1,500	20 - 400	0.1 0.25	50 - 2,500	10 - 150

Environmental Management Measures

The following measures will be implemented, to the extent possible, to control air emissions from construction activities:

- *Use well-maintained heavy equipment and machinery, preferably fitted with muffler/exhaust system baffles, engine covers;*
- *Motorized equipment should meet design specifications for emission controls and conform to provincial Drive Clean standards where appropriate;*
- *Comply with operating specifications for heavy equipment and machinery;*
- *Minimize operation and idling of gas-powered equipment and vehicles, in particular, during smog advisories – this is to be strictly monitored;*
- *Minimize vehicular traffic on exposed soils and stabilize high traffic areas with clean gravel surface layer or other suitable cover material;*
- *Minimize mud tracking by construction vehicles along access routes and areas outside of the immediate work site, and ensure timely cleanup of any tracked mud, dirt and debris;*
- *Cover or otherwise contain loose construction materials that have potential to release airborne particulates during transport, installation or removal; and*
- *Spray water to minimize the release of dust from gravel and exposed soils. Use environmentally-friendly chemical dust suppressants (e.g. Petro-Canada's Dust Suppressant Fluid 65 [DSF65]) only where necessary on problem areas.*

3.3 Noise Control

Outline of Procedure

Noise generated at the site during construction activities, will be largely attributable to operation of heavy construction vehicles as well as activities associated with turbine assembly and site preparation. This section contains measures to minimize noise emissions that may result from construction activities.

Principal Environmental Concerns

The construction phase of the proposed wind farm has the potential to be a noise source, contributing to the ambient acoustic environment of the region. This noise is mainly produced from the operation of construction equipment and vehicular activity. Construction activities will result in noise emissions in the surrounding environment. Noise associated with operation of heavy equipment will be in the range of 80-90 dBA at the source. Unmitigated, these noise emissions can disturb wildlife and may also interfere with the enjoyment of property for residents in the area.

Environmental Management Measures

The following measures will be implemented, to the extent possible, to control noise from construction activities:

- *All site activities will be carefully planned and performed in such a manner that noise is minimized.*
- *The frequency and/or duration of noise producing activities will be minimized wherever possible.*
- *All heavy construction equipment will be maintained in accordance with the manufacturer's specifications and equipped with appropriate mufflers and other noise control equipment to minimize noise where appropriate.*
- *Contractors will comply with the restrictions on hours of work for the site as determined by any applicable bylaws.*
- *All Project vehicles will be properly maintained and muffled to reduce noise emissions.*
- *The Contractor will ensure idling of construction vehicles is limited.*
- *The routing of truck traffic through residential areas will be controlled during the maximum period of activity.*
- *If complaints arise due to noise from truck traffic, acceptable alternate routing may be evaluated by the Contractor and the Municipality and implemented accordingly.*

3.4 Lighting Control

Outline of Procedure

Lights may be associated with equipment operation requirements and general lighting of work areas.

Principal Environmental Concerns

Excessive light emissions may cause a public disturbance in the vicinity of the project area, particularly during regular public off-work hours. Some lighting can also affect migratory paths of birds and lead to increased bird mortalities.

Environmental Management Measures

- *Minimum amount of aviation lighting required by Transport Canada ("TC") should be used, and TC should be consulted to see if white strobe lights with a minimum number of flashes per minute can be used.*
- *Strong lights, such as sodium vapor lights which are often used for security at substation buildings, should be avoided or shielded.*
- *Building lights will be positioned such that the direction of light is opposite to that of any residences, where possible.*
- *Where nuisance to local residents is an issue, scheduling of specific activities may be directed by the Environmental Monitor.*
- *Area lighting will be positioned and directed so as not to cause glare to approaching traffic.*
- *Building and area lighting will be directed toward the ground wherever possible.*

4.0 ENVIRONMENTAL PROTECTION MEASURES - MATERIALS, EQUIPMENT, FACILITIES

4.1 Petroleum, Oils, Lubricants, and Other Hazardous Materials

Outline of Procedure

A variety of potentially hazardous materials will be in use or stored for construction and maintenance activities for the proposed wind farm. Potentially hazardous materials routinely used include: *POLs, hydraulic fluids, acetylene, paints and solvents*. The procedures and requirements of the WHMIS program will be in place to protect employees and are generally applicable to the protection of the environment. These WHMIS procedures and requirements reinforce the proper handling, storage, and control of hazardous or toxic materials thereby reducing the potential for accidental release and consequent potential environmental effects.

Principal Environmental Concerns

The major concern regarding the use of these substances is their uncontrolled release to the environment through accidental spillage, and subsequent adverse effects on terrestrial, aquatic and marine habitat and species, soil, groundwater quality and human health and safety. The following protection measures are intended to minimize the potential for any POL spills on soil, vegetation, surface water, and groundwater.

Storage of Petroleum, Oil, Lubricant and Chemical Handling

All necessary precautions to prevent and minimize the spillage, misplacement or loss of fuels and other hazardous materials shall be taken. All Acts and Regulations pertaining to special substances shall be followed.

The delivery, storage, use and disposal of these hazardous materials will be handled only by trained personnel in accordance with government laws and regulations. The following precautions will be taken in handling POLs and chemicals:

- *The transport of fuel will be conducted in compliance with the Transportation of Dangerous Goods Act.*
- *Mobile fuelling trucks will be used to minimize the requirements for onsite storage of POLs.*
- *Diesel fuel and gasoline may be stored on site in limited quantities. Drums as required for one day's use will be on site, and drums will be delivered on a daily basis. Fuel drums will be stored upright on a deck with drip trays for the collection of spilled substances.*
- *Where possible, vehicle maintenance will be performed off site, at a nearby commercial fuelling station, in order to minimize the amount of lubricants and oils stored on site. On-site POL storage will be in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.*
- *The on-site POL storage container shall be located on level terrain, at least 100 m from any water body or wetland.*
- *Spill decks will be used for transferring products to smaller containers.*

- *No POL storage will occur in sensitive areas (e.g., near wetlands, watercourses or wells).*
- *Fire extinguishers and a spill kits will be located near POL storage areas.*
- *POL storage areas will be identified by signs, and "No Smoking" signs will be displayed at all POL storage sites and refueling areas.*
- *Smoking will not be permitted within 50 m of any POL storage area. On-site signage will indicate the location of smoking areas.*

POL and Chemical Handling Measures
▪ Equipment used will be mechanically sound with no oil or gas leaks. The Contractor shall undertake frequent inspection of equipment and repair leaks immediately. ▪ Fuelling, storage and servicing of vehicles and construction equipment is not allowed within 30 m of a watercourse, drainage ditch, areas with a high water table, or exposed and shallow bedrock. ▪ Spill clean-up materials shall be accessible and maintained in the areas of fuel and chemical storage. Any spilled fuel or lubricants shall be promptly cleaned up and disposed of in accordance with Ontario MOE requirements (MOE Spills Action Centre - 1-800-268-6060). ▪ No equipment shall be washed within 30 m of a watercourse. ▪ All tanks shall be protected from collision damage by the use of snow fencing to alert operators, or by the placement of barriers to impede equipment movement near the tank. ▪ Handling and fuelling practices shall ensure that contamination of groundwater will not occur. ▪ Fuel storage areas and transfer lines shall be clearly marked or barricaded to prevent damage from vehicles. ▪ If drums are stored on their sides, the drums shall be stored so that the bungs are in the 9" and 3" position, on level ground and prevented from rolling. ▪ Drum storage areas shall be marked or fenced with temporary fence to avoid impacts. ▪ Day-use quantities can be stored upright or on the side as required. Drip pans lined with absorbent pads shall be used beneath taps. ▪ All stained soil resulting from the use of chemicals or fuels shall be cleaned-up and disposed of prior to leaving the work area. ▪ Waste oils and lubricants will be retained in a closed container, and disposed of in an environmentally acceptable manner.

Equipment Fuelling

Only equipment that is not easily transported will be refueled on site. All other vehicles and equipment will be refueled at a central fuelling station:

When refueling equipment, operators will:

- *Use designated fuelling locations where practical;*
- *Use drips trays;*
- *Use leak free containers and reinforced rip and puncture proof hoses and nozzles;*
- *Be in attendance for the duration of the procedure; and*
- *Seal all storage container outlets except the outlet currently in use.*

Fuelling must be done at least 30 m from a wetland or water body. The Construction Manager will make daily inspections of hydraulic and fuel systems on machinery and leaks will be repaired immediately. All spills will be reported to the MOE Spills Action Centre (1-800-268-6060). Servicing of equipment will not be allowed within 100 m of a wetland, watercourse or drainage ditch. Fuelling attendants will be trained in the requirements under the Fuel and Hazardous Material Spills Contingency Plan in this EMP.

POL Waste Disposal

- *Waste POLs will be stored in a ventilated, lockable steel container. The container will be equipped with galvanized steel drip trays for the collection of spilled substances.*
- *Waste solvents and oils will be stored separately.*
- *All used oil and petroleum products will be removed as required and disposed of in an acceptable manner in accordance with government regulations, and requirements.*
- *Waste oil will be collected separately and offered for recycling or stored for collection by an appropriate special waste collection and disposal company.*
- *Greasy or oily rags or materials subject to spontaneous combustion will be deposited, and kept, in an appropriate receptacle. This material will be removed from the work site on a regular basis and will be disposed of in an approved existing waste disposal facility.*
- *POL waste disposal will be the responsibility of the Contractor.*

Spills Response

Various lubricants, oils ad fuels will be required during the operations period. Although unlikely, any leakage of oils from the turbines would be captured within the containment system. Spills response activities during the operations will be governed by this EMP. Legislation of relevance to spills management and response include:

- *Environmental Protection Act;*
- *Fisheries Act;*
- *Gasoline Handling Act;*
- *Ontario Pesticides Act;*
- *Ontario Water Resources Act; and,*
- *Transportation of Dangerous Goods Act.*

Federal and Provincial legislation place the responsibility for spill prevention and mitigation on the owner or controller of products or materials that can be spilled. Spills are defined under these Acts, as, but not limited to:

- *Spills from containers including drums and tanks;*
- *Spills resulting from breaks in hydraulic or transfer hoses or piping; and*
- *Spills resulting from traffic accidents and fire fighting.*

In accordance with these Acts, NPI has an obligation to:

- *Prevent, eliminate or remediate an adverse affect resulting from a spill; and*
- *Report the spill to NPI and the Ontario MOE (Spills Action Centre; Tel: 1-800-268-6060).*

NPI and its contractors shall reduce the likelihood of spills by implementing effective spill prevention measures such as the careful handling and proper storage of the products in use. In the event of a spill, the procedures detailed below shall be followed to facilitate a quick response.

Spills Response Measures
▪ The individual who discovers a leak or spill shall immediately attempt to stop and contain the release. ▪ Any spill or leak shall be reported immediately to NPI. ▪ NPI shall immediately report the release to the MOE Spills Action Centre (1-800-268-6060). ▪ NPI will have the authority to take appropriate action without unnecessary delay. ▪ NPI shall assume the overall responsibility of coordinating a cleanup and maintaining this contingency plan current and up-to-date. NPI shall, in consultation with regulatory authorities: o Deploy on-site personnel to contain the spilled material using a dyke, pit, absorbent material or booms, as appropriate; o Assess site conditions and environmental impact of various clean up procedures; o Choose and implement appropriate clean up procedure; o Deploy on-site personnel to mobilize pumps and empty drums (or other appropriate storage) to the spill site; o Apply absorbents as necessary; o Dispose of contaminate debris, cleaning materials, and absorbents by placing in an approved disposal site; and, o Take all necessary precautions to ensure that the incident does not reoccur. ▪ NPI shall submit a written report to appropriate regulatory authorities as required by applicable legislation. ▪ In order to respond to accidental releases, the following resources shall be made available on-site in an appropriate location to allow for immediate use: o Absorbent material (i.e., sorbent pads, Sorb-All, vermiculite); and o Protective equipment, shovels, rakes, tool kit, buckets and drums, stakes and tarpaulins.

4.2 Solid Waste Disposal

Outline of Procedure

During site preparation, construction, and maintenance, solid waste will be generated. Waste streams have been provisionally classified as domestic waste, paper, card board, wood and scrap steel and metals. This section contains measures for waste minimization, recycling and disposal.

Principal Environmental Concerns

Solid waste if not properly controlled and disposed of, can be unsightly and cause human safety and health concerns. Uncontrolled hazardous waste can contaminate soils, surface and groundwater, and can be toxic to vegetation, fish and wildlife if ingested in sufficient quantities.

Environmental Management Measures

The following protection measures will minimize the potential environmental effects of solid waste disposal:

- *Waste produced during the construction of the McLean's Mountain Wind Farm will be sorted as per the requirements of the Ontario "Waste Watch" Program.*
- *Domestic waste from temporary office quarters will be gathered on a regular basis and stored in closed containers until recycled or disposed of as per the requirements of the Ontario Waste Watch Program.*
- *Food waste will be stored in a manner that ensures wildlife will not be attracted and will be removed from the site on a daily basis.*
- *On-site temporary disposal areas for surplus material will be designated and will be located a minimum of 30 m from a wetland or watercourse. In circumstances where landowners will not permit the use of alternate locations the buffer zone will be reduced to a minimum of 10 m.*
- *The Contractor will, with the prior approval of the Site Supervisor, designate and use areas for the transfer and limited temporary storage of hazardous materials and special wastes. These sites will be properly labeled and appropriately controlled, and will be located a minimum of 30 m from a wetland or watercourse.*
- *All surplus materials, rubbish, waste materials, and construction debris will be removed from the site upon completion of construction of the project.*
- *All waste will be handled in accordance with relevant provincial and federal requirements.*
- *Waste material will not be dumped on-site. In such case as waste materials are inadvertently dumped, the Construction Manager (or designate) will immediately act to have the dumped material cleaned up and removed.*
- *No waste or debris will be permitted to enter any watercourse.*
- *Only material approved by the Environmental Monitor and the Site Supervisor will be disposed of or reused onsite (e.g., clean fill materials).*
- *Run-off from a disposal/storage area will not be allowed to enter a watercourse.*

4.3 Sewage Disposal

Outline of Procedure

Work area facilities for personnel will have sewage collection systems that will comprise temporary toilet and washing facilities or hook-ups to permanent facilities.

Principal Environmental Concerns

In most cases, it is not feasible to install permanent sewage treatment facilities at work sites. Employees will require toilet and washing facilities. The release of untreated sewage is a concern to human health, drinking water quality, and freshwater and marine ecosystems.

Environmental Management Measures

The following protection measures will minimize the potential environmental effects of sewage disposal:

- *Temporary or permanent facilities will be developed in compliance with Ontario's Environmental Protection Act to ensure that sewage effluent is not released untreated to the environment.*

Temporary Sewage Disposal

- *During the initial stages of site development and where it is not feasible to install sewage treatment facilities, portable and/or temporary toilets and wash cars will be developed with holding tanks.*
- *The holding tanks will be pumped and emptied at the treatment facilities, as required.*

Permanent Sewage Disposal

- *Where sewage facilities are required, developments will proceed, in accordance with*
- *Ontario's Environmental Protection Act, for a temporary or permanent sewage collection and treatment system (if required).*

5.0 CONTINGENCY PLANS FOR UNPLANNED EVENTS

5.1 Emergency Response Plan

Employee Training Program

The owners will develop and an operations training program to ensure personnel receive appropriate training in relation to operation and maintenance programs, environmental, health, and safety procedures, and emergency response plan. Training will cover issues such as:

- *Accident reporting;*
- *Chemical and hazardous materials handling;*
- *Fall and arrest protection;*
- *Eye, ears, head, hands, feet, and body protective equipment;*
- *First aid training and equipment;*
- *Equipment operation and hazards;*
- *Fire prevention and response;*
- *Lockout and tag out procedures;*
- *Scaffolds and ladders;*
- *Fire preparedness and response;*
- *Natural disasters (i.e., extreme weather events);*
- *Hazardous materials and spill response;*
- *Medical emergencies; and*
- *Rescue procedures.*

Training should begin as initial staff is hired during the pre-operational mobilization period. There should also be on-going training for personnel as well as specific training sessions for new hires.

5.2 Erosion Control Failure

Outline of Procedure

Control of erosion and potential sedimentation of receiving water bodies is one of the most critical environmental management concerns for this Project. Erosion control methods will be applied where there is the potential for erosion due to rain, flowing water, steep slopes and highly erodible soils. This program contains measures to prevent failure of erosion control structures.

Principal Environmental Concerns

The principal environmental concern is the associated sediment-laden runoff and the resulting effects on water quality, aquatic ecosystems and environmentally sensitive areas such as wetlands.

Environmental Management Measures

The following measures will be implemented to minimize the potential environmental effects in the event of erosion control failure.

