PORT RYERSE
WIND POWER PROJECT
DESIGN AND OPERATIONS REPORT

File No. 160960773
March 2013
Updated December 2013

Prepared for:

Boralex Inc.
772 Sherbrooke St. West
Suite 200
Montreal QC H3A 1G1

In Association with:

UDI Renewables Corporation
492 South Coast Drive
Nanticoke, ON N0A 1L0

Prepared by:

Stantec Consulting Ltd.
Suite 1 - 70 Southgate Drive
Guelph ON N1G 4P5

Record of Revisions

Revision	Date	Description
0	November 2012	Submission to Municipalities and Aboriginal Communities
1	December 2012	Submission to Public
2	March 2013	Submission to the Ministry of the Natural Environment
3	December 2013	Updated to include revisions made to the Noise Assessment Report

Table of Contents

1.0 INTRODUCTION 1.1
1.1 PROJECT OVERVIEW 1.1
1.2 REPORT REQUIREMENTS 1.2

2.0 SITE PLAN 2.1
2.1 SETBACK DISTANCES 2.3

3.0 FACILITY DESIGN PLAN 3.1
3.1 FACILITY COMPONENTS OVERVIEW 3.1
3.1.1 Wind Turbine Generators 3.1
3.1.2 Electrical Infrastructure 3.2
3.1.3 Access Roads and Parking Lot 3.3
3.1.4 Stormwater Management System 3.3
3.1.5 Meteorological Tower 3.4
3.1.6 Crane Pads 3.4

4.0 FACILITY OPERATIONS PLAN 4.1
4.1 SITE SUPERVISION AND STAFF TRAINING 4.1
4.2 PLANNED MAINTENANCE 4.1
4.3 UNSCHEDULED MAINTENANCE 4.2
4.4 MONITORING METEOROLOGICAL DATA 4.2
4.5 OTHER ACTIVITIES 4.3

5.0 POTENTIAL ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES 5.1
5.1 PERFORMANCE OBJECTIVES 5.1
5.2 HERITAGE AND ARCHAEOLOGICAL RESOURCES 5.2
5.2.1 Protected Properties and Heritage Resources 5.2
5.2.2 Archaeological Resources 5.3
5.3 NATURAL HERITAGE RESOURCES 5.4
5.3.1 Wetlands 5.4
5.3.2 Areas of Natural and Scientific Interest 5.4
5.3.3 Woodlands 5.4
5.3.4 Provincial Parks and Conservation Reserves 5.5
5.3.5 Other Designated Natural Areas 5.5
5.3.6 Significant Wildlife and Wildlife Habitat 5.5
5.3.7 Generalized Significant Wildlife Habitat 5.7
5.3.8 Significant Flora and Vegetation Communities 5.8
5.3.9 Other Flora and Vegetation Communities 5.9
5.4 WATER BODIES AND AQUATIC RESOURCES 5.10
5.4.1 Groundwater 5.10
5.4.2 Surface Water, Fish and Fish Habitat 5.10
5.5 AIR QUALITY AND ENVIRONMENTAL NOISE 5.11
5.5.1 Air Emissions 5.11

Table of Contents

5.5.2 Dust and Odour Emissions 5.12
5.5.3 Environmental Noise 5.13
5.6 LAND-USE AND SOCIO-ECONOMIC RESOURCES 5.14
5.6.1 Areas Protected Under Provincial Plans and Policies 5.14
5.6.2 Existing Land Uses 5.14
5.6.3 Hazard Lands 5.15
5.6.4 Recreation Areas and Features 5.15
5.6.5 Agricultural Lands and Operations 5.16
5.6.6 Mineral, Aggregate and Petroleum Resources 5.16
5.6.7 Game and Fisheries Resources 5.18
5.6.8 Local Traffic 5.19
5.6.9 Local Economy 5.20
5.6.10 Viewscape 5.21
5.7 EXISTING LOCAL INFRASTRUCTURE 5.21
5.7.1 Provincial, Municipal and Other Major Infrastructure 5.21
5.7.2 Navigable Waters 5.22
5.7.3 Radio Communication, Radar and Seismoacoustic Systems 5.23
5.7.4 Aeronautical Systems 5.24
5.8 WASTE MANAGEMENT AND CONTAMINATED LANDS 5.25
5.8.1 Waste Generation 5.25
5.8.2 Spills 5.26
5.9 PUBLIC HEALTH AND SAFETY 5.27
5.9.1 Turbine Blade and Structural Failure 5.27
5.9.2 Ice Fall and Shed 5.29
5.9.3 Extreme Weather Events 5.31
5.9.4 Third Party Damage 5.32

6.0 ENVIRONMENTAL EFFECTS MONITORING PLAN 6.1
6.1 GOALS AND OBJECTIVES 6.1
6.2 GUIDING PRINCIPLES 6.1
6.3 ENVIRONMENTAL MANAGEMENT SYSTEMS 6.2
6.3.1 Management Structures 6.2
6.3.2 Contract Documents 6.2
6.3.3 Change Management 6.3
6.4 PROGRAMS, PLANS, AND PROCEDURES 6.3
6.4.1 Operation and Maintenance Program 6.3
6.4.2 Environmental Procedures 6.3
6.4.3 Occupational Health and Safety Procedures 6.4
6.4.4 Training Program 6.4
6.4.5 Emergency Response Plan 6.5
6.4.6 Measurement of Performance 6.5
6.5 MONITORING REQUIREMENTS AND CONTINGENCY PLANS 6.5
6.5.1 Terrestrial Habitats and Significant Natural Features 6.6
6.5.2 Birds and Bats 6.6

Table of Contents

6.5.3 Significant Wildlife Habitat 6.7
6.5.4 Surface Water Features and Aquatic Habitat 6.7
6.5.5 Environmental Noise and Public Health and Safety 6.7
6.5.6 Local Expenditures 6.8
6.5.7 Community Relations 6.8

7.0 SUMMARY OF ENVIRONMENTAL EFFECTS MONITORING PLAN 7.1

8.0 EMERGENCY RESPONSE AND COMMUNICATIONS PLAN 8.1
8.1 COMMUNICATION PLAN FOR EMERGENCIES 8.1
8.2 PROJECT UPDATES AND ACTIVITIES 8.1
8.3 COMMUNICATIONS RESPONSE PROTOCOL 8.2
8.4 PUBLIC SAFETY PLAN 8.2

9.0 CONCLUSION AND SIGNATURES 9.1

10.0 REFERENCES 10.1

List of Tables

Table 1.1: Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1) ... 1.2
Table 2.1: Site Plan Components 2.1
Table 3.1: Turbine Coordinates 3.1
Table 3.2: Siemens SWT-3.0-113 - Wind Turbine Specifications 3.2
Table 7.1: Summary of the Potential Environmental Effects and the Environmental Effects Monitoring Plan during Operations 7.2

List of Appendices

Appendix A Figures
Appendix B Property Line Setback Assessment Report
Appendix C Environmental Effects Monitoring Plan
Appendix D Noise Assessment Report

1.0 Introduction

1.1 PROJECT OVERVIEW

Boralex Inc. (Boralex), in association with UDI Renewables Corporation (UDI), is proposing to develop the Port Ryerse Wind Power Project (the Project) east of the hamlet of Port Ryerse in Norfolk County , Ontario, in response to the Government of Ontario's initiative to promote the development of renewable electricity in the province. The Project was awarded a Feed-In-Tariff (FIT) contract with the Ontario Power Authority (OPA) on February 25, 2011. Further information on the Project can be found on the Project-specific website at http://www.udi-canada.com. Boralex Inc. is a power producer whose core business is dedicated to the development and operation of renewable energy facilities. Further information on Boralex can be found at http://www.Boralex.com/en/.

The Renewable Energy Approval (REA) process for the Port Ryerse Project was originally initiated by UDI with the assistance of M.K. Ince and Associates Ltd (MKI). Boralex is considering acquisition of the Project from UDI and retained Stantec Consulting Ltd. (Stantec) to complete the REA Application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the Act of the Environmental Protection Act (O. Reg. 359/09). According to subsection 6.(3) of O. Reg.359/09, the Project is classified as a Class 4 Wind Facility and will follow the requirements identified in O.Reg.359/09 for such a facility.

The Project Study Area is generally bounded by i) Woolley and Gilbert Roads to the north; ii) Port Ryerse Road to the west; iii) Hay Creek to the east and iv) Avalon Lane to the south (**Appendix A, Figure 1**). The proposed Project Location includes all parts of the land in, on, or over which the Project is proposed. The Project Location (**Appendix A, Figure 2**), including all Project infrastructure, is sited on privately-owned lands, where landowners have entered into a lease agreement with Boralex/UDI. Permissions to access these properties have been obtained through verbal discussions with landowners, as a requirement of their signed agreements with Boralex/UDI.

Three wind turbine models were initially assessed as part of the REA process, the Siemens SWT 3.0 113, ENERCON E-92 2.35 MW and ENERCON E-82 E2 2.3MW; however one turbine model has been selected as the preferred alternative; the Siemens SWT 3.0 113.

The Project will include four Siemens SWT 3.0 113 wind turbine generators. The 3.0 MW turbines will be customized to a nameplate capacity of 2.5 MW for this Project. The total maximum installed nameplate capacity of all four turbines will not exceed 10 MW. Other basic components include step-up transformers located adjacent to the base of each turbine (step up voltage from approximately 0.69 kV to 27.6 kV), a 27.6 kV underground collector system, fibre optic data lines, a distribution substation, a permanent parking lot (if required), a meteorological tower and turbine access roads.

Temporary components during construction include laydown areas at the turbine locations and crane pads. No operations and maintenance building or transmission line is anticipated to be required for the Project. No Project components are located within municipal road Rights of Way (ROWs).

The 27.6 kV underground collector lines will transport the electricity generated from each turbine to the distribution substation located on private property east of Port Ryerse Road. Directional bore techniques will be used where the underground collector lines cross valleylands and watercourses. At the substation, a dip-pole connection will be made directly into the local distribution system.

This Draft Design and Operations Report is one component of the REA Application for the Project, and has been prepared in accordance with O. Reg. 359/09, the Ministry of Natural Resources' (MNR's) *Approval and Permitting Requirements Document for Renewable Energy Projects* (September 2009), and the Ontario Ministry of the Environment's (MOE's) *Technical Guide to Renewable Energy Approvals* (MOE, March 2012).

1.2 REPORT REQUIREMENTS

The Design and Operations Report specifically provides the details of the design and operational stage of the proposed Port Ryerse Wind Power Project. Aspects of the Project outside of the design and operations phase such as construction and decommissioning are addressed within separate reports as part of the REA package.

The documentation requirements as specified under O. Reg. 359/09 are summarized in **Table 1.1**.

Table 1.1: Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	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, rights of way and easements required in respect of the renewable energy generation facility and situated within 300 m of the facility,	✓	Appendix A
B. any ground water and surface water supplies used at the facility,	N/A	N/A
C. any things from which contaminants are discharged into the air,	N/A	N/A
D. any works for the collection, transmission, treatment and disposal of sewage,	N/A	N/A
E. any areas where waste, biomass, source separated organics and farm material are stored, handled, processed or disposed of,	N/A	N/A
F. the project location in relation to any of the following within 125 m: the portion of the Oak Ridges Moraine Conservation	✓	2.0, Appendix A

Table 1.1: Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
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		
G. any noise receptors or odour receptors that may be negatively affected by the use or operation of the facility,	✓	2.0, Appendix A
ii. a description of each item diagrammed under subparagraph i, and	✓	3.0, 5.0
iii. one or more maps or 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,	✓	Appendix A
iv. a description, map or diagram of the distance between the base of any wind turbines and any public road rights of way or railway rights of way that are within a distance equivalent to the length of any blades of the wind turbine, plus 10 metres,	✓	Appendix B
v. a description, map or diagram of the distance between the base of any wind turbines and all boundaries of the parcel of land on which the wind turbine is constructed, installed or expanded within a distance equivalent to the height of the wind turbine, excluding the length of any blades, and	✓	Appendix B
vi. a description, map or diagram of the distance between the base of each wind turbine and the nearest noise receptor.	✓	Appendix B
2. Set out conceptual plans, specifications and descriptions related to the design of the renewable energy generation facility, including a description of,		
i. any works for the collection, transmission, treatment and disposal of sewage, including details of any sediment control features and storm water management facilities,	N/A	N/A
ii. any things from which contaminants are discharged into the air, and	N/A	N/A
iii. any systems, facilities and equipment for receiving, handling, storing and processing any waste, biomass, source separated organics, farm material and biogas, and	N/A	N/A
iv. if the facility includes a transformer substation, the works, facilities and equipment for secondary spill containment.	N/A	N/A
3. Set out conceptual plans, specifications and descriptions related to the operation of the renewable energy generation facility, including,	N/A	3.0, 4.0
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,	N/A	N/A
B. a description of the expected water takings, including rates, amounts and an assessment of the availability of water to	N/A	N/A