Prevention:

- *Erosion control measures will be implemented as described earlier in this EMP, or as deemed necessary by the Construction Project Manager.*
- *Supplies for any emergency response will be on hand at all times. This may include, but not be limited to, straw bales, filter fabric and silt curtains.*

Emergency Response Action Plan:

- *If siltation of the nearby watercourses is observed, notify the Construction Project Manager and identify the source of the siltation. Siltation indicates preventative measures have been ineffective.*
- *Suspend any construction operations contributing to the problem.*
- *Isolate, contain, and control the source using measures such as straw bales or brush mats. Erosion control structures will be fixed immediately.*
- *If the release has affected, or has the potential to affect, a sensitive area (i.e., a wetland or watercourse), the Construction Project Manager or Environmental Monitor will contact and consult with the appropriate regulatory authorities (e.g., OMNR, Fisheries and Oceans Canada) as required for notification and planning.*
- *To ensure that erosion and sediment control measures are in effective working order, their condition will be monitored periodically and prior to, during, and following storm events.*
- *Accumulated sediment will be removed once it reaches a depth of one-half the effective height of the control measure or a depth of 300 mm immediately upstream of the control measure.*
- *For all erosion control measures, accumulated sediment will be removed as necessary to perform maintenance repairs.*
- *Accumulated sediment will be removed immediately prior to the removal of control measures.*
- *The sediment removed will be deposited in an area that is approved by the Construction Project Manager and will not result in erosion and runoff into a watercourse.*

5.2 Fuel and Hazardous Materials Spills

Outline of Procedure

This Fuel and Hazardous Material Spills Contingency Plan presents a detailed response system to deal with accidents such as the release of POLs or other hazardous materials. The objectives of the Plan are to minimize the following:

- *danger to persons;*
- *pollution of land and water;*

- *size of affected area; and*
- *degree of disturbance during clean-up.*

Principal Environmental Concerns

The day-to-day operations of construction equipment, machinery and vehicles, as well as the transfer of fuel from storage containers to these, offer the potential for fuel spills. Other hazardous material products include hydraulic fluids, lubricating oil, solvents, anti-freeze, and paint. Fuels and other hazardous materials can be damaging to vegetation, soil, surface water, groundwater, human health, wildlife and aquatic organisms. Please see **Appendix B** for the required arrangement for a static refueling point.

Environmental Management Measures

Prevention of Fuel and Hazardous Materials Spills

The following measures will be implemented to minimize the potential environmental effects in the event of a fuel or hazardous material spill:

- *Hazardous materials will be handled only by personnel who are trained and qualified in the handling of these materials, and only in accordance with manufacturer's instructions and government regulations. The WHMIS program will be implemented in accordance with the Ontario Occupational Health and Safety Act and Regulations.*
- *All employees involved with hazardous materials will be trained in the use of safety equipment, spill prevention equipment and emergency response procedures.*
- *Hazardous materials will be stored and handled in accordance with applicable provincial and federal regulations, codes and guidelines.*
- *Storage of hazardous materials will not occur in environmentally sensitive areas, such as wetlands or watercourses. Hazardous material containers will be properly labeled in compliance with the requirements of WHMIS.*
- *Material Safety Data Sheets (MSDS) will be available for all hazardous materials in use or stored on-site.*
- *A Fuel and Hazardous Material Spill Contingency Plan has been developed below.*
- *Designated personnel will be trained in the procedures and responsibilities outlined in the Contingency Plan.*
- *All hazardous materials will be removed and disposed of in an acceptable manner in accordance with government regulations and requirements. Hazardous materials may be removed from the site by an appropriate special waste collection and disposal company.*
- *Contaminated materials will be separated from uncontaminated materials and disposed of at approved waste disposal facilities.*
- *Reduce the need for hazardous substances by substituting for less harmful ones.*
- *Incorporate appropriate preventative and response measures and construction practices.*
- *Providing environmental awareness training to contractors and workers involved in the Project. Training will include the handling, clean-up, reporting and disposal of contaminated material.*

- *Maintaining appropriate spill response equipment in a readily accessible location.*
- *Reporting all spills to applicable authorities (e.g., 24-hour emergency reporting system at the MOE Spills Action Centre (1-800-268-6060).*
- *The inspection of equipment (e.g., construction vehicles, exhaust systems) by the site personnel to ensure that vehicles with obvious fuel or oil leaks do not enter the project area.*

Best management practices prescribe the presence of spill kits on location and on the vehicles. Spill management procedures as outlined in the contingency plan will be followed when a spill occurs. Spill kits are mandatory on site. Any discharge will be cleaned immediately and authorities notified (e.g. OMNR, Department of Fisheries and Oceans).

Contingency and Response Plan

- *If it is safe to do so, the individual who discovers the leak or spill will immediately attempt to stop and contain the leak or spill.*
- *Any spill or leak must be reported immediately to the Construction Project Manager or designate.*
- *The Construction Project Manager will immediately report the spill to the MOE Spills Action Centre 24-hour Report Line (1-800-268-6060).*
- *A Spill Report Form will be filled out and will include:*

    - *a description of the source, including the name of the owner or operator;*
    - *the nature, extent, duration and environmental impact of the release;*
    - *the cause or suspected cause of the release;*
    - *any remedial action taken or to be taken to prevent a recurrence of the leak or spill;*
    - *The site Contractor will have the full authority to take appropriate action without unnecessary delay. The Spill Report Form will be filled out immediately following the discovery of the spill or leak, by the Contractor, and forwarded to the Environmental Monitor; Spill Reports will be made available to the OMNR upon request; and,*
    - *The Contractor will assume the overall responsibility for coordinating the clean-up and maintaining this contingency plan current and up-to-date.*

- *The Contractor will, in consultation with the regulatory authorities (if warranted):*
    - *deploy on-site personnel to contain the spilled material using a dyke, pit, or absorbent material;*
    - *assess site conditions and environmental impact of various cleanup procedures;*
    - *choose and implement an appropriate cleanup procedure;*
    - *deploy on-site personnel to mobilize pumps and empty drums (or other appropriate storage) to the spill site;*
    - *dispose of all contaminated debris, cleaning materials, and absorbents by placing in an approved disposal site; and take all necessary precautions to ensure that the incident does not recur; and,*
    - *The Contractor, with approval by the Environmental Monitor, will send a completed Spill Report Form to the OMNR, as soon as possible, and no later than 30 days after the spill.*

Spill Cleanup Resource List

During construction, the following resources will be available at an appropriate location in readiness to respond to accidental releases of fuels and/or hazardous materials:

- *Absorbent materials (i.e., sorbent pads, Sorb-All, peat moss);*
- *Small equipment such as shovels, rakes, tool kit, sledgehammer, buckets, stakes, tarpaulins, one empty drum, and protective equipment; and,*
- *Refer to the contact list of this EMP which contains the spill response information.*

5.3 Archaeological and Heritage Resources

Outline of Procedure

Archaeological/heritage resources are defined as known archaeological sites, designated historic sites, and heritage structures. These resources are considered important as they are recognized by the Province and form part of a collective body of information used to understand and define the Provincial heritage.

The geographical extent of any adverse effects will be the entire resource and adjacent areas associated with heritage resources that occur within the Project footprint. The magnitude of construction effects on unknown heritage resources will be high, as clearing and excavation activities will expose the resource. This effect will be immediate and irreversible. If unknown resources are encountered during either the construction or operation phase, they will be affected, and effects will be site-specific. However, the potential for significant loss of knowledge would be minimized through the initiation of a contingency plan for affected resources.

In addition to these resources, although much less likely, there is the potential for human remains to be encountered during construction. This plan will guide the Municipality and/or their contractors and subcontractors in how to respond in the event that a potential archaeological resource is encountered during construction activities.

Principal Environmental Concerns

These features represent a valuable cultural resource, and uncontrolled disturbance could result in loss of or damage to these resources and the information represented by them.

Environmental Management Measures

The following measures will be implemented to minimize the potential environmental or cultural effects in the event of the discovery of heritage resources.

Preventing Archaeological and Heritage Resource Encounters

- *All areas containing known historic or archaeological resources will be avoided where possible, and will be flagged or otherwise clearly marked to indicate that the area has elevated archaeological potential and /or significance.*
- *All mechanized vehicles/equipment will remain within the existing site roads except where required for clearing and other construction activities. Vehicles and equipment will avoid areas marked as having elevated archaeological potential.*

Contingency and Response Plan

- *All work will cease in the immediate area of the discovery until such time as the Environmental Monitor, having consulted with provincial authorities, advises those involved as to the disposition of the discovery and authorizes a resumption of the work.*
- *Archaeological materials encountered will be reported to the Environmental Monitor with the following information:*

    - *nature of activity resulting in the discovery;*
    - *nature of the material discovered;*
    - *the precise location of the find; and*
    - *names of persons witnessing the discovery.*

All heritage resources, including archaeological objects and sites of archaeological or historical interest or significance discovered on the site, will be deemed to be the property of the Crown and will not be disturbed. All precautions will be taken to prevent employees or other persons from removing any artifacts or damaging sites, as personnel may be held liable by prosecution for all contraventions. All human remains will be reported directly to the local police.

5.4 Wildlife Encounters

Outline of Procedure

This program contains measures to minimize interactions that Municipal and Contractor personnel may have with wildlife during Project construction.

Principal Environmental Concerns

Encounters with wildlife may result in distress for both the animal and the employee. Serious injury could result to site workers in some instances. Threats to personnel include encounters with wildlife especially animals with young and rabid animals. Bites from any animals are potentially dangerous. Wildlife encounters have the potential to distress animals to the point of altering feeding and breeding behavior. Physical injury or death to wildlife could also occur.

Environmental Management Measures

Personnel Training

Personnel will be advised of the appropriate measures to use in the event of a wildlife encounter. Personnel will be instructed in the correct and sanitary method of garbage disposal in designated disposal locations; this will minimize wildlife encounters.

Prevention

The following waste disposal recommendations will minimize the attraction of wildlife:

- *Keep work area clean of food scraps and garbage.*
- *Transport waste to an approved landfill on a regular basis.*

Contingency and Response Plan

- *All personnel will report the presence of wildlife to the Construction Project Manager.*
- *When wildlife sightings are reported to the Construction Project Manager, the Construction Project Manager will initiate any reasonable action to reduce the chance of disruption or injury.*
- *Should disruption or injury to the wildlife occur, the Construction Manager will contact the on-call Conservation Officer.*
- *In the case of wildlife encounters in sensitive areas, and for consultation on appropriate action to be taken for any encounter, the Construction Manager will contact the on-call Conservation Officer.*
- *No attempt to harass wildlife will be made by any person at the work site.*
- *Equipment and vehicles will yield the right-of-way to wildlife.*
- *If dead animals are encountered (including birds or bats), they will be removed and disposed of, as soon as possible, in consultation with the local Provincial Wildlife Officer (or, in the case of a pet, the Ontario Humane Society). All handling of bird carcasses will be in accordance with the MBCA salvage permit. If Species at Risk ("SAR") species carcasses are found they will be sent to the Ontario Region Canadian Wildlife Service ("CWS") office with suitable permitting as advised by the Canadian Wildlife Service.*
- *In the case of encounters with injured or diseased wildlife at the work site (including birds or bats), the Construction Manager will contact the on-call Conservation Officer. No attempt will be made to harass the animal, and no person at the work site will come into direct contact with the animal.*
- *Injured birds and other wildlife will be transported to the Wild at Heart Wildlife Refuge Centre in Sudbury (11 White Rd. – Lively, ON Canada P3Y 1C3 - mail@wahrefugecentre.org – 705-692-4478) which has been operating for over 20 years as a non-profit and registered charity, has provided veterinary treatment and rehabilitation to wild animals that are orphaned, sick or injured, so that they may be reintroduced into the wild. The centre's volunteers treat up to 500 animals per year, including songbirds, raptors, shorebirds, waterfowl, small mammals, and orphaned large mammals.*

- *If an injured or dead bird or bat is encountered, the following information will be recorded: date and time it was found, injury sustained (if identifiable), cause of injury (if known), and species. This information will be kept on file for incorporation into the post-construction bird monitoring program.*

5.5 Fires

Outline of Procedure

Activities related to construction could result in a fire that could spread to the surrounding area. Alternatively, a fire started off-site could spread into the Project area. This Contingency Plan contains measures for fire prevention as well as response action plans.

Principal Environmental Concerns

Fires could result in terrestrial habitat alteration, and direct mortality of wildlife. Fire fighting chemicals and spilled materials could enter aquatic habitat and adversely affect biota and habitat. Fires also have the potential to adversely affect air quality and could pose risks to human health and safety.

Environmental Management Measures

The following measures will be implemented to minimize the potential for causing a fire and the potential environmental effects in the event of a fire.

Personnel Training

All persons working on the site will be trained in the use of on-site firefighting equipment, fire prevention and response.

Prevention

- *All flammable waste will be disposed of on a regular basis.*
- *There will be no smoking within 50 m of flammable product storage or usage. Areas for disposal of smoking material will be clearly posted.*
- *Firefighting equipment, sufficient to suit on-site fire hazards, will be maintained in proper condition and to the manufacturer's standards.*

Contingency and Response Plan

- *Notify nearby personnel.*
- *On-site personnel will take immediate steps to extinguish the fire using appropriate equipment.*
- *Notify the Environmental Monitor and Construction Manager.*
- *If the fire cannot be contained, contact the NEMI Fire Department at* ***9-1-1****.*
- *In case of related medical emergencies, emergency medical assistance will be requested from* ***9-1-1****.*

Decommissioning Program

The design life of the wind turbines is estimated to be approximately 30 years, but it is possible that the turbines could continue to operate at the same location after the design life either through major turbine overhauls or with the replacement of the turbines with newer models.

Should decommissioning become necessary, the owners would follow the standard industry accepted practices in effect at that time. Such practices include the removal of facilities, recycling of suitable materials (e.g., metal and parts), reuse of components and equipment in other facilities, conversion of buildings to other uses, and/or rehabilitation of the site areas. This would include the removal of the turbines bases to a depth of approximately 1 m or bedrock and backfilling with a final layer of top soil. Similarly, access road base material would be removed and the areas returned to their former state (e.g., agriculture on natural habitat).

Health and Safety Plan

The Project has been designed and will be constructed, operated and decommissioned using applicable standards and industry best practices. Equipment will be inspected regularly and maintained to prevent any potential health or safety issues.

Accidents and malfunctions with short-term impacts may occur. More serious impacts are considered to be highly unlikely.

6.0 ENVIRONMENTAL INSPECTION AND MONITORING

In compliance with the REA, associated Natural Heritage Assessment reports were submitted to the Ontario Ministry of Natural Resources and written confirmation received that appropriate procedures were followed. Through a records review, site investigation and natural features evaluation of significance, it was determined that significant and/or provincially significant natural features exist within the project location or prescribed setback areas, as outlined in **Table 1**. The EIS Report demonstrates how negative environmental effects of the project will be mitigated, and sets out a program for ongoing monitoring of the effectiveness of the mitigation measures. **Table 2** above provides a description of performance objectives in respect of each negative environmental effect; mitigation measures planned to achieve performance objectives; how the project is to be monitored; and a contingency plan to be implemented should monitoring reveal that mitigation measures have failed. The EIS Report was completed to mitigate any potential negative environmental effects to the following significant or provincially significant natural features:

- Wetland 1 to 10;
- Waterfowl Nesting 1, 4 and 5;
- Raptor Winter Feeding and Roosting 3 & 4;
- Alvar 1 to 4;
- Woodland Amphibian Breeding Habitat 1 to 8;
- Turtle Over-wintering Area 1 to 6;
- Sites Supporting Area-sensitive Species: Forest Birds 1 & 2;
- Sites Supporting Area-sensitive Species: Open Country Breeding Birds 3 & 4;
- Species of Conservation Concern – Cooper's Milkvetch, Slender Blazing Star, Clustered Broomrape, Prairie Dropseed, Short-eared Owl, Canada Warbler, Common Nighthawk & Snapping Turtle

Table 2 outlines how the activities related to the construction, operation and decommissioning of the facility affect these natural features and the appropriate mitigation and monitoring work

to be implemented. Specifics of the Environmental Effects Monitoring Plan for bird and bats as mentioned in **Table 2**, is provided in **Appendix D**. **Table 2** also makes reference to "*see Section 6 for mitigation commitments to compensate for habitat loss and disturbance*". The mitigation commitments being referred to are for Raptor Winter Roosting and Feeding Area, Sites Supporting Area Sensitive Species: Open-Country Breeding Birds, Sites Supporting Area Sensitive Species: Forest Birds and Waterfowl Nesting Habitat. Compensation for habitat loss and disturbance for each of these habitats is itemized below.

Raptor Winter Roosting and Feeding Area and Sites Supporting Area Sensitive Species: Open-Country Breeding Birds

Develop an agreement with current participating landowners of Lot 7 and 8 of Concession 7, north of the cluster of wind turbines (T5, T6, T9, T10, T13, T15), to manage an area of 15 ha of open country habitat (i.e. Raptor Winter Roosting & Feeding Area and Open-Country Breeding Birds). This area to be managed is equal to or greater than that being removed or displaced by the above turbines, associated access roads and transmission line. The focus of this habitat management program should be to ensure:

1. Active maintenance of open country habitat, consisting of either cattle grazing or bi-annual cutting of herbaceous and woody debris, to prevent succession or change in land-use. This will ensure 15 ha of undisturbed open country habitat on Lot 7 and 8 of Concession 7 remains available for Open-Country Breeding Birds; and

2. Similar habitat maintenance will also provide the necessary habitat for a population of small mammals. These small mammals will support the Raptor Winter Roosting and Feeding Habitat; and

3. Agreement of participating landowners within the management zone (15 ha of Lot 7 and 8 of Concession 7), which prohibits cutting between May 15 to July 15.

Sites Supporting Area Sensitive Species: Forest Birds

Develop an agreement with current participating landowner of Lot 33, Concession 1, to manage a 3 ha area of treed pasture adjacent to turbine 35. This area is equal to or greater than that being removed or displaced as a result of turbine construction, associated access roads and feeder line. The focus of the habitat management program should ensure:

1. Agreement of participating landowner of Lot 33 Concession 1, which overlaps Forest Bird Interior 1 and 2 to not undertake any modification of the forest that would create gaps greater than 20m wide or decrease the canopy cover to less than 75%;

2. Expansion of interior forest habitat through infilling incised areas which currently have a treed pasture community with restoration plantings. This should be completed with native trees species which complement the adjacent vegetation communities and environmental conditions.