Table 1.1: Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
meet the expected demand, and		
C. an assessment of and documentation showing the potential for the facility to interfere with existing uses of the water expected to be taken,	N/A	N/A
ii. a description of the expected quantity of sewage produced and the expected quality of that sewage at the project location and the manner in which it will be disposed of, including details of any sediment control features and storm water management facilities,	N/A	N/A
iii. a description of any expected concentration of air contaminants discharged from the facility,	N/A	N/A
iv. in respect of any biomass, source separated organics and farm material at the facility		
A. the maximum daily quantity that will be accepted,	N/A	N/A
B. the estimated annual average quantity that will be accepted,	N/A	N/A
C. the estimated average time that it will remain at the facility, and	N/A	N/A
D. the estimated average rate at which it will be used, and	N/A	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	✓	5.0
B. the estimated annual average quantity that will be accepted,	N/A	N/A
C. the estimated average time that it will remain at the facility, and	N/A	N/A
D. the estimated average rate at which it will be used,	N/A	N/A
vi. if the facility includes a transformer substation,		
A. a description of the processes in place to prevent spills,	N/A	N/A
B. a description of the processes to prevent, eliminate or ameliorate any adverse effects in the event of a spill, and	N/A	N/A
C. a description of the processes to restore the natural environment in the event of a spill.	N/A	N/A
4. Include an environmental effects monitoring plan in respect of any negative environmental effects that may result from engaging in the renewable energy project, setting out,		
i. performance objectives in respect of the negative environmental effects,	✓	6.0
ii. mitigation measures to assist in achieving the performance objectives mentioned in subparagraph i,	✓	5.0, 6.0
iii. a program for monitoring negative 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.	✓	5.0, 6.0
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		

Table 1.1: Design and Operations Report Requirements (as per O. Reg. 359/09 – Table 1)

Requirements	Completed	Section Reference
with respect to the project, including,		
i. measures to provide information regarding the activities occurring at the project location, including emergencies,	✓	8.0
ii. means by which persons responsible for engaging in the project may be contacted, and	✓	8.0
iii. means by which correspondence directed to the persons responsible for engaging in the project will be recorded and addressed.	✓	8.0
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 of 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	N/A
ii. how the project will be engaged in to,		
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	N/A
B. use a vegetative riparian area, unless the project location is used for agricultural purposes and will continue to be used for such purposes.	N/A	N/A
7. If it is determined that the project location is not on a property described in Column 1 of the Table to section 19, provide a summary of the matters addressed in making the determination.	N/A	2.0, 5.0
8. If section 20 applies in respect of the project and it is determined that the project location does not meet one of the descriptions set out in subsection 20 (2) or that the project location is not in an area described in subsection 20 (3), provide a summary of the matters addressed in making the determination.	N/A	2.0
9. If subsection 21 (3) or 23 (2) applies, provide a summary of the matters addressed in making the determination,		
i. under subsection 21 (3) or clause 23 (2) (a), as the case may be, including a copy of the document completed under the applicable provision, and	N/A	2.0
ii. under clause 23 (3) (b), if applicable.	N/A	2.0

2.0 Site Plan

The Site Plan is provided in **Appendix A**, and is presented as a series of three figures:

Figure 1 – Project Location- Overview;

Figure 2 – Socio-economic Features; and,

Figure 3 – Significant Natural Heritage Features and Water Bodies.

Table 2.1: Site Plan Components

Site Plan Component	Additional Information and Site Plan Reference
Project Components	
Buildings or structures	The following buildings or structures are shown on **Figures 2** and **3**: • Wind Turbine Generators ; • Distribution Substation; • 27.6 kV electrical collection system (underground); • Permanent parking lot; • Meteorological tower; and, • Temporary construction and laydown areas.
Roads	Permanent Project access roads for turbine and site access are shown on **Figures 2** and **3**.
Utility corridors, rights of way or easements	Easements associated with participating properties are for certain access roads and collector system elements.
Existing Features within 300 m of the Project Location	
Buildings or structures	Buildings are shown on the aerial imagery of **Figures 2** and **3**; these are primarily rural residences but also include other types of buildings such as agricultural outbuildings.
Roads	Majority of the roads in the Project Study Area are County roads designated as arterial roads (Cookson Street and King Street North part of County Road 57 Norfolk) and local roads (Port Ryerse Road, Gilbert Road, Youngs Creek Road, Hilltop Drive, Ralph Street North and Ralph Street South). Avalon Lane, a private road, runs south through the central portion of the Project Location and then east along Lake Erie shoreline.
Utility corridors, rights of way, and easements	There is an existing local distribution easement located along the south-western Project boundary, to which the Project would connect. Utilities located within the road allowances would have associated easements or rights of way.
Groundwater Wells	Wells as mapped by the MOE well water records (2011) are shown in **Figure 2**.

Table 2.1: Site Plan Components	
Site Plan Component	**Additional Information and Site Plan Reference**
Project Components	
Petroleum Wells	The locations of petroleum wells (i.e., abandoned, active or status unknown) as recorded in the Ontario Oil, Gas and Salt Resources (OGSR) library database are shown in **Figure 2**.
Topographical land contours	Shown at 5 m intervals in **Figure 2**.
Surface water drainage	Drainage is depicted as per base mapping obtained from the MNR's Land Inventory Ontario (LIO) database on **Figures 2** and **3**.
Land Use	Land uses including agricultural, residential, and natural heritage is shown on the aerial imagery used on **Figures 2** and **3**.
Other Site Plan Components	
Noise receptors	Noise receptors are shown in **Figure 2**, and include: • Participating receptors: properties participating in the Project by hosting permanent Project infrastructure, and to which noise setbacks and limits do not apply; • Non-participating receptors: properties not participating in the Project that have dwellings, buildings used for institutional purposes (educational facility, day nursery, health care facility, community centre or place of worship), and buildings planned for construction that have a building permit; and, • Vacant lot receptors: vacant land zoned to allow construction of potential noise receptors; location selected with regard to the typical building pattern in the area. All proposed turbines will be located at least 550 m from the nearest non-participating receptor; these receptors are included in the Noise Assessment.
Protected properties and heritage resources	No protected properties were identified in the Project Study Area. 38 potential built heritage resources (8 of which are of cultural heritage value or interest) and 2 potential cultural heritage landscapes (both of which are of cultural heritage value or interest) were identified in the Study Area. The locations of these heritage resources are shown in the Heritage Assessment Report.
Archaeological resources	A total of 22 find spots were identified in the Project Study Area. The specific locations of these archaeological sites are sensitive information and therefore mapping of these locations have been omitted.
Water bodies	Three REA water bodies are located within the 120 m Zone of Investigation and are shown in **Figure 3** as per the Water Assessment.
Significant or provincially significant natural features	Two significant woodlands and two significant wildlife habitats are located within the 120 m Zone of Investigation. Significant natural features are shown in **Figure 3** as per the Natural Heritage Assessment.
Hazard lands	Three hazard lands (valleylands) are located within the 120 m Zone of Investigation and are shown in **Figure 2**.
Public road rights of way	Shown in **Figure 2**.
Participating property lines	Shown in **Figure 2**.

A detailed description of the Project components, heritage and natural features, and water bodies is provided in **Sections 3.0, 4.0** and **5.0**.

2.1 SETBACK DISTANCES

O. Reg. 359/09 provides setback distances between the Project Location and:

- Significant and provincially significant natural features (120 m; 50 m for earth science Areas of Natural & Scientific Interest);
- Provincial parks and conservation reserves (120 m); and,
- Water bodies (120 m; 30 m for turbines).

O. Reg.359/09 provides setback distances between wind turbine base and:

- Property lines (hub height);
- Public road right-of-ways (blade length plus 10 m);
- Railway right-of-ways (blade length plus 10 m); and,
- Noise receptors (550 m).

Visual representation of the setback distances are illustrated on the Site Plan (**Appendix A, Figures 2 and 3**).

A Property Line Setback Assessment Report has been prepared in accordance with s.53 (3) of O. Reg. 359/09, and is one component of the REA application for this Project. The purpose of this report is to provide a review of potential adverse impacts and preventative measures for wind turbines located within the prescribed setback from non-participating parcels of land (i.e., where there is no agreement with the landowner specifically permitting a closer setback). A copy of the report is provided in **Appendix B**.

3.0 Facility Design Plan

The following provides a description of the key facility design components on the Site Plan (**Appendix A**).

The key mitigation strategy used to address potential environmental effects from operation of the facility was the avoidance of significant natural features and water bodies to the extent possible during siting of the Project.

3.1 FACILITY COMPONENTS OVERVIEW

No equipment will be required relating to water takings, sewage, air discharges and/or water and biomass management.

3.1.1 Wind Turbine Generators

The Project will consist of 4 wind turbine generators for a total maximum installed nameplate capacity of up to 10 MW. Turbine coordinates for the Project are shown in **Table 3.1** below.

Table 3.1: Turbine Coordinates

Turbine #	Easting UTM NAD83 Zone 17	Northing UTM NAD83 Zone 17
1	561114	4734743
2	561623	4735211
3	561217	4735252
4	561987	4735411

Each wind turbine consists of the following key components:

- Concrete tower foundation;
- Steel tower sections;
- Nacelle (comprised of electrical generator and housing);
- Three rotor blades;
- Hub (the structure where the blades attach);
- Power convertor;
- Step-up transformer; and,
- Electrical wiring and grounding.

The Project will consist of four Siemens SWT 3.0 113 wind turbine generators. The 3.0 MW turbines will be customized to a nameplate capacity of 2.5 MW for this Project. The total maximum installed nameplate capacity of all four turbines will not exceed 10 MW. A summary

of the basic specifications of the turbine model is provided in **Table 3.2** below. Detailed specification about the turbine model is provided in the Wind Turbine Specifications Report.

Table 3.2: Siemens SWT-3.0-113 - Wind Turbine Specifications

Operating Data	Specification
General	
Manufacturer	Siemens
Model	SWT 3.0 113
Name plate capacity (MW)	3.0 MW (customized to 2.5 MW)
Cut-in wind speed (m/s)	3-5 m/s (10.8 – 18 km/hr)
Cut-out speed (m/s)	25 m/s (90 km/hr)
Frequency (Hz)	50 or 60 Hz
Sound power (dBA)	102.5 dBA
Tonal audibility	<2dB
Rotor	
Blade length (m)	55 m
Rotor diameter (m)	113 m
Rotor swept area ($m^{2)}$	10,000 m^2
Rotational speed (rpm)	6.0 – 15.5 rpm
Tower	
Hub height (m)	99.5 m
Tower height (m)	154.5 m

3.1.2 Electrical Infrastructure

A step-up transformer, adjacent to each turbine, is required to transform the electricity generated in the nacelle to a common collection system line voltage (i.e., 0.69 kV to 27.6kV). From each step-up transformer, 27.6 kV underground collector lines would carry the electricity generated by the turbines to the Project's distribution substation where a dip-pole connection will be made directly from an underground line into a LDC existing distribution system. Fibre optic data lines used for monitoring and control of each turbine will run with the collector lines. Where possible, underground collector lines have been incorporated into the design of the access roads to reduce the area required for construction and to minimize potential construction impacts; the cables would be installed immediately to one side of the access road, just off the gravelled surface. Approximately 2.41 km (2,410 m) of underground collection line would be installed as part of the Project .Typically the collector lines would be buried to a depth of 1 m.

Where there are crossings of watercourses, the underground collector lines would be installed by directional drilling. If site conditions require directional drilling to cross roads, streams, valleylands or other obstacles, lines may be installed in plastic conduits.

No transmission lines would be constructed for the Project.

The Project's distribution substation yard would be approximately 1800 m^2 (30 m x 60 m) in size and would be located on private property east of the intersection of Port Ryerse Road and Cookson Street (**Figure 2**). The substation site would house the disconnection switches, control devices, and communication and metering systems required to support the operation of the substation. The area may also be used to temporarily act as a Project office site with one or two modular trailers.

3.1.3 Access Roads and Parking Lot

An estimated 560 m section of Avalon Line will require upgrades and 2.33 km of new access roads would be required to support construction/operation vehicles. There are two alternative 6 m wide access roads/entrances to Turbine 1. Final selection of one alternative will be based on discussions with the turbine manufacturer. Access to Turbines 2, 3 and 4 would be achieved by upgrading Avalon Lane which will connect to three Project access roads 11 m wide**.** The 11 m wide roads connecting Turbines 2, 3, and 4 will be reduced to the width of a common driveway once construction is completed. All roads will require wider turning radii for construction equipment.

All new access roads will be sited in active agricultural fields. Access roads have been planned in consultation with the landowners, where possible, parallel property boundaries to reduce potential impacts to drainage systems, farm operations and agricultural lands. No temporary structures (such as culverts) and no direct impacts to on-site woodlots or vegetation are anticipated during access road construction. No blasting would be required for the access roads; excavation is expected to be above the water table at all times. It is anticipated that entrance permits will be obtained from Norfolk County for the access roads.

A 15 m x 15 m permanent parking lot (if required) off Avalon Lane, south of Gilbert Road will be used during construction/decommissioning and operation of the Project. Construction of the parking lot would follow the same steps and use the same material as the access roads construction. The parking lot will not be used as a laydown area. The parking lot may accommodate temporary facilities such as a construction trailer (alternative location may be adjacent to substation infrastructure), sanitary facilities (self-contained), health and safety/first aid facility, lunch facilities, training and site security. Additionally, the footprint of the parking lot will include adequate parking for employee, contractor and service vehicles (approximately 2-3 vehicles).

The new access roads and parking area will be built on private lands and will be privately maintained throughout the life of the Project for ongoing turbine monitoring and maintenance.

3.1.4 Stormwater Management System

Area drainage from the distribution substation will be accomplished through swales/ditches adjacent to the proposed access road that will collect and convey runoff from the substation area and the associated access road. The total drainage area associated with the substation

and access road “hard” surfaces is less than 2 ha and therefore a “wet” water quality control pond (i.e., one containing a permanent pool) is inappropriate, as per the MOE *SWM Planning and Design Guidelines Manual* (2003). In addition to the conveyance of runoff, the swales will also provide water quality control, which is a suitable stormwater management practice for such an area according to the MOE guidelines.