Waterfowl Nesting Habitat

Develop an agreement with current participating landowners to manage availability of nesting habitat within Waterfowl Nesting Areas 1, 4 and 5. This area will be equal to or greater than that being removed or displaced (1.4 ha) as a result of turbine construction and feeder line installation. The focus of the habitat management program should ensure:

1. Strategic placement of waterfowl nest boxes within Waterfowl Nesting Area 1, 4 and 5, greater than 200m from turbine edge.

Species at Risk and other Approval and Permitting Requirements

Specific mitigation and or permits required for Species at Risk as well as other requirements specific to the MNR's Approval and Permitting Requirements Document for Renewable Energy (MNR 2009), are being discussed directly with the MNR and will be implemented as directed by

the MNR.

Table 1: Summary of the Natural Heritage Assessment for McLean's Mountain Wind Farm

Natural Feature	Applicable Project Component(s)	Distance Between Feature & Project Location (metres)	Summary of Natural Heritage Assessment			EIS Required?
			Identified During Records Review?	Identified, Verified or Refined During Site Investigation?	Evaluation of Significance Results	
Provincial Parks and Conservation Reserves						
Not applicable to project location						
ANSI, Life Science						
Not applicable to project location						
ANSI, Earth Science						
Not applicable to project location						
Valleylands						
Not applicable to project location						
Wetlands						
1	T40, Horizontal Directional Drilling (HDD) Access/Exit Pit, Access Road, Feeder Lines	30 m	✓	Refined	Prov. Significant	✓
2	HDD Access/Exit Pit, Feeder Lines	30 m	☒	Identified	Prov. Significant	✓
3	HDD Access/Exit Pit, Access Road, Feeder Lines	25 m	☒	Identified	Prov. Significant	✓
4	Access Road, Feeder Lines	0m	☒	Identified	Prov. Significant	✓
5	Access Road, Feeder Lines	0m	☒	Identified	Prov. Significant	✓
6	HDD Access/Exit Pit, Access Road, Feeder Lines, T23	30 m	☒	Identified	Prov. Significant	✓
7	Access Road, Feeder Lines, T30	52 m	✓	Refined	Prov. Significant	✓
8	Access Road	5 m	☒	Identified	Prov. Significant	✓
9	Access Road	2 m	☒	Identified	Prov. Significant	✓
10	Access Road	40 m	☒	Identified	Prov. Significant	✓
11	Access Road	75 m	☒	Identified	Not Significant	☒

Natural Feature	Applicable Project Component(s)	Distance Between Feature & Project Location (metres)	Summary of Natural Heritage Assessment			EIS Required?
			Identified During Records Review?	Identified, Verified or Refined During Site Investigation?	Evaluation of Significance Results	
12	Transmission line	Within	☒	Identified	Not Significant	☒
Seasonal Concentration Areas						
Waterfowl Nesting Area – WNA 1	HDD Access/Exit Pit, Feeder Line and Access Road, T40, T42	Within project location	☒	Identified as Candidate	Significant	✓
Waterfowl Nesting Area – WNA 4	HDD Access/Exit Pit, Feeder Line and Access Road, T29	Within project location	☒	Identified as Candidate	Significant	✓
Waterfowl Nesting Area – WNA 5	T6	Within 120m	☒	Identified as Candidate	Significant	✓
Waterfowl Nesting Area – WNA 2 & 3	HDD Access/Exit Pit, Feeder Line and Access Road,	Within project location	☒	Identified as Candidate	Not Significant	☒
Raptor Winter Feeding and Roosting Area RWFR 1 & 2	HDD Access/Exit Pit, Feeder Line, Access Road, T16, T29	Within project location	☒	Identified as Candidate	Not Significant	☒
Raptor Winter Feeding and Roosting Area RWFR 3	Turbine 34, Feeder Line and Access Road	Within project location	☒	Identified as Candidate	Significant	✓
Raptor Winter Feeding and Roosting Area RWFR 4	T6, T5, T13, T10, T9, T15, T19, T20 Construction Staging Area, Feeder line and Transmission line -	Within project location	☒	Identified as Candidate	Significant	✓
Bullfrog Concentration Area - BCA 1, 2, 3, 4, 5 & 6	HDD Access/Exit Pit, Feeder Line and Access Road, T40, T23	Within 120m	☒	Identified as Candidate	Not Significant	☒
Rare Vegetation Communities						

Natural Feature	Applicable Project Component(s)	Distance Between Feature & Project Location (metres)	Summary of Natural Heritage Assessment			EIS Required?
			Identified During Records Review?	Identified, Verified or Refined During Site Investigation?	Evaluation of Significance Results	
Alvar - ALV 1, 2	Feeder Line	Within 120m	☒	Identified as Candidate	Significant	✓
Alvar - ALV 3	Feeder Line & HDD Access/Exit Pit	Within project location	☒	Identified as Candidate	Significant	✓
Alvar - ALV 4	Transmission Line	Within 120m	☒	Identified as Candidate	Significant	✓
Alvar - ALV 5	Transmission Line	Within project location	☒	Identified as Candidate	Not Significant	☒
Specialised Wildlife Habitat						
Woodland Amphibian Breeding Habitat - WABH 1 & 7	Feeder Line & HDD Access/Exit Pit	Within 120 m	☒	Identified as Candidate	Significant	✓
Woodland Amphibian Breeding Habitat – WABH 2	T40, Feeder Line and Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Woodland Amphibian Breeding Habitat - WABH 3 & 4	Feeder Line & HDD Access/Exit Pit	Within 120 m	☒	Identified as Candidate	Not Significant	☒
Woodland Amphibian Breeding Habitat - WABH 5	HDD Access/Exit Pit, Feeder Line & Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Woodland Amphibian Breeding Habitat - WABH 6	Feeder Line & Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Woodland Amphibian Breeding	Feeder Line & T23	Within 120 m	☒	Identified as Candidate	Significant	✓

Natural Feature	Applicable Project Component(s)	Distance Between Feature & Project Location (metres)	Summary of Natural Heritage Assessment			EIS Required?
			Identified During Records Review?	Identified, Verified or Refined During Site Investigation?	Evaluation of Significance Results	
Habitat - WABH 8						
Turtle Overwintering Areas - TOA 1	T40, HDD Access/Exit Pit, Feeder Line & Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Turtle Overwintering Areas - TOA 2	HDD Acess/Exit Pit, Feeder Line	Within 120 m	☒	Identified as Candidate	Significant	✓
Turtle Overwintering Areas - TOA 3	HDD Access/Exit Pit, Feeder Line & Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Turtle Overwintering Areas - TOA 4	Feeder Line	Within 120 m	☒	Identified as Candidate	Significant	✓
Turtle Overwintering Areas - TOA 5	HDD Access/Exit Pit, T23, Feeder Line and Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Turtle Overwintering Areas - TOA 6	Access Road	Within 120 m	☒	Identified as Candidate	Significant	✓
Sites Supporting Area-sensitive Species: Forest Birds - FB 1	T43, T39, Feeder line & Access Road	Within project location	☒	Identified as Candidate	Significant	✓
Sites Supporting Area-sensitive	HDD Access/Exit Pit & Feeder Line	Within project location	☒	Identified as Candidate	Significant	✓

Natural Feature	Applicable Project Component(s)	Distance Between Feature & Project Location (metres)	Summary of Natural Heritage Assessment			EIS Required?
			Identified During Records Review?	Identified, Verified or Refined During Site Investigation?	Evaluation of Significance Results	
Species: Forest Birds - FB 2						
Sites Supporting Area-sensitive Species: Forest Birds - FB 3, 4 & 5	HDD Access/Exit Pit, T17, T21, T11, T14, Feeder Line & Access Road	Within project location	☒	Identified as Candidate	Not Significant	☒
Sites Supporting Area-sensitive Species: Open Country Breeding Birds - OCBB 1	Feeder Line & Access Road	Within project location	☒	Identified as Candidate	Not Significant	☒
Sites Supporting Area-sensitive Species: Open Country Breeding Birds - OCBB 2	HDD Access/Exit Pit, T29, T16, Feeder Line & Access Road	Within project location	☒	Identified as Candidate	Not Significant	☒
Sites Supporting Area-sensitive Species: Open Country Breeding Birds - OCBB 3	T34	Within 120m	☒	Identified as Candidate	Significant	✓
Sites Supporting Area-sensitive Species: Open Country Breeding Birds - OCBB 4	T6, T5, T13, T10, T9, T15, Feeder Line, Construction Staging Area, Access Road & Transmission line	Within project location	☒	Identified as Candidate	Significant	✓
Sites Supporting Area-sensitive Species: Open Country Breeding Birds - OCBB 5	Access Road	Within project location	☒	Identified as Candidate	Not Significant	☒
Habitat of Species of Conservation Concern						

Natural Feature	Applicable Project Component(s)	Distance Between Feature & Project Location (metres)	Summary of Natural Heritage Assessment			EIS Required?
			Identified During Records Review?	Identified, Verified or Refined During Site Investigation?	Evaluation of Significance Results	
Northern Shrike	---	---	✓	Identified as Candidate	Not Significant	☒
Rough-legged Hawk	---	---	✓	Identified as Candidate	Not Significant	☒
Olive-sided Flycatcher	---	---	✓	Identified as Candidate	Not Significant	☒
Red-headed Woodpecker	---	---	✓	Identified as Candidate	Not Significant	☒
Short-eared Owl	See OCBB4	See OCBB4	✓	Identified as Candidate	Significant	✓
Bald Eagle	---	---	✓	Identified as Candidate	Not Significant	☒
Common Snapping Turtle	See TOA	See TOA	✓	Identified as Candidate	Significant	✓
Cooper's Milkvetch	T30	10 m from T30	✓	Identified as Candidate	Significant	✓
Slender Blazing Star	Transmission Line	Within 120m	✓	Identified as Candidate	Significant	✓
Clustered Broomrape	No occurrence known	--	✓	Identified as Candidate	Significant	✓
Prairie Dropseed	No occurrence known	--	✓	Identified as Candidate	Significant	✓

Potential Negative/Positive Effect(s)		Significant Natural Feature Affected by Activity	Performance Objective	Mitigation Measures	Residual Effects	Monitoring Strategy & Methods	Monitoring Locations	Frequency & Duration	Reporting Requirements	Contingency Measures
Physical	**Functional**									
▪ Potential for increased erosion and sedimentation on adjacent lands ▪ Removal of vegetation adjacent to natural features	▪ Habitat fragmentation and decreased shade cover in areas adjacent to natural feature ▪ Increased vulnerability of the cleared area to invasion by non-native species ▪ Greater exposure of wildlife to predation through the opening of interior habitat to increased predator activity ▪ Greater potential for reduced water quality required for successful breeding	Wetland 1, 3, 6, 7, Woodland Amphibian Breeding Habitat 1, 2, 5, Turtle Over-wintering Habitat 1, 2, 3, 4, 5, 6	Prevent erosion and sedimentation of adjacent lands, minimize removal of vegetation and maintain water quality of natural feature	▪ Develop and implement an erosion and sediment control plan before removing vegetation ▪ Fencing of boundary between wetland and area to be cleared to prevent encroachment ▪ Erosion and sediment control plan and/or fencing will be designed in a manner that does not prevent turtle access/exit to over-wintering habitat	No Residual Effect	Monitor the effectiveness of the erosion and sedimentation control measures	Areas of clearing and grubbing within 30m of a wetland, Woodland Amphibian Breeding Habitat and Turtle Over-wintering Habitat	Biweekly and/or after a 10mm rain event until vegetation is re-established	Notification of incident to the appropriate onsite personnel Identification of results, issue and resolution in annual report, which is to be submitted to the MNR	Soils stabilization treatment and native replacement plantings to be provided in significantly disturbed areas with repeated erosion and sedimentation control measure failures
▪ Limited potential for increased erosion and sedimentation to enter into habitat ▪ Removal/storage of spoils from HDD Access/Exit Pit on either side of Perch Creek.	▪ Localized temporary displacement of wildlife due to noise and vibration	Wetland 1, 2, 3, 4, 5, 6, 7, Waterfowl Nesting Area 1, 4, Raptor Winter Feeding and Roosting Area 3, Woodland Amphibian Breeding Habitat 1, 3, 4, 6, 7, 8	Remove or contain spoils from HDD on site	▪ Ensure all spoils from site are removed in a timely manner. If any storage of spoils is required they should be no closer than 30m from the wetland ▪ Implement erosion and sediment control plan to ensure no transportation of spoils into adjacent areas ▪ Re-grade to preconstruction condition and re-vegetate using native plant species typical of the adjacent habitat	No Residual Effect		In areas where HDD spoils are stored between 120m and 30m from natural features	Biweekly and/or after a 10mm rain event until spoils are removed and vegetation is re-established		Any failure of sediment and erosion control measures meant to contain spoils will result in spoils being truck offsite or at a minimum > 120m away from a natural feature
▪ Loss of native substrate and potential for imported gravel material	▪ Loss of plant diversity in localized area adjacent to road	Wetland 1, 3, 7, Waterfowl Nesting Area 1, Woodland Amphibian Breeding Habitat 5, 6	Prevent reduction in quality or lose of plant/vegetation	▪ Design roads to promote infiltration (e.g. use of gravel materials);	Minimal Residual Effect – road area small, thus marginal	Visual assessment of vegetation communities for	Areas adjacent to access roads and turbine basis	At the end of construction	Identification of results, issue and resolution in annual report,	Foreign substrate to be removed and native replacement plantings to be

Potential Negative/Positive Effect(s)		Significant Natural Feature Affected by Activity	Performance Objective	Mitigation Measures	Residual Effects	Monitoring Strategy & Methods	Monitoring Locations	Frequency & Duration	Reporting Requirements	Contingency Measures
Physical	**Functional**									
to enter into immediately adjacent habitat during storm events ▪ Increased runoff during storm events as a result of reduced infiltration in local area	▪ Where road substrate is removed post-construction, imported soil has the potential to support the growth of non-native species		communities adjacent to access roads and turbine basis	▪ Maintain or provide vegetative buffers; ▪ Stock piled materials necessary for construction will be placed greater than 30m away from a wetland and potential sedimentation arising from these will be contained by the erosion and sediment control measures.	decrease in localized infiltration expected; negligible change to surface water runoff volumes expected from pre-development conditions	disturbance			which is to be submitted to the MNR	provided in significantly disturbed areas
	▪ Loss of upland forage structure in localized area adjacent to road	Woodland Amphibian Breeding Habitat 5								
▪ Disturbance of vegetation that has regenerated adjacent to access road during the operational period	▪ Increased vulnerability of the site to invasion by non-native species	Wetland 1, 3, 6, 7, 8, 9, 10, Waterfowl Nesting Area 1, 4 & 5, Raptor Winter Feeding and Roosting Area 4, Woodland Amphibian Breeding Habitat 2, 5, 6, Turtle Over-wintering Habitat 1, 3, Area Sensitive Species: Forest Birds FB 1, Area Sensitive Species: Open Country Breeding Birds OCBB 3, 4	Reduce disturbance of vegetation that has regenerated around project components that are to be removed	▪ Confine disturbance to the smallest area possible ▪ No additional footprint disturbance than was created during construction ▪ Re-vegetate disturbed area with fast growing competitive nurse crop; ▪ Develop and implement an erosion and sediment control plan prior to decommissioning ▪ Cease decommissioning in Waterfowl Nesting Area during April 15 to June 15, May 1 to July 15 for other natural features	No Residual Effect	Monitor establishment of nurse crop as well as the effectiveness of the erosion and sediment control plan	A representative subset of project components where habitat is disturbed, including those within 30m of a wetland, Woodland Amphibian Breeding Habitat and Turtle Over-wintering Habitat	Biweekly and/or after a 10mm rain event for one growing season until vegetation is re-established	Notification of incident to the appropriate onsite personnel. Identification of results, issue and resolution in annual report, which is to be submitted to the MNR	Where nurse crop does not sufficiently establish itself and erosion is observed to be occurring, reseed and monitor
▪ Existing access road to follow an esker and material to be used as construction material, which may result in reduced stability of landform composed of	▪ Clearing of forest vegetation along slope of road as material is extracted for other construction purposes. ▪ Potential to reduce the quality of natural features	Wetland 6, 8, 9, 10, Waterfowl Nesting Area 4	Prevent the sedimentation of wetland at the base of esker road slope	▪ Use existing access road (esker) and minimize widening ▪ Minimize vegetation removal on slopes and add additional thick native shrub plantings at the base of slope closest to 75m Wetland 6 finger in	Minimal Residual Effect – provided: appropriate construction monitoring occurs' erosion and sediment	Monitor the effectiveness of the erosion and sedimentation control measure protecting & visually inspect slope stability	Areas of wetland 6, 8, 9 and 10 that are closest to the access road	Bi-weekly during construction and monthly after construction for 2 years (except during	Identification of results, issue and resolution in annual report, which is to be submitted to the MNR	Stabilize slopes ; remove esker material which has reduced quality of wetland and provide native replacement plantings of an appropriate extent

Potential Negative/Positive Effect(s)		Significant Natural Feature Affected by Activity	Performance Objective	Mitigation Measures	Residual Effects	Monitoring Strategy & Methods	Monitoring Locations	Frequency & Duration	Reporting Requirements	Contingency Measures
Physical	**Functional**									
unconsolidated material ▪ Increased erosion of esker material into down slope natural features	vegetation immediately down slope of access road			proximity to access road ▪ Maintain appropriate side slopes and add native plantings to stabilize material during and after removal ▪ Develop and implement an erosion and sediment control plan before removing vegetation on slopes and before any extraction ▪ Stock piled materials necessary for construction will be placed greater than 30m away from a wetland and potential sedimentation arising from these will be contained by the erosion and sediment control measures.	control structure is maintained, additional native plantings added and side slopes are stabilized effects will be decreased	and wetland		winter when snow cover is present)		and species diversity to ensure no net lose of wetland vegetation and function
▪ Loss of forest vegetation	Disturbance/displacement of wintering raptors, especially Short-eared Owl from local area	Raptor Winter Feeding and Roosting Area 3	Monitor effectiveness of project location design to prevent the displacement of wintering raptors	▪ Project location designed to be on the periphery of this habitat and minimize the loss of vegetation ▪ Additional pre-construction surveys will be conducted to further assess the significance of this feature. If the feature continues to be considered significant, mitigation, as detailed here, is required. Pre-construction surveys to be conducted will be confirmed in consultation with the MNR.	No Residual Effect	Behavioural and mortality post construction monitoring developed in consultation with MNR	Raptor Winter Feeding and Roosting Area 3 & 4, Forest Birds FB 2, Area Sensitive Species: Open Country Breeding Birds OCBB 3, 4	Winter season for 3 years post-construction	Identification of results, issue and resolution in bird and bat post-construction annual report, which is to be submitted to the MNR	Possible change in project operations as determined necessary through consultation with MNR and Northland Power Inc. Possible habitat compensation in other areas of Manitoulin Island, as determined appropriate with MNR and NLP Inc.

Potential Negative/Positive Effect(s)		Significant Natural Feature Affected by Activity	Performance Objective	Mitigation Measures	Residual Effects	Monitoring Strategy & Methods	Monitoring Locations	Frequency & Duration	Reporting Requirements	Contingency Measures
Physical	Functional									
				▪ See Section 9.1 for mitigation commitments to compensate for habitat loss and disturbance.						
Loss of open pasture habitat	Reduced foraging area for winter raptors	Raptor Winter Feeding and Roosting Area 4	Monitor the level of displacement or mortality of birds associated with significant wildlife habitats	▪ To the degree possible, the project location has been designed to minimize habitat displacement and reduce potential disturbance of winter raptors using this area. ▪ Construction to be done outside of the winter months to avoid disturbance to wintering raptors ▪ Additional pre-construction surveys will be conducted to further assess the significance of this feature. If the feature continues to be considered significant, mitigation, as detailed here, is required. Pre-construction surveys to be conducted will be confirmed in consultation with the MNR. ▪ See Section 9.1 for mitigation commitments to compensate for habitat loss and disturbance.	Minimal Residual Effect					
▪ Displacement/mortality of birds	▪ Reduced foraging/breeding area, abundance and diversity	Waterfowl Nesting Area 1, 4 & 5, Raptor Winter Feeding and Roosting Area 4, Area Sensitive Species: Forest Birds FB 1, Area Sensitive		▪ 3 year post-construction behavioural and mortality monitoring, consistent with MNR protocols, to assess	Minimal Residual Effect					

Potential Negative/Positive Effect(s)		Significant Natural Feature Affected by Activity	Performance Objective	Mitigation Measures	Residual Effects	Monitoring Strategy & Methods	Monitoring Locations	Frequency & Duration	Reporting Requirements	Contingency Measures
Physical	Functional									
		Species: Open Country Breeding Birds OCBB 3, 4		impacts of turbines on birds for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan ▪ Potential occurrence of raptor mortality during winter months will be completed during behavioural monitoring.						
▪ Potential for increased erosion and sedimentation within and adjacent to Alvars ▪ Disturbance of adjacent habitat and potential for sedimentation of area where Slender Blazing Star plants occur during extreme storm event	▪ Disruption of indicator species in Alvar 3 ▪ Increased vulnerability of the cleared area to invasion by non-native species within Alvar 3 and adjacent to Alvar 1, 2 & 4 ▪ Reduction in quality of plants and germination of seeds in areas associated with Alvar 4 Slender Blazing Star occurrence	Alvar 1, 2, 3 & 4 including Slender Blazing Star Associated with Alvar 4	Prevent sediment and erosion within or immediately adjacent to Alvars and protect indicator species	▪ Develop and implement an erosion and sediment control plan before removing vegetation ▪ Fencing of boundary between Alvar community and area to be cleared/disturbed to prevent encroachment	No Residual Effect	Monitor the effectiveness of the erosion and sedimentation control measures	Areas of clearing and grubbing within 30m of a Alvar	Biweekly and/or after a 10mm rain event until vegetation is re-established	Notification of incident to the appropriate onsite personnel Identification of results, issue and resolution in annual report, which is to be submitted to the MNR	Soils stabilization treatment and native replacement plantings to be provided in significantly disturbed areas with repeated erosion and sedimentation control measure failures
▪ Displacement and disturbance of area sensitive forest birds	▪ Reduced recruitment	Area Sensitive Species: Forest Birds FB 2	Monitor the level of displacement or mortality of birds associated with significant wildlife habitats	▪ Avoid site preparation and construction during the core breeding bird season (May 1 to July 15)	No Residual Effect	Behavioural and mortality post construction monitoring developed in consultation with MNR	Waterfowl Nesting Areas 1, 4 & 5, Forest Birds FB 1, 2, Area Sensitive Species: Open Country Breeding Birds OCBB 3, 4	Breeding season for 3 years post-construction	Identification of results, issue and resolution in bird and bat post-construction annual report, which is to be submitted to the MNR	Possible change in project operations as determined necessary through consultation with MNR and Northland Power Inc. Possible habitat compensation in other areas of Manitoulin Island, as determined appropriate with
▪ Removal of a small portion of habitat ▪ Localized disturbance/displacement /mortality of waterfowl/areas sensitive birds	▪ Greater exposure of wildlife (birds) to predation and parasitism ▪ Reduced recruitment	Waterfowl Nesting Area 1, 4 & 5, Area Sensitive Species: Forest Birds FB 1, Area Sensitive Species: Open Country Breeding Birds OCBB 3, Area Sensitive Species: Open Country Breeding Birds OCBB 4		▪ Avoid site preparation and construction during the core breeding bird season (May 1 to July 15), for waterfowl nesting areas dates will be April 15 to June 15 ▪ See Section 9.1 for mitigation commitments to compensate	Minimal Residual Effect					

Potential Negative/Positive Effect(s)		Significant Natural Feature Affected by Activity	Performance Objective	Mitigation Measures	Residual Effects	Monitoring Strategy & Methods	Monitoring Locations	Frequency & Duration	Reporting Requirements	Contingency Measures
Physical	**Functional**									
				for habitat loss and disturbance.						
▪ Loss of Cooper's Milkvetch	▪ The individual was the only one observed in the study area	Species of Conservation Concern – Cooper's Milkvetch	Prevent the disturbance or possible extirpation of Cooper's Milkvetch from the local area	▪ Transplant Cooper's Milkvetch from area around Turbine 30 and plant other individuals within appropriate habitat ▪ Monitor transplants/plantings to document plant survivorship	No Residual Effect	Monitor the survivorship of transplanted and other planted Cooper's Milkvetch	Alvar habitat with low potential for disturbance	Twice yearly for two years after transplant during the growing season.	Identification of results, issue and resolution in annual report, which is to be submitted to the MNR.	Provide additional plantings and locations if survivorship is found to be low
▪ Potential loss of plants of conservation concern	▪ A single individual removed could influence survivorship of species in the larger area	Plant Species of Conservation Concern – Clustered Broomrape, Prairie Dropseed, Slender Blazing Star and Cooper's Milkvetch	Prevent the disturbance or possible extirpation of listed plants from the local area	▪ As a precaution, assess areas of project location with appropriate habitat for presence of species prior to clearing. This is recommended due to recent changes in project location ▪ Transplant any occurrence observed and plant other individuals within appropriate habitat ▪ Monitor transplants/plantings to document plant survivorship	No Residual Effect	Were appropriate habitat occurs and prior to clearing, a search for plant species of conservation concern will be completed within the footprint to be cleared	Clustered Broomrape – Alvar; Prairie Dropseed - Alvars and prairie/grassland ; Slender Blazing Star - limestone and dolostone pavement, prairies and open woods; Cooper's Milkvetch - Alvars, riparian, woodlands and woodland edges	Twice yearly for two years after transplant during the growing season.	Identification of results, issue and resolution in annual report, which is to be submitted to the MNR.	Provide additional plantings and locations if survivorship is found to be low

7.0 KEY CONTACT LIST

The following section lists key organizations and/or individuals that may be contacted during emergency situations and regarding regulatory issues, followed by the Project Contact List. This list will be posted in the base of each turbine, and it will be carried by maintenance personnel during the operation phase of the project.

Agency	Area	Phone Number
Emergency Contacts		
Ambulance/Police/Fire/Rescue		**9-1-1**
RCMP/OPP		**9-1-1**
Regulatory and Municipal Contacts		
Ontario Ministry of Environment	Paula Allen Environmental Planner/ EA Coordinator Ministry of the Environment 199 Larch Street, Suite 1201 Sudbury ON P3E 5P9	705-564-3273
Ministry of Transportation Ontario (MTO)	Sudbury 159 Cedar Street 5th Floor, Suite 503 Sudbury, ON P3E 6A5	705-564-7722
Association of Worker's Compensation Board of Canada	Customer Liaison Officer	905-542-3633
Department of Fisheries and Oceans	Fisheries and Oceans Canada Ontario Area 867 Lakeshore Road Burlington Ontario L7R 4A6	905-336-4595
Environment Canada (EC) / Canadian Wildlife Service (CWS)	Bird / Bat Conservation Officer	1-800-668-6767
Ministry of Natural Resources (OMNR)	Ms. Caleigh Sinclair Espanola District Office Ministry of Natural Resources 148 Fleming Street, 2nd Floor Espanola, ON, P5E 1R8	705-869-1330
Environmental Emergencies and Spills		
Local Hospitals with Emergency Services	Sudbury Regional Hospital 700 Paris Street, Sudbury, ON, P3E 3B5	1-866-469-0822

MOE Spills Action Centre	24-hour Report Line	1-800-268-6060
Project Contacts		
Development Manager	**TBD**	
Environmental Monitor	**TBD**	
Site Supervisor	**TBD**	
Construction Manager	**TBD**	

8.0 REFERENCES

Cadman, M.D., D. A. Sutherland, G. G. Beck, D. Lepage, and A. R. Couturier. 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. 728 pages.

COSEWIC 2002. COSEWIC assessment and update status report on the massasauga *Sistrurus catenatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 23 pp.

COSEWIC 2005a. COSEWIC assessment and status report on the Houghton's goldenrod Solidago houghtonii in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 17 pp.

COSEWIC 2005b. COSEWIC assessment and update status report on the Blanding's Turtle Emydoidea blandingii in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 40 pp.

Environment Canada. 2007. Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Final Report. February 2007.

Konze, Karl and McLaren, Margaret. 1997. Wildlife Monitoring Programs and Inventory Techniques for Ontario. Ontario Ministry of Natural Resources. Northeast Science and Technology. Technical Manual TM-009. 139 pp.

Massasauga Recovery Team. 2005. Guidelines for Identifying Significant Habitat, and Significant Wildlife Habitat, for the Massasauga in Eastern Georgian Bay and Bruce Peninsula Populations, Ontario. Version 1.0 – July 2005.

Stantec. 2008. Post-Construction Follow-up Plan for Bird and Bat Resources for the Wolfe Island Wind Plant (the "Plan"). Final Draft Report. Report developed among Canadian Renewable Energy Corporation, Environment Canada, Natural Resources Canada, Ontario Ministry of Natural Resources and Ducks Unlimited Canada. November 2008.

APPENDIX A: ENVIRONMENTAL CHECKLIST

Project Number**:**	Project Name:	
Environmental Checklist		
Originated by: Name	Organisation	Date

1	**Existing Conditions**	**Y**	**N**	**N/A**
1.1	Are areas of contaminated land being protected/remediated properly?			
1.2	Are all underground services identified and excavation permits used?			
1.3	Have existing storage tanks been checked and safely emptied?			
1.4	Is the site reasonably protected from vandalism and dumping?			
1.5	Are procedures in place to prevent fires on site?			
1.6	Are all survey monuments protected?			
1.7	Are existing communication lines protected?			
1.8	Are land improvements further than 500 yards from water tanks?			
1.9	Is Archaeological Monitoring being carried out in accordance with the requirements of the "Cultural Resources Construction Monitoring and Construction Plan"			
2	**Site Drainage**			
2.1	Is surface and foul water drainage independent and identified?			
2.2	Is there sufficient surface water drainage?			
2.3	Are pad sites rehabilitated for drainage?			
3	**Deliveries**			
3.1	Are material deliveries being correctly supervised?			
4	**Storage**			
4.1	Are all static fuel and oil storage units located in suitable bunds?			

4.2	Are all fuel bowsers bunded or double-skinned?			
4.3	Are all fuel bowsers secured in sensible locations?			
4.4	Is all subcontractors work, plant and materials secure?			
4.5	Are all chemicals stored in accordance with the material data sheets?			
4.6	Is fuel delivery manual and are all valves locked when not in use?			
4.7	Do all tanks display their contents and other warning notices?			
4.8	Is a competent contractor removing all storage tanks off site?			
5	**Waste Management**			
5.1	Is waste being stored in designated areas away from watercourses?			
5.2	Are all skips on site covered and being replaced when full?			
5.3	Is all waste being disposed of quickly and correctly?			
5.4	Is "special waste" being identified and disposed of correctly?			
5.5	Are copies of consignment notes being kept in the job book?			
5.6	Are all fuel/oil leaks properly removed?			
5.7	Has sewage been properly disposed in portable toilets?			
6	**Earthworks**			
6.1	Does excavation drainage prevent silty water reaching watercourses?			
6.2	Are temporary stockpiles protected from silt/dust loss?			
6.3	Are roads being kept free of excess mud or dust?			
6.4	If silty water exists is it being treated prior to meeting a watercourse?			
6.5	Are excavated and demolition materials being re-used?			
6.6	Are all blasting activities being adequately controlled?			
6.7	Are the requirements of the SWPPP being followed?			
6.8	Are the requirements of the Pollutants Discharge Elimination Systems permits being followed?			
6.9	Are the requirements of the Temporary Air Quality permits being met?			

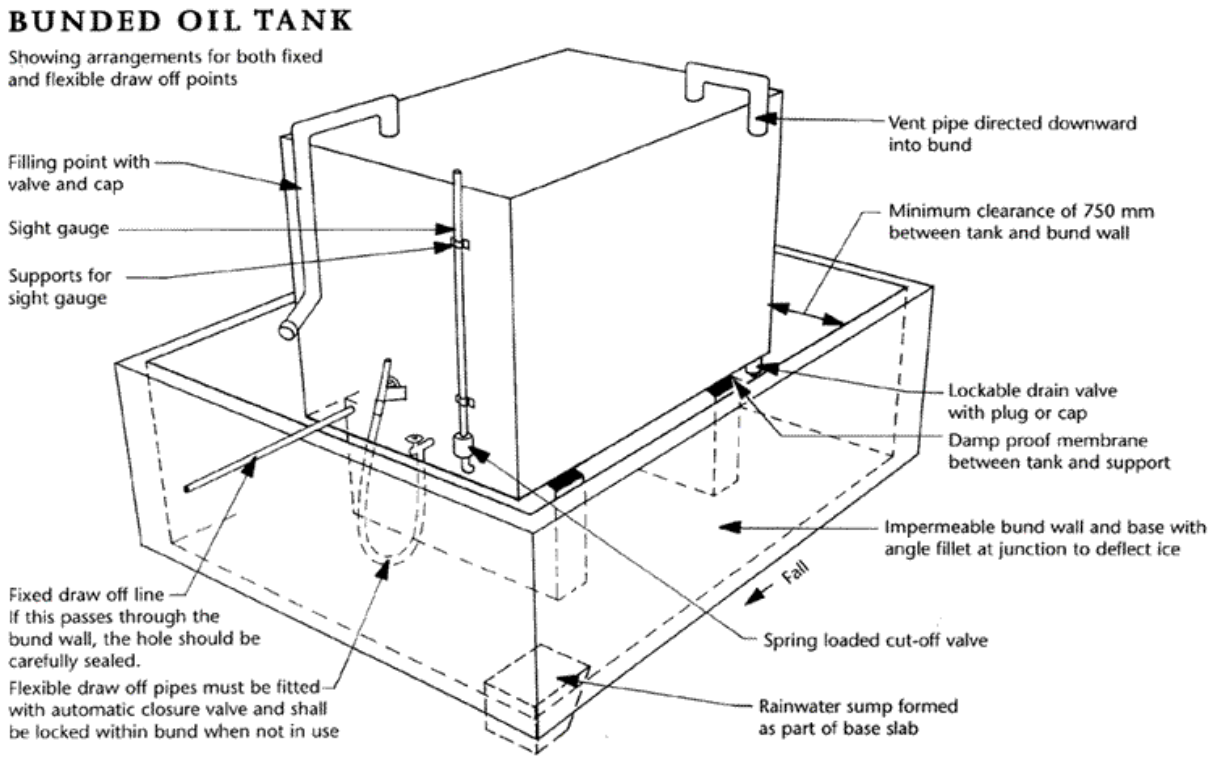
7	**Plant**			
7.1	Is refueling of plant taking place in a clean and controlled way?			
7.2	Does all site plant appear to be in good condition and free from leaks?			
7.3	Is plant servicing taking place over a well-maintained drip-tray?			
7.4	Are plant operators aware of the sites environmental responsibilities?			
8	**Concrete**			
8.1	Are concrete trucks washing out in the agreed locations?			
8.2	Is cement or mortar being allowed to enter watercourses?			
8.3	Is site batching in accordance with the agreed method statement and permits?			
8.4	Are the requirements of the sand and gravel permit being met?			
9	**Emergencies**			
9.1	Is site personnel trained and able to perform emergency procedures?			
9.2	Are the relevant environmental emergency numbers widely posted?			
9.3	Are there adequate fire precautions in operation?			
9.4	Has Owner been notified of any Emergencies within 24hrs?			
10	**Wildlife**			
10.1	Is wildlife protected from becoming trapped/injured in the works?			
11	***Site Restoration and Reclamation***			
11.1	Are areas disturbed by construction being kept to a minimum?			
11.2	Has a site reclamation plan been agreed for all construction facilities?			
11.3	*Are there measures to stop introduction and spread of noxious plants?*			
11.4	*Has the use of pesticides complied with Applicable laws?*			
12	***Installation***			
12.1	*Are all leaks being promptly repaired?*			

12.2	*Has all work met proper requirements?*			
13	***Final Job Book***			
13.1	Is the Job Book being developed during the construction period?			
14	***Personnel Reprimands***			
14.1	Has personnel been reprimanded for failure to comply with above?			