3.1.5 Meteorological Tower

A meteorological tower (met tower) was installed in 2009 on private property, east of the intersection of Port Ryerse Road and Cookson Street (**Figure 2**). This met tower has been used to identify the quality of the wind resource for the proposed Project. It may remain in use during the operation phase of the Project.

3.1.6 Crane Pads

A temporary crane pad (approximately 40 m x 22 m) adjacent to each turbine location will be constructed to allow for crane deployment should a major maintenance event occur.

4.0 Facility Operations Plan

Operation activities include daily monitoring of wind turbines, function of the distribution station, maintenance activities, and monitoring of meteorological data.

4.1 SITE SUPERVISION AND STAFF TRAINING

Boralex/UDI may hire a specialized Operations and Maintenance (O&M) Contractor to carry out various on-going activities, including daily operation, associated with the Project. During pre-operational mobilization, Boralex/UDI and/or the O&M Contractor will develop an operation and maintenance program designed to ensure compliance with any applicable municipal, provincial, and/or federal requirements. As appropriate, the program will cover staff training, predictive/preventive maintenance, routine maintenance, unscheduled maintenance (including appropriate environmental mitigation measures), annual overhauling, inspection of equipment and components, procurement of spare parts, and maintenance of optimum inventory levels in order to reduce inventory carrying costs and working capital costs. It will also include a schedule for regular inspections of the turbines and ancillary facilities.

4.2 PLANNED MAINTENANCE

The wind turbines will be subject to periodic inspection and maintenance, including routine oil changes, motor maintenance, and lubricant and fluid replacement. To ensure proper operational output and safety the wind turbines will be maintained by certified technicians according to the schedules recommended by equipment manufacturers.

Regular maintenance activities will be performed by a small crew (2-4 people) accessing the site using a pick-up truck. Periodically, major components of the wind turbines such as blades or generators may require replacement. Major component replacement will be performed with similar equipment and methods to those used in the construction phase, including cranes and oversized vehicles for transportation. Crane pads will be reconstructed as necessary for this activity.

The Project site, including roads, will be maintained during the operations phase of the Project. Regular grounds-keeping will be undertaken to ensure access to the site year-round. In the winter months a contractor will be hired to clear access roads after snow falls using a pick-up truck mounted plough or other appropriate machinery. Sand will be applied to roads as necessary; no salt will be used for de-icing.

Through the Supervisory Control and Data Acquisition (SCADA) system that is connected to the fibre optic cables installed with the collector lines, the maintenance staff will be able to monitor the performance of all turbines on-line in real time basis. The SCADA system will also identify any potential problems so that pro-active inspection and maintenance can be undertaken. Potentially damaged turbines will be shut down until maintenance staff can perform a site

inspection. Regular maintenance of the equipment will be a key method of mitigating these potential effects.

Scheduled maintenance will include the following:

- Visual inspection;
- Inspection of mechanical components;
- Inspection of electrical components; and,
- Greasing and general maintenance.

Initial visits for planned maintenance are more frequent, slowing to once every six months or more as the Project matures. Maintenance of each wind turbine usually takes one day to complete.

Turbine oil changes will be completed in accordance with oil analysis recommendations. An oil change is not likely to occur until the findings of the annual oil analysis indicate that it is required, which could be after years of operation. The amount of oil and grease stored on site will depend on availability, transportation schedules, and the service cycle. The maintenance team will be responsible for transport of used oil to a certified disposal/recycling site following maintenance. No oil and grease will be stored on-site.

4.3 UNSCHEDULED MAINTENANCE

Boralex/UDI will also provide unscheduled maintenance for the turbine units when required. Maintenance and inspection related to the electrical collector system will be sub-contracted. An operations and maintenance building will not be required as part of the Project since the operation and maintenance of the facilities will be external.

Temporary crane pads that may be required for unscheduled maintenance activities will be constructed adjacent to individual turbine sites as required to facilitate turbine maintenance. The crane pads will be in the same location as the crane pads used during construction of the Project, if possible. Operation-phase crane pad construction, if required, will follow the same design and process used during the construction phase, as described in the Construction Plan Report. As a result, any potential effects from construction of the crane pads will the similar to those identified during the construction phase. Disturbed areas will be restored immediately following completion of the maintenance activities in the same manner as described in the Construction Plan Report unless the landowner asks for the crane pads to remain.

4.4 MONITORING METEOROLOGICAL DATA

Each turbine will have sensors to measure wind speed and direction. This data will be used to determine when the turbines are operating as well as to control the pitch of the blades and the orientation of the nacelle.

Meteorological data will also be collected from the met tower. The wind Project's SCADA system may use this data to:

- Provide additional parameters such as wind direction, air temperature, air pressure and wind shear to better manage the operational performance of the equipment; and,
- Provide a backup source of wind speed data should a wind turbine's own sensors prove unreliable.

4.5 OTHER ACTIVITIES

No ground water or surface water supplies will be used and/or impacted as part of the operation of the facility and there is no potential for the Project to interfere with existing uses of water within or near the Project. No structures during operation of the Project will discharge contaminants into the air and no works are required associated with the collection, transmission, treatment and disposal of sewage during the operation of the Project. As there will be no operations and maintenance building constructed for the Project, there will be no sewage produced during the operation of the Project. In addition, there are no areas where waste, biomass, source separated organics and farm material are stored, handled, processed or disposed of during the operation of the Project. Temporary portable sanitary facilities located in the parking lot will be removed following construction activities and therefore no potential impact is expected during operations of the facility.

In accordance with s.8 of O. Reg. 419/05, air emission rate calculations and dispersion modeling do not have to be performed for emissions from negligible sources or for the emission of negligible contaminants from significant sources.

Based on the preliminary facility design, the following sources of air contaminant emissions have been identified:

- Fuel combustion from on-site vehicles;
- Maintenance use of solvent-based cleaners;
- Maintenance welding activities;
- One stand-by emergency diesel generator; and,
- Battery chargers.

Based on the guidance given in Table B-3 of *Procedure for Preparing an ESDM Report* (Version 3, February 2009), the following facility sources are defined as sources that emit contaminants in negligible amounts:

- Small maintenance activities;
- Maintenance welding stations;

- Standby power generators firing liquid or gaseous fuels that are used for standby power only with periodic testing as per the Regulation;
- Exhaust of inert gases; and,
- Battery chargers.

Therefore, as O. Reg. 419/05 does not apply to discharges of contaminants from motor vehicles and all other facility sources can be considered negligible per the information provided above, no further assessment is required.

5.0 Potential Environmental Effects and Mitigation Measures

O. Reg. 359/09 requires that any adverse environmental effects that may result from operations activities be described (including those within the 120 m Zone of Investigation). **Sections 5.2** to **5.9** describe the potential effects, mitigation measures (if required) and net effects that may result from operations activities within the 120 m Zone of Investigation.