N.B. If the answer to any of the questions on the previous page are "No," then please confirm what further preventative measures will be taken to prevent any environmental problems from occurring. Should any environmental concerns specific to the site not be covered in the above document please detail the steps necessary to mitigate possible problems, below.

APPENDIX B: FUEL AND OIL STORAGE (STATIC REFUELING POINT)

The required arrangement for a static refueling point is shown below:



Bund design for storage tanks of up to 25m^3 capacity can be found in a report produced by the Construction Industry Research and Information Association (CIRIA):

CIRIA Report 163 "Construction of bunds for oil storage tanks" ISBN 0 86017 468 9

APPENDIX C: SUMMARY OF EMERGENCY SERVICES

(to be developed prior to Construction)

APPENDIX D: *AVIAN AND BAT DRAFT POST-CONSTRUCTION MONITORING PLAN*

APPENDIX D

UTM Coordinates for Project Components

McLean's Mountain Wind Farm
UTM Coordinates for Project Components

ID	HEIGHT	X	Y	Z	Status
T10	98	426243	5088273	382	24 Wind Turbine Locations
T11	98	423155	5087692	418	24 Wind Turbine Locations
T12	98	424685	5087875	413	24 Wind Turbine Locations
T13	98	425578	5087836	385	24 Wind Turbine Locations
T14	98	424005	5087874	417	24 Wind Turbine Locations
T15	98	426514	5087605	374	24 Wind Turbine Locations
T16	98	423976	5085277	395	24 Wind Turbine Locations
T17	98	421160	5086508	414	24 Wind Turbine Locations
T18	98	423020	5086314	409	24 Wind Turbine Locations
T19	98	426002	5086354	368	24 Wind Turbine Locations
T20	98	425263	5086379	392	24 Wind Turbine Locations
T21	98	420869	5086170	411	24 Wind Turbine Locations
T23	98	423091	5085958	401	24 Wind Turbine Locations
T25	98	415729	5084615	377	24 Wind Turbine Locations
T28	98	424742	5084943	381	24 Wind Turbine Locations
T29	98	423719	5084978	391	24 Wind Turbine Locations
T30	98	424258	5084654	385	24 Wind Turbine Locations
T31	98	416174	5082550	371	Five Extra Permitted Sites
T34	98	423970	5084235	376	Five Extra Permitted Sites
T35	98	415668	5083842	371	24 Wind Turbine Locations
T36	98	416181	5083552	376	24 Wind Turbine Locations
T38	98	415679	5083197	370	24 Wind Turbine Locations
T39	98	417095	5082519	379	Five Extra Permitted Sites
T40	98	416441	5082915	371	Five Extra Permitted Sites

T42	98	415354	5082675	362	24 Wind Turbine Locations
T43	98	416653	5082179	390	Five Extra Permitted Sites
T5	98	425967	5088867	388	24 Wind Turbine Locations
T6	98	425374	5088648	390	24 Wind Turbine Locations
T9	98	426960	5088349	378	24 Wind Turbine Locations

APPENDIX E

MOE Letters Regarding Hunt Camps

Ministry of the Environment

Environmental Assessment and Approvals Branch

2 St. Clair Avenue West
Floor 12A
Toronto ON M4V 1L5
Tel.: 416 314-8001
Fax: 416 314-8452

Ministère de l'Environnement

Direction des évaluations et des autorisations environnementales

2, avenue St. Clair Ouest
Étage 12A
Toronto ON M4V 1L5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Ontario

March 19, 2010

Mr. Rick Martin
Project Manager
Northland Power Inc.
30 St. Clair Avenue West, 17th Floor
Toronto, ON M4V 3A1

Dear Mr. Martin:

RE: Noise Receptors and Vacant Lots

The Ministry of the Environment (MOE) has reviewed the matters raised regarding noise receptors in relation to hunt camps and the centre of vacant lots. The MOE offers the following position on both matters below.

Hunt Camps as Noise Receptors

In respect of Northland Power's McLean's Mountain Wind Project, we understand that shortly after the turbine layout was made available to the public in July 2009, a number of applications were made for building permits to allow the construction of small buildings without servicing. We understand that individuals are claiming these to be hunt camps. It does not seem likely that these buildings will be used for overnight accommodation and thus will not be considered noise receptors as defined under section 1(4) of the Renewable Energy Approval Regulation (O.Reg 359/09). When preparing the documentation that forms part of your application, we would expect you to identify and explain whether or not a particular hunt camp meets the definition of a "noise receptor" and as part of the renewable energy approval process, we expect you to consult with the public about this determination.

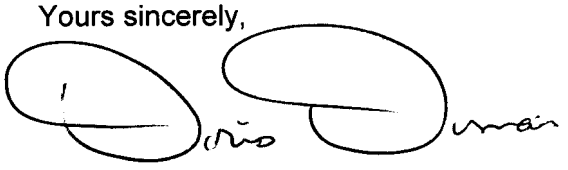
Centre of Vacant Lot

For the purposes of the setback prohibitions in sections 54 and 55 of O.Reg 359/09, the noise receptor is considered to be the centre of the vacant lot if no site plan approval or building permit has been issued to permit a building or structure used for overnight accommodation, educational facility, a day nursery or a place of worship. However, the definition of a noise receptor as it pertains to vacant lots as described in the ministry's *Noise Guidelines for Wind Farms,* dated October 2008 (Guideline) governs the preparation of a noise report prepared in accordance with the Guideline.

Proponents will need to demonstrate that receptor locations on vacant lots as defined in 6.3.3 of the *Noise Guidelines for Wind Farms* can comply with O.Reg 359/09 noise setbacks including the minimum 550 metre setback.

If you have any questions or concerns, please contact myself at (416) 314-8171 or Mansoor Mahmood at (416) 314-8573.

Yours sincerely,



Doris Dumais
Director – Environmental Approvals
Environmental Assessment and Approvals Branch

c: David A. Williamson, Chief Administrative Officer, Town of Northeastern Manitoulin and the Islands
Don McKinnon, Dillon Consulting

Ministry of the Environment

Environmental Assessment and Approvals Branch

2 St. Clair Avenue West
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Ministère de l'Environnement

Direction des évaluations et des autorisations environnementales

2, avenue St. Clair Ouest
Étage 12A
Toronto ON M4V 1L5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Ontario

March 22, 2010

Mr. Rick Martin
Project Manager
Northland Power Inc.
30 St. Clair Avenue West, 17th Floor
Toronto, ON M4V 3A1

Dear Mr. Martin:

Further to our March 19th letter and in response to your request for further clarification on what constitutes overnight accommodation for the purposes of the definition of noise receptors in section 1(4) of the Renewable Energy Approval Regulation (O.Reg 359/09), we offer the following information:

It was not intended that the definition of noise receptor would apply in respect of things like hunt camps (e.g. a building or structure that was used for limited duration in any given month to facilitate hunting or fishing activities). Factors that would indicate that a building or structure would not be used for overnight accommodation are limited use and a lack of physical infrastructure to support services such as electricity, potable water supply, and sanitary sewage disposal.

The main purpose of establishing the setback prohibitions in sections 54 and 55 of O.Reg 359/09 was in consideration of long term exposure to noise. Given the temporary use of hunt camps, there is limited potential for long term exposure to noise from wind turbines or transformers.

Where there are existing hunt camps, we would expect you to make efforts to obtain in consultation with the owner the nature of the hunt camp in question (e.g. whether it has servicing and is suitable for accommodation other than during the summer months), and how the hunt camps have historically been used (e.g. duration and frequency of stay, wildlife habitat on the property). The MOE would expect Northland Power Inc. to provide these details as part

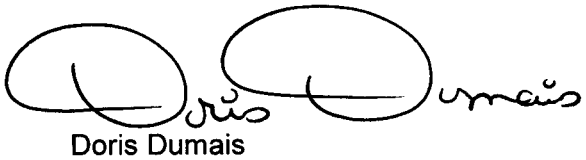
of its renewable energy approval application.

We understand that shortly after the turbine layout was made available to the public in July 2009, a number of applications were made for building permits to allow the construction of hunt camps. For these hunt camps that have not yet been constructed, the MOE expects you to make efforts to obtain information regarding when the building permits were sought, when construction is to occur, whether the building will have servicing, how the building will be used (e.g. duration of stay, wildlife habitat on the property), details about the owners hunting practices on the property, and the rationale for where it is proposed to be constructed. The MOE would expect Northland Power Inc. to provide these details as part of its renewable energy approval application.

The MOE is in the process of preparing policy to provide further direction and clarification regarding this matter which will be posted on the Environmental Registry for review and comment.

If you have any questions or concerns, please contact myself at (416) 314-8171 or Mansoor Mahmood at (416) 314-8573.

Yours sincerely,



Doris Dumais
Director – Environmental Approvals
Environmental Assessment and Approvals Branch

c: David A. Williamson, Chief Administrative Officer, Town of Northeastern Manitoulin and the Islands
Don McKinnon, Dillon Consulting

APPENDIX F

Post-Construction Monitoring Plan

Bird and Bat Environmental Effects Monitoring Plan:

McLean's Mountain Wind Farm

September 16, 2011

09-1983

Submitted by:

Dillon Consulting Limited

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LIST OF FIGURES

1.0 INTRODUCTION

Northland Power Inc. (Northland Power) and Mnidoo Mnising Power (MMP), propose to develop a wind facility with a maximum name plate capacity of 60 megawatts (MW) located south of Little Current in the Town of Northeastern Manitoulin and the Islands, Ontario (**Figure 1**). The renewable energy facility will be known as the McLean's Mountain Wind Farm and will be rated as a Class 4 wind facility. Northland Power has received a contract from the Ontario Power Authority (OPA) for the purchase of electricity generated by wind turbines from this renewable facility through the Province's Feed-in-Tariff (FIT) program (enabled by the *Green Energy and Green Economy Act*). Natural Heritage Assessment reporting was submitted to the Ontario Ministry of Natural Resources (MNR) and confirmation in writing was received that reporting fulfilled the requirements of relevant sections of the *Ontario Energy Approvals* (*Ontario Regulation 359/09*).

A requirement of *Ontario Regulation 359/09* is the preparation of an Environmental Effects Monitoring Plan for birds and bats. In developing this Plan, protocols outlined in *Bird and Bird Habitats: Guidelines for Wind Power Projects (MNR 2010)* and *Bat and Bat Habitat – Draft Guidelines for Wind Power Projects* (MNR 2011) were used. In addition, mitigation/monitoring requirements, as outlined in the Environmental Impact Study (EIS), which form the final component of the Natural Heritage Assessment reports, was used. The MNR are being consulted to confirm this monitoring strategy. Once their input is received, this plan will be finalized.

Figure 1: General Location of the McLean's Mountain Wind Farm Project in Ontario

2.0 EXISTING ENVIRONMENTAL CONDITIONS OF RELEVANT NATURAL FEATURES

Existing environmental conditions for the project location and surrounding areas was determined through the records review and site investigation, which comply with Section 25 and 26 of the *REA* process. An evaluation of significance, consistent with Section 27 of the *REA* identified four bird wildlife habitats that required an EIS. Based on the EIS, specific monitoring requirements for these four bird wildlife habitats were identified. Below, we provide the EIS commitments made regarding pre and post-construction monitoring, which is to help confirm the predicted environmental effect and inform an adaptive management strategy.

Waterfowl Nesting Area 1, 4 and 5 & Raptor Winter Roosting and Feeding Area 3 and 4

- Additional pre-construction surveys will be conducted to further assess the significance of these features. If these features continue to be considered significant a 3 year post-construction behavioural and mortality monitoring, consistent with MNR protocols, to assess impacts of turbines on birds for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan. Methods to be followed for behavioural monitoring are outlined in Section 4.2.1 below. Mortality monitoring methods are outlined in Section 4.2.2.

Area Sensitive Species: Forest Birds 1 - Including Canada Warbler, Common Night Hawk & Area Sensitive Species: Open Country Breeding Birds 3 and 4 - Including Short-eared Owl, Common Night Hawk

- A 3 year post-construction mortality monitoring, consistent with MNR protocols will be undertaken to assess impacts of turbines on birds for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan. Mortality monitoring methods are outlined in Section 4.2.2.

Bats

- According to Section 23.1 of the REA a 3 year post-construction mortality monitoring, consistent with MNR protocols will be undertaken to assess impacts of turbines on birds for the purpose of advising on mitigation strategies to be used as part of an adaptive management plan. Mortality monitoring methods are outlined in Section 4.2.2.

3.0 PROJECT TEAM

Table 1: Post Construction Environmental Monitoring Team

Staff	Role
Michael Enright	Dillon Consulting Limited – Project Manager
Dave Restivo	Dillon Consulting Limited – Field Ornithologist
Richard Baxter	Dillon Consulting Limited – Field Ornithologist

Michael Enright, B.Sc. (Hons) - is a Terrestrial Biologist with eleven years of education and professional employment in the biological sciences. During this time, Michael has acquired an in-depth knowledge of natural systems and their protection under the various levels of the legislative framework. He has been involved in numerous Renewable Energy Projects and developed environmental solutions for multi-disciplinary projects. Michael is currently the Project Manager for two post-construction monitoring studies for birds and bats in Ontario.

David Restivo, B.Sc. (Hons), CEPIT - is a Biologist with over seven years of professional experience conducting biological assessments including avian surveys. Prior to working with Dillon, David worked with Bird Studies Canada conducting migration monitoring studies on the shores of Lake Erie. David has been involved in avian surveys for six wind power projects.

Richard Baxter, B.Sc. - is a Biologist with over four years of professional experience conducting biological assessments including avian surveys. Prior to working with Dillon, Richard worked with Ducks Unlimited Canada as a Biological Technician, the University of Alberta as a Research Assistant on a cavity nester study and with Bird Studies Canada conducting migration monitoring studies on the shores of Lake Erie. Richard has been involved in avian surveys for four wind power projects.

4.0 BIRD AND BAT ENVIRONMENTAL MONITORING PLAN

4.1 The Need for Monitoring - Bird and Bat Mortality at Wind Farms in North America

Birds

Data available from studies of wind farms in North America indicate that the number of passerine birds killed due to blade strikes is not numerically significant in terms of population effects. Estimates of total passerine fatalities from a review of 14 studies of North American wind farms vary considerably, however on a per turbine and per MW basis, fatality rates are similar (Arnett 2007). Annual fatality rates ranged from 0 at a Searsburg, Vermont wind farm (Kerlinger 1997 *in* Arnett 2007) to 11.7 birds/MW/year at Buffalo Mountain, Tennessee (Nicholson 2003 *in* Arnett 2007). Most studies indicate that passerine fatalities occur throughout the wind farm facility, with no relationship to specific features within the facility. In general, fatalities occur throughout the year but are most common from April to October (Arnett 2007). It appears that certain seasons pose a higher risk to birds at specific facilities; for example spring migration at Buffalo Ridge, Minnesota (Johnson et al 2002 *in* Arnett 2007) and fall migration at Stateline, Washington (Erickson et al 2004 *in* Arnett 2007).

The highest recorded raptor fatality rates relating to wind power facilities have occurred in California at a few specific sites that were designed and constructed with little thought given to impacts on avian resources. Outside of California, studies of 14 newer generation wind farm facilities in North America indicate that the mean fatality rate for raptors was 0.03 raptors per turbine and 0.04 raptors per MW. These studies occurred over at least a one-year period and included correction for scavenging and searcher efficiency (Arnett 2007).

Several studies on wind farms in Ontario have been performed which can provide more area specific context for the McLean's Mountain Wind Farm. James (2003) reported finding 3 bird carcasses in association with the single turbine present near the Lake Ontario shore at Pickering, with monitoring conducted throughout 2002. James and Coady (2004) reported finding 2 bird carcasses in association with the single turbine present at Exhibition Place in Toronto, over 11 weeks of monitoring during the spring and fall of 2003. James (2008) estimated a range of 0.41-2.6 native birds/turbine/year at the 66 turbine Erie Shores Wind Farm near Port Burwell. For the Erie Shores project, all but 4 individual turbines had estimates of below 1 bird/turbine/year. For raptors a mortality estimate of 0.04 raptors/turbine/year was observed at Erie Shores. Natural Resource Solutions Inc. (2008) estimated an annual mortality rate for birds at 0.39 birds/turbine (0.26 birds/MW) at the 126 turbine Prince Wind Power Project (Stantec 2008a). Stantec Consulting Ltd (2008b) estimated an annual mortality rate for birds at 1.4 birds/turbine (0.9 birds/MW) at the Melancthon 1 Wind Plant, based on 12 weeks of post construction monitoring during the spring and fall of 2007 (Stantec 2008a).