Descriptions of the existing natural heritage, water, archaeological and built heritage environments in the area and/or Project Location can be found within the Natural Heritage Assessment & Environmental Impact Study (NHA/EIS), Water Assessment and Water Body Report (WAWB), Stage 1 Archaeological Assessment (Stage 1 AA), Stage 2-3 Archaeological Assessments (Stage 2-3 AAs), and Heritage Assessment Report. These reports form part of the complete REA application.

A description of potential effects and mitigation measures for specific natural features located within the specified setbacks within O. Reg. 359/09 is provided in the NHA/EIS and WAWB.

For some natural environment and socio-economic features, mitigation measures are anticipated to eliminate all effects. The need, assessment, and selection of protection and mitigation measures discussed in the following sections have been predicated on the hierarchical principles of:

- avoidance – the elimination of adverse environmental effects by siting, scheduling, and design considerations;
- minimization – reduction or control of adverse environmental effects through Project modifications or implementation of protection and mitigation measures; and
- compensation – enhancement or rehabilitation of affected areas.

The application of these principles has greatly reduced the potential for adverse environmental effects from the Project as demonstrated in the following subsections. The key mitigation strategy used to address potential environmental effects from operation of the facility was avoidance of significant natural features and water bodies to the extent possible during siting of the Project.

5.1 PERFORMANCE OBJECTIVES

The key performance objective for each of the features discussed below is avoiding and/or minimizing potential effects (through the use of appropriate mitigation measures) to the features throughout the operation phase of the Project. The proposed mitigation measures will assist in achieving this performance objective. Additional information related to specific performance objectives is provided in **Table 7.1**. A program for monitoring environmental effects is provided in **Section 6**.

5.2 HERITAGE AND ARCHAEOLOGICAL RESOURCES

5.2.1 Protected Properties and Heritage Resources

In accordance with O. Reg. 359/09, a Heritage Assessment Report was undertaken for the Project, and is included under separate cover as part of the REA application.

The Heritage Assessment Report determined that:

- There are no protected properties within the Project Study Area;
- 38 properties with potential built heritage resources are within the Study Area (7 of which are of cultural heritage value or interest); these will not be negatively impacted by the Project; and,
- 2 potential cultural heritage landscapes (Port Ryerse and Avalon Park Cottages) are within the Study Area (both of which are of cultural heritage value or interest); these will not be negatively impacted by the Project.

Potential Effects

As operational and maintenance activities will not occur on the properties containing the built heritage resources and cultural heritage landscapes, no adverse effects on heritage resources are anticipated during operations.

The Heritage Assessment Report determined that the proposed Project infrastructure will not result in the direct or indirect obstruction of any significant views or vistas within, from, or of built or natural features associated with the built heritage resources or cultural heritage landscapes. Significant views and vistas are not heritage attributes of any of the seven properties with identified heritage resources. In addition, the visual links between Port Ryerse and Avalon Park Cottages and their respective landscape will not be disrupted by the Project, as all of the significant views and vistas are orientated to the south (i.e., towards Lake Erie) rather than to the north or east (i.e., towards the Project Location).

Mitigation Measures

As no potential effects are likely to occur as a result of the Project on heritage resources, no mitigation measures are necessary. The Heritage Assessment Report recommended that “the Port Ryerse Wind Farm be released from further heritage concerns”.

Net effects

No net effects are anticipated.

5.2.2 Archaeological Resources

In accordance with O. Reg. 359/09, a Stage 1 Archaeological Assessment (Stage 1 AA) and Stage 2-3 Archaeological Assessments (Stage 2-3 AAs) were completed for the Project.

The results of the Stage 1 AA indicated that the Project Study Area comprised a mixture of areas of archaeological potential and areas of no archaeological potential. Given the potential for Pre-Contact and Euro-Canadian archaeological sites, a Stage 2 Archaeological Assessment was recommended for all areas of archaeological potential within the Project Location including the areas proposed for access roads, parking lot, collector lines, turbines and the distribution substation.

The Stage 2-3 AAs identified one Euro-Canadian artifact scatter with a small Pre-Contact lithic component and twenty-one Pre-Contact artifact scatters and isolated find spots. Of the 22 find spots recorded, 8 were found to be of further cultural heritage value or interest; however to avoid impacts to these eight sites the Project Location was modified. It was noted in the Stage 2-3 AAs that a partial Stage 3 archaeological investigation was conducted on a find spot that had the potential to be impacted by the Project prior to Project modification. This assessment was ceased when the Project Location was modified to avoid any further impacts to the site.

As a result of the modifications to the Project design, none of the sites recommended for further work were located within the current Project location. It was noted that two find spots are located within 20 m of the Project Location (i.e., a portion of each site's 20 m protective buffers falls within the Project Location). At both find spots, the 20 m buffer is interrupted by a permanently disturbed cultural form (i.e., private road and its associated embankment/ditch). Six find spots are located at least 70 m away from the Project Location. Of these six find spots, it was recommended that two find spots be subjected to a site-specific Stage 3 archaeological investigation if any future developments are planned in their immediate vicinity, or if the Project Location is revised at a later date to include these areas.

Potential Effects
There are no areas that will be excavated during the operation phase that will not have been assessed by a Stage 2 Archaeology Assessment; therefore no potential effects are anticipated to archaeological resources.

Mitigation Measures

The Stage2-3 Archaeological Assessments recommended placing temporary barriers around six of the eight find spots located between 20 to 70 m away from the Project Location during construction.

No potential effects are anticipated during operation and therefore no mitigation measures are necessary.

Net effects

No net effects are anticipated. For the two find spots located within 20 m of the Project Location, any proposed work will not expand the existing disturbed area.

5.3 NATURAL HERITAGE RESOURCES

In accordance with O. Reg. 359/09, an NHA/EIS was undertaken for the Project and is included under separate cover as part of the REA application. The following provides a summary of the potential effects and associated mitigation measures as described in that report in relation to facility operation.

5.3.1 Wetlands

No wetlands are found in the Project Location or within the 120 m Zone of Investigation/ Project Study Area. This includes provincially-significant, locally-significant, or other unevaluated wetlands. As no wetlands are present, no potential effects will occur and therefore no mitigation measures are necessary.

5.3.2 Areas of Natural and Scientific Interest

The Study Area does not contain any Earth Science or Life Science Areas of Natural and Scientific Interest (ANSIs). As no ANSIs are present, no potential effects will occur and therefore no mitigation measures are necessary.

5.3.3 Woodlands

Two significant woodlands (WO02 and WO03) are located within the 120 m Zone of Investigation. One significant woodland (WO02) occurs in the Project Location and contains Project infrastructure (i.e., underground collector lines cross woodland area).

Potential Effects

No direct effects are anticipated to significant woodlands as a result of operation or maintenance activities.

Indirect impacts may occur to significant woodlands due to dust generation, and sedimentation and erosion.

During operation and maintenance of the facility, some materials such as lubricating oils and other fluids associated with turbine maintenance have the potential for discharge to the on-site environment through accidental spills.

Mitigation Measures

Mitigation measures related to dust are outlined in **Section 5.5.2**. Mitigation measures related to erosion and sedimentation are outlined in **Section 3.3.3** of the Construction Plan Report. Mitigation measures for accidental spills are outlined in **Section 5.8.2**.

Net Effects

Indirect impacts are expected to be short-term in duration, and highly localized.

Accidental spills would be spatially limited and of short duration and protocols to minimize their impact would be provided in the Emergency Response Plan (see **Section 8.0**).

5.3.4 Provincial Parks and Conservation Reserves

The Project Study Area does not contain any provincial parks or conservation reserves, nor is it adjacent to any such areas. As no provincial parks or conservations reserves are present, no potential effects will occur and therefore no mitigation measures are necessary.

5.3.5 Other Designated Natural Areas

The Study Area does not contain any other designated natural areas. As such no potential effects will occur and therefore no mitigation measures are necessary.

5.3.6 Significant Wildlife and Wildlife Habitat

The following significant wildlife habitats were identified within the 120 m Zone of Investigation:

- Landbird Migratory Stopover Area; and,
- Pignut Hickory Habitat.

Potential Effects

No direct impacts to landbird migratory stopover areas or pignut hickory habitat are anticipated as no encroachment into, or removal of, this habitat type is proposed during operation or maintenance activities.

Landbird Migratory Stopover Area

Wind turbines have been sited outside of landbird migratory stopover area. Indirect effects include loss of species diversity and abundance through habitat displacement or avoidance.

Pignut Hickory Habitat

Project components are sited outside of the habitat for Pignut Hickory. Indirect effects include loss of species habitat through

Pre-construction surveys were performed for Bald Eagle Winter Perching Habitat in the fall/winter of 2012/2013 and non-significance was confirmed and approved by the MNR. No mitigation or future consideration for post-construction surveys will be necessary for this specific habitat type at Project Location.

Mitigation

Landbird Migratory Stopover Area

Landbird migratory stopover area was evaluated as significant based on fall surveys; however, additional spring surveys will be conducted on this habitat. The following monitoring, mitigation, and contingency measures will be implemented in consultation with MNR:

- Post construction monitoring for disturbance and mortality, for three years; and,
- Submission of annual reports to MNR, and contingency measures, if required, will be determined in consultation with MNR.

Pignut Hickory Habitat

A post construction monitoring plan of the habitat will be implemented. A report will be prepared and submitted to MNR and contingency measures, if required, will be determined in consultation with MNR and other relevant agencies.

Mortality monitoring for birds is outlined in **Section 5.3.7**. Additional details are provided in the Environmental Effects Monitoring Plan (**Appendix C**).

Net Effects

Given the low potential for effects and the proven effectiveness of the proposed mitigation, minimal net effects are predicted for significant wildlife habitats. Post-construction disturbance and mortality monitoring would be conducted to verify effects predictions and additional operational mitigation would be implemented in consultation with MNR, if significant effects occur.

5.3.7 Generalized Significant Wildlife Habitat

In addition to the significant wildlife habitats identified in **Section 5.3.6**, the following Generalized Significant Wildlife Habitats were identified within the 120 m of Zone of Investigation; however not in the Project Location:

- Landbird Migratory Stopover Area;
- Woodland Area-Sensitive Bird Breeding Habitat;
- Woodland Raptor Nesting Habitat; and,
- Bat Maternity Colony.

Potential Effects

No potential effects on Generalized Significant Wildlife Habitats are anticipated during operations and maintenance of the Project.

Sensory disturbance of wildlife may occur during maintenance as a result of increased on-site human activities. During operations, activity levels would be considerably lower. However, a certain level of sensory disturbance to wildlife in the area already exists from ongoing agricultural activities.

During operation there is the potential for spills and contamination to the Generalized Significant Wildlife Habitats. Noise, dust, and general disturbance could also increase when maintenance crews are on site. These impacts are anticipated to be temporary in duration and relatively minor in scale.

During operation direct mortality to birds and bats may occur from collisions with turbines.

Mitigation Measures

Mitigation measures related to dust, noise, spills and traffic are listed in **Sections 5.5.2, 5.5.3, 5.6.8** and **5.8.2**, respectively.

A post-construction monitoring study for bird and bat mortality have been developed in consultation with the Ministry of Natural Resources (MNR) that is consistent with guidance provided in MNR's Bat Guidelines and MNR's Bird Guidelines. This is contained within the Environmental Effects Monitoring Plan and is provided in **Appendix C**.

Elements of the post-construction monitoring program include:

- Bird mortality monitoring at all wind turbines will be conducted twice-weekly (3-4 day intervals) at all turbines from May 1st - October 31st and raptor mortality surveys weekly from May 1st - November 30th for three years following start of operations.

- Bat mortality monitoring at all turbines will be conducted twice-weekly (3-4 day intervals) at all turbines from May 1st - October 31st for three years following start of operations.

- Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1 and October 31st, and repeated for each searcher. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species).

- Regular reporting that includes analysis and submission of results to the MOE and MNR.

Net Effects

Given that all mitigation and monitoring measures developed by the MNR are implemented, any adverse net effects on wildlife from operations are anticipated to be non-significant. There is some potential for disturbance to wildlife during operations and maintenance of the Project as a result of increased human activity. Some limited mortality is possible; however potential long-term effects to wildlife populations from this mortality and from barrier effects are anticipated to be minimal.

5.3.8 Significant Flora and Vegetation Communities

One provincially rare plant species, Pignut hickory (*Carya glabra*) was identified within the 120 m Zone of Investigation. This species was observed in a hedgerow approximately 63 m south of Turbine 3 constructable area during NHA/EIS site investigations. In Ontario, this species is ranked 'S3' indicating it is considered vulnerable (NHIC, 2010).

No rare vegetation communities were identified within the 120 m Zone of Investigation.

Potential Effects

Project components are sited outside of the habitat for Pignut Hickory. No direct impact to this species is anticipated as no removal of trees is proposed during operation or maintenance activities.

Indirect effects are related to dust emissions from maintenance activities.

Mitigation Measures

Post construction monitoring of the overall health status of the Pignut Hickory tree identified during NHA/EIS site investigations within 120 m of an access road will be conducted for any changes in health.

Operation and maintenance activities will remain on previously disturbed areas. Mitigation measures related to dust are outlined in **Section 5.5.2.**

Net Effects

Provided that all mitigation measures are implemented, any indirect adverse net effects from operations are anticipated to be non-significant.

5.3.9 Other Flora and Vegetation Communities

Within the 120 m Zone of Investigation, 65 species of vascular plants were recorded. Of that number, 53 species (82%) were native and 12 species (18%) were exotic. All of the native species are ranked S4 (apparently secure) or S5 (secure in Ontario).

Potential Effects

Given that no vegetation removal or disturbance is required for operation of the Project no direct effects are anticipated.