Bats

Large numbers of bat fatalities have been reported at some wind energy facilities in North America. In general, bat fatalities at wind farms are higher than at other man made structures. Estimates of bat fatalities from 21 studies located at 19 wind farms in North America range from 0.9-53.3

bats/MW/year. The highest bat fatality rates have been found to occur near forested ridges. Bat fatalities appear to be higher in late summer and early fall, with migratory species like hoary bat, eastern red bat and silver haired bat being most susceptible. Bat activity and associated wind farm mortality appear to be higher on nights with low wind speeds (Arnett 2007).

4.2 Methods

4.2.1 Pre-Construction Monitoring

Waterfowl Nesting Area 1, 4 and 5

For pre-construction waterfowl breeding surveys, a standardized fixed width linear transect area search methodology will be used in Waterfowl Nesting Area 1, 4 and 5 (**Figure 2**). Surveys will include a single survey event between April 15 and May 15. This method requires that the area being searched and the search effort be strictly standardized. The number of individuals of each species detected during the sampling period is recorded to provide an index of abundance. The number of transects and fixed width of observations will be confirmed with the MNR prior to implementation. Information recorded for each survey event will include:

- The level of effort for each visit (date, start time, finish time, hours of searching, width and length of transect;
- A complete list of species detected and an estimate of the number of individuals actually detected (by sound or by sight);
- Data on any breeding evidence detected, using standard breeding bird atlas codes; and
- A basic description of the habitat(s) covered.

This survey will be repeated in a similar manner 3 years post-construction, where pre-construction surveys support the designation of these habitats as significant.

Raptor Winter Roosting and Feeding Area 3 and 4

For pre-construction raptor winter and feeding area surveys, an area search methodology will be used in Raptor Winter Roosting and Feeding Area 3 and 4 (**Figure 3**). Surveys will include three survey events between November 15 and February 15. This method requires that a similar transect path and survey duration be completed during each. Each transect will sample both portions of both open areas as well as adjacent wooded areas within 120 metres of open areas. The general route of transects will be confirmed with the MNR prior to implementation. Information recorded for each survey event will be the same as above width exception to the width of transect, which not required.

This survey will be repeated in a similar manner 3 years post-construction, where pre-construction surveys support the designation of these habitats as significant.

NORTHLAND POWER

McLean's Mountain Wind Farm
Figure 2: Waterfowl Nesting Areas of Significance

Legend

- Local Roads
- Highway
- Watercourse
- 120 m Project Location Setback
- Lots/Concessions
- Water Body
- Unclassified Woodland Community
- Waterfowl Nesting Areas (Including: MAMM1, MAMM3, MASM1, MASM1-1, MASM1-14, ME, SWDM2,SWDM2-1, SWDM2-2, SWDM3, SWDM4-5, SWTM2-5, SWTM3

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Transmission Line
- Access Road
- Feeder Lines
- Construction Staging Area

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NORTHLAND POWER

McLean's Mountain Wind Farm
Figure 3: Raptor Winter Feeding and Roosting Areas of Significance

Legend

- Local Roads
- Highway
- Watercourse
- 120 m Project Location Setback
- Lots/Concessions
- Water Body
- Unclassified Woodland Community
- Raptor Winter Feeding and Roosting Area (120m Buffer) (Including: OAGM4)

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Transmission Line
- Access Road
- Feeder Lines
- Construction Staging Area

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4.2.2 Post-Construction Mortality Monitoring

Post-construction mortality monitoring for birds and bats will be done concurrently to improve efficiency of fieldwork. As this project has been assigned as a REA Class 4 wind facility it will be subject to the environmental effects monitoring surveys for the first three years (for each phase) of wind turbine operation. Monitoring will include carcass removal trials, searcher efficiency trials and post-construction mortality monitoring around a minimum of 30% of the turbines. Monitoring for all birds and bats will take place twice per week from May 1 to October 31 in each monitoring year. As this wind farm plans to construct 24 turbines, a stratified sample of 8 turbines, which reflect the various habitat types and distribution of the wind farm, will be selected for monitoring.

In addition to this, specific raptor mortality surveys will be continued once per week through the month of November at the stratified sample turbine locations. All turbines are to be searched at least once during the month of November. These additional surveys are not to be added to the sample survey mortality estimate calculations. Rather, the purpose of the raptor mortality surveys is to identify any individual or groups of turbines that may exceed the significant mortality threshold. Searcher efficiency and scavenger removal trials are only necessary for raptors considered as part of bird/bat mortality survey monitoring, but are not necessary when conducting raptor mortality surveys.

Mortality Surveys will use the Baerwald Spiral Method which includes circular transects within 50 m of the turbine base, spaced 5.0 – 6.0 metres apart allowing for a visual search of 2.5 – 3.0 metres on each side. Carcass searches will be performed by trained technicians, under the guidance of an experienced biologist. All carcasses found will be photographed and recorded/labelled with species, sex, date, time, location, carcass condition, searcher, injuries, distance and direction to nearest turbine, ground cover/substrate, estimated number of days since time of death and distance to plot centre. The condition of each carcass collected should be recorded in one of the following categories:

- Intact – a carcass that is not badly decomposed and shows no sign of having been fed upon by a predator or scavenger, although it may show signs of traumatic injury such as amputation from a turbine collision;
- Scavenged – an entire carcass that hows signs of having been fed upon by a predator or scavenger or a partial carcass that has been fed upon, with portions of it found in more than one location

Each carcass should be collected (using vinyl, latex or rubber gloves), bagged and stored in a freezer for future reference, identification, and/or necropsy. In the case of bats, White Nose Syndrome Protocol is to be used throughout all monitoring, which includes the use of 1 pair of latex gloves per bat carcass handled. A copy of the data sheet should be kept with the carcass at all times. All searchers will have updated rabies pre-exposure vaccination. Carcasses found during bird mortality searches may be used in carcass removal or searcher efficiency trials.

The following equation will be used to calculate Corrected Mortality Estimates:

The minimum estimated bird (or bat) mortality (C) is as follows:

$$C = c/[(S_e)(S_c)(Ps)]$$

Where:

C - is the corrected number of bird/bat fatalities
c - is the number of carcasses found
S_e - is the searcher efficiency
S_c - is the proportion of carcasses not removed by scavengers over the search period
Ps - is the percent of the area searched

Percent Area Searched

Most birds/bats appear to fall within 50m of a wind turbine base. Therefore, a circular search area consisting of a 50m radius will be used for all mortality searches, unless specific site attributes require a reduced search area (e.g. steep slopes, active cultivation, etc.). In cases where a reduced search area is necessary, the actual available area to be searched during the mortality survey will be mapped and calculated at each turbine and a correction factor applied.

A description of habitat, as well as other physical attributes, (e.g. % vegetation cover, vegetation height, steep slopes, active cultivation, etc.) within the 50m radius search area will be mapped and described to determine the respective visibility class as outlined in MNR 2010 and 2011. Changes in visibility class will be updated on a continuous basis to inform the need for additional searcher efficiency trials.

The following equation will be used to calculate Percent Area Searched:

$$P_s = \text{actual area searched} / \Pi r^2$$

R = 50 m

Carcass Removal Trials

Levels of carcass scavenging will be determined through carcass removal trials. In these trials, carcasses are planted around the wind turbines and monitored until they disappear or have sufficiently decomposed (2 weeks). Carcass Removal Trials will be conducted once a month during each monitoring year and will be performed to estimate the proportion of carcasses that are scavenged.

Carcass Removal Trials will use native bird/bat species that are freshly dead or frozen while freshly dead. Where possible, an equal amount of bird and bat carcasses should be used throughout carcass removal trials. Trials using other small mammals may also be used, where birds and bats are not available. Technicians will wear gloves to avoid getting human scent on the test specimens, which could bias results.

Carcasses will be laid out in a search area before daylight with their location marked by GPS in advance of a search being conducted. Weather conditions will be recorded. Carcasses should be laid out for trials at each turbine that will be searched, with a small number used (1 to 2 specimens) at each site. To avoid confusion with turbine-related fatalities, carcasses should be discreetly marked (e.g., clipping the ear, wing leg, fur; hole-punching ear; etc.). Carcasses should be distributed on substrates in proportion to the availability of these substrates. Scavenger trials will be repeated during each monitoring year, as efficiency of scavengers may change among years. Presence or absence of scavenging, and degree of scavenging if present, will be recorded for trial specimens.

Proportions of carcasses remaining after each search interval are pooled to calculate the overall scavenger correction (S_c) factor using the following equation:

$$S_c = (nvisit1 + nvisit2 + nvisit3)/ (n\ visit0 + nvisit1 + nvisit2)$$

Where:

S_c - is the proportion of carcasses not removed by scavengers over the search period
n visit0 - is the total number of carcasses placed
nvisit1- nvisit3 - are the numbers of carcasses remaining on visit 1 through 3

Searcher Efficiency Trials

Searcher efficiency will vary between each searcher as well as between different sites. To correct for this, searcher efficiency trials will be conducted at least once a season for each surveyor during mortality monitoring surveys. A minimum of 10 carcasses per searcher per visibility class will be used. These trial carcasses will be spread out over the trial period and conducted with the bird/bat mortality surveys. Searcher efficiency trials will be conducted for each individual searcher. The searcher will not be notified when they are participating in an efficiency trial to avoid potential search biases. Trial carcasses will be discreetly marked (e.g., clipping of ear, wing leg, fur or hole punching ear) with a unique identification so that they can be identified as a trial carcass. Trial carcasses will be randomly placed within the search area and location recorded so that they can be retrieved if they are not found during the trial. Bird/bat carcasses (including at least one raptor) will be used for searcher efficiency trials. Bat species known to be prone to white nose syndrome will not be used in searcher efficiency trials. Where frozen carcasses are used, they will be thawed prior to beginning searcher efficiency trials. Trails will be repeated for all post-construction monitoring years.

The date, time and location that test specimens were planted will be recorded, as will the date it was searched for and whether or not it was retrieved. The condition of the carcass when it was retrieved will also be recorded.

The following equation will be used to calculate Searcher Efficiency:

S_e = number of test carcasses found / # of test carcasses placed – # of carcasses scavenged

The number of turbines that each individual searches will vary so it will be necessary to calculate a weighted average that reflects the proportion of turbines each searcher searched. The weighted average or overall searcher efficiency will be calculated as follows:

$$S_{eo} = S_{e1}(n_1/T) + S_{e2}(n_2/T) + S_{e3}(n_3/T)\ldots$$

Where:

S_{eo} - is the overall searcher efficiency
S_{e1} and $_2$ and $_3$…- are individual searcher efficiency ratings
n_1 and $_2$ and $_3$… - are number of turbines searched by each searcher

T - is the total number of turbines searched by all searchers

4.2.3 Post-Construction Disturbance Effect Monitoring

If pre-construction surveys support the designation of Waterfowl Nesting Area and Raptor Winter Roosting and Feeding Area habitats as significant, pre-construction surveys are to be repeated post-construction for three years. These surveys will be used to assess potential disturbance effects for these habitat types.

Additional disturbance effect monitoring is required for Sites Supporting Area Sensitive Species: Open Country 3 and 4 (**Figure 4**) and Sites Supporting Area Sensitive Species: Forest Birds 1 (**Figure 5**). Monitoring will occur twice between June and July. Methodology will include the use of paired ten minute fixed radius point counts (with point counts located 100m and 300m from the edge of a turbine or other infrastructure component). This pairing of point counts will allow analysis of possible change of bird diversity or abundance as it relates to the distance from a turbine (e.g. 0-50, 50-100, 100-150… up to 400 m away). Only turbines with similar habitat type extending out for at least 400m, will be sampled for disturbance effects. Specific turbines which confirm to the above will be determined prior to monitoring in consultation with the MNR.

NORTHLAND POWER

McLean's Mountain Wind Farm
Figure 4 : Sites Supporting Area-Sensitive Species: Forest Birds

Legend

- Local Roads
- Highway
- Watercourse
- 120 m Project Location Setback
- Lots/Concessions
- Water Body
- Unclassified Woodland Community (< 200m from edge)
- Unclassified Woodland Community (Interior > 200 m from edge) (Including: FOD, FODM1, FODM5-1, FODM8-1, FOMM10, FOMM4, FODM5-1, SWCM1-2, SWDM2-1, SWDM2-1, SWDM2-2, SWDM2, SWDM3, SWDM4-5, SWMM1-1, SWMM3-2, SWMM4)

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Transmission Line
- Access Road
- Feeder Lines
- Construction Staging Area

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NORTHLAND POWER

McLean's Mountain Wind Farm
Figure 5 : Sites Supporting Area-Sensitive Species: Open Country Breeding Bird Habitat

Legend

- Local Roads
- Highway
- Watercourse
- 120 m Project Location Setback
- Lots/Concessions
- Water Body
- Unclassified Woodland Community
- Open Country Breeding Bird Habitat > 30 ha (Including: OAGM4, ME)

Project Components

- 24 Wind Turbine Locations
- Five Extra Permitted Sites
- Substation
- Operations Building
- Horizontal Directional Drilling Access/Exit Pit
- Transmission Line
- Access Road
- Feeder Lines
- Construction Staging Area

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5.0 REPORTING

Reporting of fieldwork results will be submitted annually, and results will be expressed both in terms of fatalities/turbine/year and fatalities/MW/year, to enable comparison between studies. Reports will include comparisons between projected annual avian and bat mortality rates for the McLean's Mountian Wind Farm and rates reported at other projects in North America (e.g., as summarized in Arnett 2007). If these projected annual mortality rates fall within the low or middle ranges of reported rates, no immediate mitigation is needed. However, if mortality rates begin to approach, meet or exceed the significant mortality threshold numbers outlined below, Northland Power will consult with the relevant agencies as needed to determine the reasons for the high mortality rates. Subsequently, Northland Power will develop possible mitigation measures and adjust monitoring as needed. If needed, Northland Power may take action prior to contacting the relevant agencies.

Bird, raptor and bat mortality will be considered significant when a threshold of annual mortality exceeds the following:

- 18 birds/ turbine/year at individual turbines or turbine groups;
- 0.2 raptors/turbine/year (all raptors) across a wind power project;
- 0.1 raptors/turbine/year (raptors of provincial conservation concern) across a wind power project;
- 2 raptors/wind power project (<10 turbines); or
- 10 bats/turbine/year (averaged over the entire wind farm)

Studies indicate that turbine-related mortality maintained below these thresholds is unlikely to affect bird populations. Thresholds have been established based on the highest reported bird mortality at wind power projects in North America, outside California.

A single mortality event will be considered significant when a bird mortality event exceeds:

- 10 or more birds at any one turbine; or
- 33 or more birds (including raptors) at multiple turbines.

These thresholds are not intended to replace any species-specific approaches that may be needed to comply with the Endangered Species Act.

6.0 ADAPTIVE MONITORING AND MANAGEMENT

In general, if observed mortality impacts for any group of birds, bats and/or Species at Risk are found to exceed thresholds noted in **Table 2** above, EC and the MNR will be consulted to establish the appropriate mitigative response, which could include: conducting research with the goal of identifying the factors leading to the observed mortality rate; conducting more frequent surveys; increasing reporting frequency; and operational modifications.

If bats are experiencing disproportionate mortality, and rates are near the higher reported levels, Northland Power may consider installation of ultrasonic deterrent devices. However, as yet this technology has limited ability to effectively deter bats from areas as large as a turbines blade-sweep radius (Szewczak and Arnett 2008). Furthermore, the wind speed required to start turbines (i.e., increasing the turbine cut-in speed to 5.5 m/s or controlled idling) could be implemented on select turbines of the wind power project should the mortality threshold rates be met. This method could help to mitigate bat mortality if implemented during peak bat activity (July 15 to September 30 or overnight), as bats tend to be active at lower wind speeds (Arnett 2007).

If a review of environmental conditions unrelated to the wind farms operation is unable to shed light on increased mortality rates, then further action will be required. This could include blade feathering, and if necessary, shutting down specific problem turbines.

Blade feathering involves adjusting the pitch of the turbine blade such that reduced aerodynamics precludes efficient turbine operation. Blade rotation would be slowed and energy output reduced. This approach would be used to manage the turbine operation during specific time periods or weather conditions considered a high risk for bats or birds.

Turbine shut down would include the temporary removal of a turbine from service, stopping production of power. This action would be taken during a set period, such as a core seasonal migration window, and turbine operation would resume after the period of high risk has passed (EC 2007a).

These actions will be considered on a turbine by turbine basis or could be applied across the wind farm, based on areas of concern identified through the monitoring program and as deemed economically feasible. Actions taken in response to mortality events will depend on species involved, behaviour implicated (migration, foraging etc.) and geographical extent of the observed mortality, as agreed upon by the relevant agencies.

Where operational mitigation measures are required to reduce bird or bat mortality, the post-construction mortality monitoring period may be extended beyond the minimum requirement of three years to assess the effectiveness of mitigation.

7.0 SUMMARY

The Project Location for Northland Power's McLean's Mountain Wind Farm has been designated as REA Class 4 Wind Facility. This REA designation triggers the need for this post-construction monitoring plan as stipulated in MNR guideline documents. Some pre-construction monitoring is planned to confirm the significance of certain bird wildlife habitats. Post-construction monitoring is planned for three years after the wind farm is in operation. The MNR will be kept up to date on monitoring results through annual reporting and will be notified of unexpected negative environmental effects. Mitigation measures have also been outlined for unexpected negative environmental effects that may occur but cannot be explained by factors unrelated to the wind farms operation.

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APPENDIX G

GE Maintenance Checklist

TPM Americas

GE 2.5 MW WTG
Break-in Maintenance Checklist

This is a supplement to the Revision 4 maintenance manual 2.5xl_xxHz_OM_allComp_maintena.ENxxx.04.doc, applicable TIL's, ETCs, or WDIs. All personnel performing maintenance activities must understand the contents of the maintenance manual and have access to a copy

Site Name:	**WTG Number:**	**Date:**
Maintenace: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 18 19 Other:		**WTG COD Date:**
Rev. 02052011		**SR#:**

Task Description and additional information	Task Performed & No defects found?		Notes, Comments, or Explanations
Color of Paint Pen used for the Break-In Maintenance:			
1.1 Welded Structure			
Visual Inspection: Twist locks, bolted connections, fixing of platform plating, fixing of railings and ladders, spark marks, moisture and insects.	Yes	No	
Function Test: Hatches closing properly	Yes	No	
Grind down corroded areas and restore the original coating.	Yes	No	
1.2 Fire Extinguisher (optional feature)			
Date of the next maintenance:	Yes	No	
2.2 Fan			
Function Test	Yes	No	
7.1 Shell and T-Flange of the Adapter			
Visual inspection: shell deformations (dents, creases), shell material defects (cracks, gouges, delamination), weld seam integrity (cracks, gouges, defects), corrosion (rust, defects in paintwork) flange deformation (gaps between flange and concrete, local bending)	Yes	No	
7.2 Adapter Anchor Bolts			
Visual inspection:flange deformation (gaps between flange and concrete, local bending), material defects (cracks, gouges, delamination), corrosion protection (rust, defects in metallization)	Yes	No	
Pretensioning of T- flange connection adapter/concrete: Do not undo the bolts beforehand! The pre-tightening force and the number of anchor bolts vary depending on the tower height and wind class and the foundation design. Information about the applied pretension force is to be found on a label at the tower adapter and in P-Net.	Yes	No	
Customer will provide specifications from the anchor bolt manufacture stating "MAINTENANCE" criteria. This should include a frequencey, torque spec "KIPS" , and quantity.	Yes	No	
7.3 Tower Shell			
Visual inspection: shell deformations (dents, creases), shell material defects (cracks, gouges, delamination), weld seam integrity (cracks, gouges, defects), corrosion (rust, defects in paintwork)	Yes	No	
Function test: sockets, lamps	Yes	No	
7.4 Tower Flanges			
Visual inspection: flange deformation (gaps between flanges, local bending), material defects (cracks, gouges, delamination), corrosion protection (rust, defects in metallization), weld integrity (defects, gouges, cracks)	Yes	No	

7.4 Tower Flanges			
100% Torque Check (1st tower flange transformer level)	Yes	No	
100% Torque Check (2nd tower flange)	Yes	No	
100% Torque Check (3rd tower flange)	Yes	No	
100% Torque Check (4th tower flange)	Yes	No	
7.6 Power and Control Cables			
Visual inspection: Fastening, damage to insulation, cable baskets, twist, compression joints, Check the fit of the rubber mat in the opening of platform A and the cable guide in the top section. Check the rubber mat for damages.	Yes	No	
7.7 Twist of Power Cable Loop			
Visual inspection: Twist may not be greater than 2 turns in each direction	Yes	No	
7.9 Railing doors on each platform			
Check of the railing doors: Open the railing door up to 90° and check if it closes automatically. If not, check if the hinges are installed in accordance with the supplier manual. If not, adjust the upper hinge (including spring element) to be parallel to the door and railing. Adjust the lower hinge in exactly the same way as the upper hinge.	Yes	No	
7.10 Winch / Hoist			
Check by authorized/experienced personnel2) and documentation in the inspect and test log book. Follow the instructions of the manufacturer!	Yes	No	
Visual Inspection: Check of the rope - for squeezed or broken wires (DIN 15020 sheet 2), - rust, - condition of the windings.	Yes	No	
Brake: Check of the air gap	Yes	No	
Lubrication of the rope (MoS2 or lithium base grease)	Yes	No	
Electric control: - power cable (squeezed, pulled off) - control box: damage - pendant: damage, proper function, emergency stop, all electric accessories	Yes	No	
7.11 Ladder and Fall Protection			
Check by authorized/experienced personnel2) and documentation in the inspection and test logbook. Follow the instructions of the manufacturer!	Yes	No	
Visual inspection: Damage, fastening Visual inspection while climbing: Alignment of ladder and HACA safety rails or TUFTUG safety wire rope (as applicable), incipient crack, locations of fracture, stability. Inspect all bolted connections fixing the ladder to tower wall, HACA safety climbing system or TUFTUG wire rope fall arrest system (as applicable) to ladder or safety cable stand-offs to ladder for loose or missing parts. Install or tighten as necessary.	Yes	No	
Function test: Function of travelling safety hook or wire grab fall arrestor (as applicable)	Yes	No	
8.2 Yaw Drive			
First maintenance of the bolted connections (yaw drive to mainframe): All bolts (100%) must be torque checked. For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	

8.3.1 Connection: Base frame - yaw bearing			
All bolts (100%) For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	
8.3.2 Connection: Yaw bearing - tower top flange			
All bolts (100%) For wrench size and tightening torque see 2.5xl_WDI_bolts	Yes	No	
9.1 Base frame top section (also bearing housing) and bottom section			
Bolted connection: Cast frame top and bottom section Check 10% without loosening bolts	Yes	No	
9.2 Generator Frame			
Bolted Connection: cast frame - generator frame Check 10% without loosening bolts.	Yes	No	
10.1 Contactors, Sensors			
Visual inspection:Control elements, electrical connections, cable terminals, fastening, gen. condition, wiring, spark marks	Yes	No	
Function test: Control and operating elements	Yes	No	
10.2 Rotational Speed Sensor (IFM)			
Function test: switching function Note: determine or justify the shift point with a frequency generator	Yes	No	
10.3 Speed frequency sensor for IFM			
Visual inspection: Fastening, cleanness, setting	Yes	No	
Function test: speed frequency signal	Yes	No	
10.5 Fire Extinguisher (optional feature)			
Date of the next maintenance:	Yes	No	
11.1 Emergency Stop Switch (PC, Top and central switch cabinet)			
Function test: Switching function	Yes	No	
11.2 Vibration Switch			
Function test: Switching function	Yes	No	
11.3 Rotor Lock Switch			
Function test: Switching function	Yes	No	
Verify 0° Rotor Position: Position rotor so that the rotor position in VisuPro (ANGLE_ROT_POS) is showing 0°. Verify that blade 1 is in a vertical position (pointing up). If not, re-reference the rotor position.	Yes	No	
11.4 Converter Emergency Stop			
Function test: Switching function	Yes	No	
14.3 Pitch Drive			
First maintenance of the screw connections:All bolts (100%) must be torque checked on the first maintenance. For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	
14.5 Pitch Bearings			
Fastening: hub / pitch bearing First maintenance: 100% bolts	Yes	No	
15.3 Rotorblade / Pitch Bearing			
Connection rotor blade - blade pitch bearing: First inspection - after one month Loosen all bolts individually and re-tighten.	Yes	No	
16.2 Connection rotor shaft/hub			
Fastening hub/rotor shaft first maintenance: All bolts (100%)	Yes	No	

16.5 Main Bearing Groove Nut			
Check: bearing play, i.e. check installation of the labyrinth cover on the shaft shoulder for gap with a filler gage or cracks in the paintwork No clearance for the lock nuts to the labyrinth rings on the shaft is allowed.	Yes	No	
Check: If gap in between a lock nut and ring is observed: Loosen the 4 axially arranged screws in the lock nut and turn split groove nut up to the end position against the labyrinth ring and re-tension. To tension the groove nut, retighten the 4 axial screws. There are two different lock nut designs with different threads. The tightening torque is depending on the screw size (see 2.5xl_WDI_Bolts). Even it is not necessary to adjust the lock nuts, the screws have to be checked according to these torque values with a torque wrench.	Yes	No	
16.9 Gearbox			
Visual inspection: Leakage, tooth contact pattern / roller bearing document if necessary) - untight places, damage	Yes	No	
Check: Noise, oscillatory characteristics	Yes	No	
Oil samples: Remarks: Oil change is dependent upon the oil analysis Oil type: Optimol Optigear Synthetic A 320 (by Castrol) or Gearmaster Eko 320 (by Fuchs)	Yes	No	
16.14 Alignment of Generator			
Alignment of the generator Remark: Use laser alignment system	Yes	No	

List of Tools, Serial Numbers, and Calibration Dates

TOOL	Model	Serial Number	Calibration Due Date
Pressure Gauge			
Multi Meter			
Slide Caliper			
Torque wrench			
Torque wrench			
Torque wrench			
Laser Alignment			

Comments

BIM Personnel WTG#_____

Name	Date	Signature

I hereby confirm the correct performance of the maintenance in accordance with the checklist, manual, and all applicable GE Work Instructions.	Site Manager or Site Lead Name	Date	Site Manager or Site Lead Signature

TPM Americas

GE 2.5 MW WTG
Break-in Maintenance Checklist

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Site Name:	WTG Number:	Date:
Maintenace: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 18 19 Other:		WTG COD Date:
Rev. 02052011		SR#:

Task Description and additional information	Task Performed & No defects found?		Notes, Comments, or Explanations
Tech A			
Color of Paint Pen used for the Break-In Maintenance :			
2.2 Fan			
Check the Function of the fan	Yes	No	
Shut Down Turbine	Yes	No	
LOTO GMCB	Yes	No	
Climb Turbine and complete next step	Yes	No	
7.9 Railing doors on each platform			
Check of the railing doors: Open the railing door up to 90° and check if it closes automatically. If not, check if the hinges are installed in accordance with the supplier manual. If not, adjust the upper hinge (including spring element) to be parallel to the door and railing. Adjust the lower hinge in exactly the same way as the upper hinge.	Yes	No	
7.11 Ladder and Fall Protection			
Check and document in the inspection and test logbook. Follow the instructions of the manufacturer!	Yes	No	
Visual inspection: Damage, fastening Visual inspection while climbing: Alignment of ladder and HACA safety rails or TUFTUG safety wire rope (as applicable), incipient crack, locations of fracture, stability. Inspect all bolted connections fixing the ladder to tower wall, HACA safety climbing system or TUFTUG wire rope fall arrest system (as applicable) to ladder or safety cable stand-offs to ladder for loose or missing parts. Install or tighten as necessary.	Yes	No	
Function test: Function of travelling safety hook or wire grab fall arrestor (as applicable)	Yes	No	
7.6 Power and Control Cables			
Visual inspection: Fastening, damage to insulation, cable baskets, twist, compression joints, Check the fit of the rubber mat in the opening of platform A and the cable guide in the top section. Check the rubber mat for damages.	Yes	No	
7.7 Twist of Power Cable Loop			
Visual inspection: Twist may not be greater than 2 turns in each direction	Yes	No	
16.14 Alignment of Generator			
Alignment of the generator Remark: Use laser alignment system (Work with Tech C)	Yes	No	
10.1 Contactors, Sensors			
Visual inspection:Control elements, electrical connections, cable terminals, fastening, gen. condition, wiring, spark marks	Yes	No	
Function test: Control and operating elements	Yes	No	
Work with Tech C to rabbit ear the WTG	Yes	No	
LOTO the rotor lock and prepare tools for next task	Yes	No	

14.5 Pitch Bearings			
Fastening: hub / pitch bearing First maintenance:100% bolts For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	Hytorc?
16.2 Connection rotor shaft/hub			
Fastening hub/rotor shaft first maintenance: All bolts (100%) For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	Hytorc?
8.3.2 Connection: Yaw bearing - tower top flange			
Finish the flange so that 100% of the bolts are checked For wrench size and tightening torque see 2.5xl_WDI_bolts	Yes	No	
8.3.1 Connection: Base frame - yaw bearing			
All bolts (100%)	Yes	No	
Stay Up tower until tooling is lowered to the ground	Yes	No	
7.3 Tower Shell			
Visual inspection: shell deformations (dents, creases), shell material defects (cracks, gouges, delamination), weld seam integrity (cracks, gouges, defects), corrosion (rust, defects in paintwork)	Yes	No	
Function test: sockets, lamps	Yes	No	
11.4 Converter Emergency Stop			
Function test: Switching function	Yes	No	
Assist Tech C with the anchor bolts.	Yes	No	

List of Tools, Serial Numbers, and Calibration Dates

TOOL	Model	Serial Number	Calibration Due Date
Pressure Gauge			
Multi Meter			
Slide Caliper			
Slide Caliper			
Torque wrench			
Torque wrench			
Torque wrench			
Laser Alignment			

Comments

Name	**Date**	**Signature**

I hereby confirm the correct performance of the maintenance in accordance with the checklist, manual, and all applicable GE Work Instructions.	**Site Manager or Site Lead Name**	**Date**	**Site Manager or Site Lead Signature**

TPM Americas

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Site Name:	**WTG Number:**	**Date:**
Maintenace: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 18 19 Other:		**WTG COD Date:**
Rev. 4 _____10		**SR#:**

Task Description and additional information	Task Performed & No		Notes, Comments, or Explanations
Tech B			
Color of Paint Pen used for the Break-In Maintenance:			
LOTO GMCB	Yes	No	
Climb Turbine and hoist tools to the Nacelle	Yes	No	
7.10 Winch / Hoist			
Check by authorized/experienced personnel. Follow the instructions of the manufacturer.	Yes	No	
Visual Inspection: Check of the rope - for squeezed or broken wires (DIN 15020 sheet 2), - rust, - condition of the windings.	Yes	No	
Brake: Check of the air gap	Yes	No	
Lubrication of the rope (MoS2 or lithium base grease)	Yes	No	
Electric control: - power cable (squeezed, pulled off) - control box: damage - pendant: damage, proper function, emergency stop, all electric accessories	Yes	No	
16.9 Gearbox			
Oil samples: Remarks: Oil change is dependent upon the oil analysis Oil type: Optimol Optigear Synthetic A 320 (by Castrol) or Gearmaster Eko 320 (by Fuchs)	Yes	No	
9.2 Generator Frame			
Bolted Connection: cast frame - generator frame Check 10% without loosening bolts! For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	
9.1 Base frame top section (also bearing housing) and bottom section			
Bolted connection: Cast frame top and bottom section Check 10% without loosening bolts For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	
8.2 Yaw Drive			
First maintenance of the bolted connections (yaw drive to mainframe): All bolts (100%) must be torque checked. For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	
Reinstall flooring remove to access the yaw drives	Yes	No	
16.5 Main Bearing Groove Nut			
Check: bearing play, i.e. check installation of the labyrinth cover on the shaft shoulder for gap with a filler gage or cracks in the paintwork No clearance for the lock nuts to the labyrinth rings on the shaft is allowed.	Yes	No	
Check: If gap in between a lock nut and ring is observed: Loosen the 4 axially arranged screws in the lock nut and turn split groove nut up to the end position against the labyrinth ring and re-tension. To tension the groove nut, retighten the 4 axial screws. There are two different lock nut designs with different threads. The tightening torque is depending on the screw size (see 2.5xl_WDI_Bolts). Even it is not necessary to adjust the lock nuts, the screws have to be checked according to these torque values with a torque wrench.	Yes	No	

10.2 Rotational Speed Sensor (IFM)			
Function test: switching function Note: determine or justify the shift point with a frequency generator	Yes	No	
10.3 Speed frequency sensor for IFM			
Visual inspection: Fastening, cleanness, setting	Yes	No	
Function test: speed frequency signal	Yes	No	
10.5 Fire Extinguisher (optional feature)			
Date of the next maintenance:	Yes	No	
11.1 Emergency Stop Switch (PC, Top and central switch cabinet)			
Function test: Switching function	Yes	No	
11.2 Vibration Switch			
Function test: Switching function	Yes	No	
11.3 Rotor Lock Switch			
Function test: Switching function	Yes	No	
Verify 0° Rotor Position: Position rotor so that the rotor position in VisuPro (ANGLE_ROT_POS) is showing 0°. Verify that blade 1 is in a vertical position (pointing up). If not, re-reference the rotor position.	Yes	No	
Clean and assist other techs until they return from the hub	Yes	No	
16.9 Gearbox			
Visual inspection: Leakage, tooth contact pattern / roller bearing document if necessary) - untight places, damage	Yes	No	
Check: Noise, oscillatory characteristics	Yes	No	
7.4 Tower Flanges			
Visual inspection: flange deformation (gaps between flanges, local bending), material defects (cracks, gouges, delamination), corrosion protection (rust, defects in metallization), weld integrity (defects, gouges, cracks)	Yes	No	
100% Torque Check (2nd tower flange)	Yes	No	
7.3 Tower Shell			
Visual inspection: shell deformations (dents, creases), shell material defects (cracks, gouges, delamination), weld seam integrity (cracks, gouges, defects), corrosion (rust, defects in paintwork)	Yes	No	
Function test: sockets, lamps	Yes	No	
LOTO MVSG before entering transformer level	Yes	No	
7.1 Shell and T-Flange of the Adapter			
Visual inspection: shell deformations (dents, creases), shell material defects (cracks, gouges, delamination), weld seam integrity (cracks, gouges, defects), corrosion (rust, defects in paintwork) flange deformation (gaps between flange and concrete, local bending)	Yes	No	
100% Torque Check (1st tower flange transformer level)	Yes	No	

List of Tools, Serial Numbers, and Calibration Dates			
TOOL	**Model**	**Serial Number**	**Calibration Due Date**
Pressure Gauge			
Multi Meter			
Slide Caliper			
Slide Caliper			
Torque wrench			
Torque wrench			
Torque wrench			
Laser Alignment			

Comments

Name	**Date**	**Signature**

I hereby confirm the correct performance of the maintenance in accordance with the checklist, manual, and all applicable GE Work Instructions.	**Site Manager or Site Lead Name**	**Date**	**Site Manager or Site Lead Signature**

TPM Americas

GE 2.5 MW WTG
Break-in Maintenance Checklist

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Site Name:	**WTG Number:**	**Date:**
Maintenace: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 18 19 Other:		**WTG COD Date:**
Rev. 4 _____10		**SR#:**

Task Description and additional information	Task Performed & No defects found?		Notes, Comments, or Explanations
Tech C			
Color of Paint Pen used for the Break-In Maintenance _____			
LOTO GMCB	Yes	No	
Hoist tools to the Nacelle with Tech B	Yes	No	
1.1 Welded Structure			
Visual Inspection: Twist locks, bolted connections, fixing of platform plating, fixing of railings and ladders, spark marks, moisture and insects.	Yes	No	
Function Test: Hatches closing properly	Yes	No	
Grind down corroded areas and restore the original coating.	Yes	No	
1.2 Fire Extinguisher (optional feature)			
Date of the next maintenance:	Yes	No	
Climb Turbine and hoist tools to the Nacelle	Yes	No	
16.14 Alignment of Generator			
Alignment of the generator Remark: Use laser alignment system (Work With Tech A)	Yes	No	
8.2 Yaw Drive			
Remove flooring for access to yaw drives for Tech B	Yes	No	
Work with Tech A to rabbit ear the WTG	Yes	No	
LOTO the rotor lock and enter the hub with tools	Yes	No	
14.3 Pitch Drive			
First maintenance of the screw connections:All bolts (100%) must be torque checked on the first maintenance. For wrench size and tightening torque see 2.5xl_WDI_bolts.	Yes	No	
15.3 Rotorblade / Pitch Bearing			
Connection rotor blade - blade pitch bearing: First inspection - after one month Loosen all bolts individually and re-tighten.	Yes	No	
8.3.2 Connection: Yaw bearing - tower top flange			
All bolts that can be access with the "ETG"Electic torque Gun For wrench size and tightening torque see 2.5xl_WDI_bolts	Yes	No	
7.4 Tower Flanges			
Visual inspection: flange deformation (gaps between flanges, local bending), material defects (cracks, gouges, delamination), corrosion protection (rust, defects in metallization), weld integrity (defects, gouges, cracks)	Yes	No	
100% Torque Check (3rd tower flange) For tightening torque see 2.5xl_WDI_bolts.	Yes	No	
100% Torque Check (4th tower flange) For tightening torque see 2.5xl_WDI_bolts.	Yes	No	

7.2 Adapter Anchor Bolts			
POWER FROM PADMOUNT TRANSFORMER MUST BE OFF (LOTO) FOR ALL INTERIOR WORK PERFORMED UNDER OR AROUND DTA			
Visual inspection:flange deformation (gaps between flange and concrete, local bending), material defects (cracks, gouges, delamination), corrosion protection (rust, defects in metallization)	Yes	No	
Pretensioning of T- flange connection adapter/concrete: Do not undo the bolts beforehand! The pre-tightening force and the number of anchor bolts vary depending on the tower height and wind class and the foundation design. Information about the applied pretension force is to be found on a label at the tower adapter and in P-Net.	Yes	No	
Customer will provide specifications from the anchor bolt manufacture stating "MAINTENANCE" criteria. This should include a frequencey, torque spec "KIPS" , and quantity.	Yes	No	

Comments

List of Tools, Serial Numbers, and Calibration Dates			
TOOL	**Model**	**Serial Number**	**Calibration Due Date**
Pressure Gauge			
Multi Meter			
Slide Caliper			
Slide Caliper			
Torque wrench			
Torque wrench			
Torque wrench			
Laser Alignment			

Name	Date	Signature

	Site Manager or Site Lead Name	Date	Site Manager or Site Lead Signature
I hereby confirm the correct performance of the maintenance in accordance with the checklist, manual, and all applicable GE Work Instructions.			

Maintenance Checklist

Turbine name:			
Turbine ID:		**Cost unit:**	
Operating hours:		**Date:**	

OK	**not OK**	**n.pre.**	**n.inc.**	**adj./exch.**
in order	not in order	not present	Not included in scope of maintenance	Adjusted or exchanged

1 – Pre-assembled Power Module (PPM)		**OK**	**not OK**	**n.pre**	**n.inc**	**adj./ exch.**	**Completed by**	**Remarks**
1.1 – Welded Structure	Condition, function of the hatches	☐	☐	☐	☐	☐		
1.2 – Fire Extinguisher (optional feature)	Expiration date:	☐	☐	☐	☐	☐		

2 – Transformer Level		**OK**	**not OK**	**n.pre**	**n.inc**	**adj./ exch.**	**Completed by**	**Remarks**
2.1 – Encapsulated-winding dry-type Transformer	Condition	☐	☐	☐	☐	☐		
2.2 – Fan	Function	☐	☐	☐	☐	☐		

3 – Medium Voltage Switch Gears		**OK**	**not OK**	**n.pre**	**n.inc**	**adj./ exch.**	**Completed by**	**Remarks**
Entire	Condition, function	☐	☐	☐	☐	☐		

4 – Converter Cabinets		**OK**	**not OK**	**n.pre**	**n.inc**	**adj./ exch.**	**Completed by**	**Remarks**
4.1 – Cabinet/housing complete	Condition, function	☐	☐	☐	☐	☐		
4.2 – Cable Terminals / Cables	Condition, function	☐	☐	☐	☐	☐		
4.3 – Filter Element	Condition, exchange	☐	☐	☐	☐	☐		
4.4 – Low Voltage Part	Condition, function	☐	☐	☐	☐	☐		
4.5.1 – Converter Cooling Circuit – both *Single* and *Dual Loop Cooling System*	Condition, function	☐	☐	☐	☐	☐		

4 – Converter Cabinets		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
4.5.2 – Radiator Cooling Circuit – *Dual Loop Cooling System* only	Condition, function	☐	☐	☐	☐	☐		
4.6 – Software	Check fault history	☐	☐	☐	☐	☐		

5 – Power Distribution Panel (PDP)		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
5.1 – Power Circuit Breaker	Condition, function, Switching cycles:	☐	☐	☐	☐	☐		
5.2 – Cable Terminals	Condition	☐	☐	☐	☐	☐		
5.3 – Grounding Conductor	Condition	☐	☐	☐	☐	☐		
5.4 – Filter Element	Condition, exchange	☐	☐	☐	☐	☐		
5.5 – Fuses	Condition	☐	☐	☐	☐	☐		
5.6 - Switches	Condition, function	☐	☐	☐	☐	☐		

6 – Main Control Cabinet (MCC)		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
6.1 – Complete Cabinet	Condition, function	☐	☐	☐	☐	☐		
6.2 – Filter Element	Condition, exchange	☐	☐	☐	☐	☐		
6.3 – Filter Fan and Thermostat	Function	☐	☐	☐	☐	☐		
6.4 – PLC	Check for software update, parameter settings	☐	☐	☐	☐	☐		
6.5 – PC	Check for software update,	☐	☐	☐	☐	☐		
6.6 - UPS	Function	☐	☐	☐	☐	☐		

7 – Tower		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
7.1 – Shell and T-Flange of the Adapter	Condition	☐	☐	☐	☐	☐		
7.2 – Adapter Anchor Bolts	Condition, check pre-tightening	☐	☐	☐	☐	☐		
7.3 – Tower Shell	Condition	☐	☐	☐	☐	☐		
7.4 – Tower Flanges	Condition, check pre-tightening	☐	☐	☐	☐	☐		
7.5 – Tower Interior	Check installations	☐	☐	☐	☐	☐		

7 – Tower		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
7.6 – Power and Control Cables	Condition	☐	☐	☐	☐	☐		
7.7 – Twist of Power Cable Loop	Condition, function	☐	☐	☐	☐	☐		
7.8 – Platforms, Hatches	Condition, function	☐	☐	☐	☐	☐		
7.9 – Railing doors on each platform	Condition, function	☐	☐	☐	☐	☐		
7.10 – Winch/Hoist	Condition, function	☐	☐	☐	☐	☐		
7.11 – Ladder and Fall Protection	Condition, function	☐	☐	☐	☐	☐		
7.12 – Door / Entrance Area	Condition, function	☐	☐	☐	☐	☐		
7.13 – Emergency Lights	Function, check of batteries	☐	☐	☐	☐	☐		
7.14 – Shadow Sensor (optional feature)	Condition	☐	☐	☐	☐	☐		
7.15 – Oil drain tank underneath tower top flange	Condition	☐	☐	☐	☐	☐		

8 – Yaw System		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
8.1 – Hydraulic Brake	General condition, function	☐	☐	☐	☐	☐		
8.1.1 – Brake Disc	Condition	☐	☐	☐	☐	☐		
8.1.2 – Brake Calipers	Condition, check bolted connections	☐	☐	☐	☐	☐		
8.1.3 – Brake Pads	Condition	☐	☐	☐	☐	☐		
8.1.4 – Hydraulic System	Condition, function	☐	☐	☐	☐	☐		
8.2 – Yaw Drive	Condition, function, oil change, check of bolted connections	☐	☐	☐	☐	☐		
8.3 – Connection of the Yaw Bearing	Check of bolted connections, lubrication	☐	☐	☐	☐	☐		
8.3.1 – Connection base frame – yaw bearing	Check of bolted connections	☐	☐	☐	☐	☐		
8.3.2 – Connection yaw bearing – tower top flange	Check of bolted connections	☐	☐	☐	☐	☐		
8.4 – Yaw bearing and gear-tooth system	Condition, lubrication	☐	☐	☐	☐	☐		
8.5 – Position Sensor	Condition, function	☐	☐	☐	☐	☐		
8.6 – Gear Ring and Driving Pinion	Condition	☐	☐	☐	☐	☐		

8 – Yaw System		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
8.7.1 – Wind Vanes	Condition, function	☐	☐	☐	☐	☐		
8.7.2 – Anemometer	Condition, function	☐	☐	☐	☐	☐		
8.8 – Ultrasonic Anemometer (FT Tech)	Condition, function	☐	☐	☐	☐	☐		

9 – Base Frame		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
9.1 – Base frame top section (also bearing housing) and bottom section	Condition, check of bolted connections	☐	☐	☐	☐	☐		
9.2 – Generator Frame	Condition, check of bolted connections	☐	☐	☐	☐	☐		
9.3 – Tread of the steps, gratings	Condition	☐	☐	☐	☐	☐		

10 – Top Box		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
10.1 – Contactors, Sensors	Condition, function	☐	☐	☐	☐	☐		
10.2 – Rotational Speed Sensor (IFM)	Function	☐	☐	☐	☐	☐		
10.3 – Speed frequency sensor for IFM	Condition, function	☐	☐	☐	☐	☐		
10.4 – First Aid Kit (optional feature)	Completeness, Expiration date:	☐	☐	☐	☐	☐		
10.5 – Fire Extinguisher (optional feature)	Expiration date:	☐	☐	☐	☐	☐		

11 – Safety Chain		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
11.1 – Emergency Stop Switch (PC, Top and central switch cabinet)	Function	☐	☐	☐	☐	☐		
11.2 – Vibration Switch	Function	☐	☐	☐	☐	☐		
11.3 – Rotor Lock Switch	Function	☐	☐	☐	☐	☐		
11.4 – Converter Emergency Stop	Function	☐	☐	☐	☐	☐		
11.5 – Over Speed Monitor	Condition, function	☐	☐	☐	☐	☐		

12 – Nacelle		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
12.1 – General	Condition, check of fastenings and bolted connections	☐	☐	☐	☐	☐		
12.2 – Rotor Lock – low-speed shaft	Condition, function, bolted connections	☐	☐	☐	☐	☐		
12.3 – Emergency Lights	Function	☐	☐	☐	☐	☐		
12.4 – Storage net for the height rescue device	Condition, fastening	☐	☐	☐	☐	☐		
12.5 – Obstruction Lights (optional feature)	Condition, function	☐	☐	☐	☐	☐		
12.6 – Ice Sensor (optional feature)	Condition, function	☐	☐	☐	☐	☐		

13 – Hub		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
13 - General	Condition	☐	☐	☐	☐	☐		
13.1 – Emergency Lights	Function	☐	☐	☐	☐	☐		
13.2 – General condition of the spinner	Condition, fastening	☐	☐	☐	☐	☐		
13.3 – Entry to the hub	Condition, function	☐	☐	☐	☐	☐		

14 – Pitch System		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
14.1 – Blade Control Cabinets Battery Cabinets	Condition, function	☐	☐	☐	☐	☐		
14.2 – Test of Battery	Function	☐	☐	☐	☐	☐		
14.3 – Pitch Drive	Condition, function, oil change, lubrication of output bearing, bolted connections	☐	☐	☐	☐	☐		
14.4 – Pitch Motors	Condition, function of fan	☐	☐	☐	☐	☐		
14.5 – Pitch Bearings	Condition, check of bolted connections, lubrication	☐	☐	☐	☐	☐		
14.6 – Gear Rings and Driving Pinions	Condition, check of lubrication, exchange of grease, function of lubrication system	☐	☐	☐	☐	☐		
14.7 – 5° and 89° Position Switch, Camshaft Segment	Condition, function	☐	☐	☐	☐	☐		
14.8 – Pinion Encoder (optional feature)	Condition	☐	☐	☐	☐	☐		

15 – Blades		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
15.1 – Outer Shell	Condition	☐	☐	☐	☐	☐		
15.2 – Inside	Condition, check of fastenings	☐	☐	☐	☐	☐		
15.3 – Rotorblade/Pitch Bearing	Check of bolted connections	☐	☐	☐	☐	☐		

16 – Drive Train		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
16.1 – Rotor shaft (outside and inside)	Condition	☐	☐	☐	☐	☐		
16.2 – Connection Rotor Shaft/Hub	Condition, check of bolted connections	☐	☐	☐	☐	☐		
16.3 – Main Bearing Seals	Condition	☐	☐	☐	☐	☐		
16.4 – Main Bearing Lubrication System	Condition, function	☐	☐	☐	☐	☐		
16.5 – Main Bearing Groove Nut	Condition, adjustment	☐	☐	☐	☐	☐		
16.6 – Coupling Flange Shaft - Gearbox	Check of bolted connections	☐	☐	☐	☐	☐		
16.7 – Gearbox Fastening	Check of bolted connections	☐	☐	☐	☐	☐		
16.8 – Structure Born Noise Insulation Gearbox	Condition	☐	☐	☐	☐	☐		
16.9 – Gearbox	Condition, oil sample/change, hoses, ventilating filters	☐	☐	☐	☐	☐		
16.10 – Offline Filter	Condition, function, filter/seal kit exchange	☐	☐	☐	☐	☐		
16.11 – Oil Cooler	Condition, check/exchange of hoses	☐	☐	☐	☐	☐		
16.12 – External Oil Heater (if present)	Condition	☐	☐	☐	☐	☐		
16.13 – Coupling	Condition, check of bolted connections, measure leakage current insulation	☐	☐	☐	☐	☐		
16.14 – Generator Alignment	Check	☐	☐	☐	☐	☐		

17 – Generator		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
17 - General	Condition	☐	☐	☐	☐	☐		
17.1 – Bearings	Condition, function, lubrication system, grease exchange	☐	☐	☐	☐	☐		
17.2 – Fastening	Check of bolted connections	☐	☐	☐	☐	☐		
17.3 – Generator Sound Isolation (Dampener)	Condition	☐	☐	☐	☐	☐		
17.4 – Carbon Brushes for Grounding (optional feature)	Condition	☐	☐	☐	☐	☐		
17.5 – Power Cables	Condition, fixation	☐	☐	☐	☐	☐		
17.6 – Incremental Encoder	Condition, check failure signal	☐	☐	☐	☐	☐		
17.7 – GMCB	Function, settings, bolted cable fastenings, exchange of the fan filter	☐	☐	☐	☐	☐		
17.8 – Cooling System	Function, condition	☐	☐	☐	☐	☐		

18 – Slip Ring Tranformer		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
18 - General	Condition	☐	☐	☐	☐	☐		
18.1 – Slipring Unit	Condition, lubrication	☐	☐	☐	☐	☐		

19 – Active Brake		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
19.1 – Brake Pads	Condition, adjustment, exchange	☐	☐	☐	☐	☐		
19.2 – Brake Disc	Condition	☐	☐	☐	☐	☐		
19.3 – Brake Caliper	Condition, check of bolted connections,	☐	☐	☐	☐	☐		
19.4 – Pad Wear and ON/OFF Indicator Switch	Condition, function	☐	☐	☐	☐	☐		
19.5 – Hydraulic System	Condition, function, oil and filter exchange	☐	☐	☐	☐	☐		

20 – Crane System		OK	not OK	n.pre	n.inc	adj./ exch.	Completed by	Remarks
20 - General	Safety check by authorized person	☐	☐	☐	☐	☐		

Remarks

Date, Signature . . . . .

Maintenance Personnel

Name	Signature