Indirect effects to flora species and vegetation communities are related to dust emissions from maintenance traffic.

Mitigation Measures

Mitigation measures related to dust are outlined in **Section 5.5.2**.

Net Effects

Provided that all mitigation measures are implemented, any indirect adverse net effects on other flora and vegetation communities from operation activities are anticipated to be short term in duration and intermittent.

5.4 WATER BODIES AND AQUATIC RESOURCES

5.4.1 Groundwater

Potential Effects

It is not anticipated that operation of the Project will adversely affect groundwater quality, quantity or movement. Some materials, such as fuel, lubricating oils and other fluids associated with turbine maintenance have the potential for discharge to the on-site environment through accidental spills.

Mitigation Measures

Mitigation measures for accidental spills are listed in **Section 5.8.2**

Net Effects

Accidental spills would be spatially limited and of short duration and protocols to minimize any impact will be provided in the Emergency Response Plan **(Section 8.0**).

5.4.2 Surface Water, Fish and Fish Habitat

In accordance with O. Reg. 359/09, a Water Assessment and Water Body Report was undertaken for the Project to determine the presence of water bodies as defined by O. Reg. 359/09 and associated setbacks. The following provides an assessment of potential effects and mitigation measures during operation for water bodies and fish/fish habitat within the 120 m Zone of Investigation.

Three REA water bodies were identified within the Zone of Investigation. Two will be crossed by underground collector lines and one access road is located within 120 m of a water body (the access road does not require a water body crossing).

Potential Effects

The potential for effects on watercourses during operation exists from soil erosion resulting from maintenance activities (removal of stabilizing vegetative cover). Erosion can cause downstream sediment transport and a short-term increase in surface water turbidity, including associated impacts to fish and fish habitat. The magnitude and duration of potential effects to watercourses depend on the specific characteristics of each watercourse (e.g. flow regime, water velocity, bed substrates, bank conditions, local soils and the extent and duration of exposure). In addition, some materials, such as fuel, lubricating oils and other fluids associated with turbine maintenance have the potential for release to the environment in the event of accidental spills.

Mitigation Measures

Mitigation measures related to sedimentation and erosion would be the same as discussed in **Section 3.4.2** of the Construction Plan Report.

The Emergency Response Plan (**Section 8.0**) will contain procedures for spill contingency and response plans, spill response training, notification procedures, and necessary cleanup materials and equipment. As per S.13 of the *Environmental Protection Act*, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of prescribed regulatory levels will be reported to the MOE's Spills Action Centre.

Net Effects

Provided that maintenance activities are performed properly, no adverse net effects on surface water features and fish/fish habitat are anticipated during operation of the Project.

5.5 AIR QUALITY AND ENVIRONMENTAL NOISE

5.5.1 Air Emissions

Potential Effects

During operations, minor localized air emissions will occur from the periodic use of maintenance equipment over the life of the Project.

Mitigation Measures

To reduce emissions from equipment and vehicles, several mitigation measures will be employed:

- Multi-passenger vehicles will be utilized to the extent practical;
- Company and construction personnel will avoid idling of vehicles when not necessary for operational activities;
- Equipment and vehicles will be turned off when not in use unless required for operational activities and/or effective operation of the equipment or vehicle;
- Equipment and vehicles will be maintained in good working order with functioning mufflers and emission control systems as available;
- All vehicles will be fitted with catalytic converters as required by applicable legislation;
- All operational equipment and vehicles will meet the emissions requirements of the MOE and/or MTO;
- As appropriate, records of vehicle maintenance will be retained and made available for periodic review by the Operations and Maintenance Contractor and Boralex/UDI; and

- All vehicles identified through the monitoring program that fail to meet the minimum emission standards will be repaired immediately or replaced as soon as practicable.

Net Effects

The application of the recommended mitigation measures during operations will limit air emissions to the work areas and limit the magnitude of combustion emissions. As a result, any adverse net effects to air quality from air emissions during operation of the Project are anticipated to be short-term in duration and highly localized.

5.5.2 Dust and Odour Emissions

Potential Effects

Operations related traffic and maintenance activities have the potential to create nuisance dust effects in the immediate vicinity of the Project. Unpaved road surfaces exposed to wind can also be a source of fugitive dust emissions.

No odour emissions are anticipated during operation of the Project. Therefore, no mitigation measures are required to address odour.

Mitigation Measures

To protect adjacent receptors from potential off-site dust concerns, the Operations and Maintenance Contractor and/or Boralex/UDI will implement good site practices during operations which may include:

- Maintaining equipment in good running condition and in compliance with regulatory requirements;
- Dust suppression (e.g. water) of source areas as necessary;
- Covering loads of friable materials during transport; and,
- Limiting vehicle speeds on gravel or dirt roads.

Boralex/UDI will monitor concerns raised by the public regarding dust and noise.

Net Effects

The application of the recommended mitigation measures during operations will limit fugitive dust emissions to the work areas. As a result, any adverse net effects to air quality from dust emissions during operation of the facility are anticipated to be short-term in duration and highly localized.

5.5.3 Environmental Noise

Zephyr North conducted a Noise Assessment as per the requirements of the MOE's 2008 Noise Guidelines (see **Appendix D**). The Noise Assessment Report determined that that the estimated sound pressure levels at receptors and vacant lot surrogate receptors (VLSRs) in the Project area comply with the Ontario Ministry of Environment sound level limits at all qualified points of reception.

Potential Effects

During operations of the Project, sound will be generated by the periodic use of maintenance equipment to repair the wind turbines. In addition, vehicles will travel to and from the substation property during regular business hours. The audible sound at receptors beyond the turbine siting areas and substation property is expected to be a minor, short-term disruption.

Aerodynamic sound will be emitted from the wind turbines. All turbines proposed as part of the Project are located at a distance of at least 550 m from the nearest non-participating noise receptor. Based upon the Project design, the analysis carried out in the AAR indicates that sound produced by the Project was found to be within the acceptable limits established by the MOE at all noise receptors.

Mitigation Measures

The Project will be required to operate according to the terms and conditions of the Renewable Energy Approval (REA). In the event the Project does not operate according to the terms and conditions of the REA, the non-compliant turbine(s) may be shut down until the problem is resolved. A regular maintenance program will largely mitigate potential effects related to noise from damaged turbines. Routine facility maintenance to ensure infrastructure is operating properly and efficiently will be performed as required.

To minimize inconvenience brought on by vehicle noise during operations, all engines will be equipped with mufflers and/or silencers in accordance with MOE and/or MTO guidelines and regulations. Maintenance equipment noise levels will also be compliant with sound levels established by the MOE.

To the greatest extent possible, operations activities that could create excessive noise will be restricted to regular business hours and adhere to any local noise by-laws. If maintenance activities that cause excessive noise must be carried out outside of these time frames, adjacent residents will be notified in advance and by-law conformity will occur, as required. Any potential noise complaints will be handled on an individual basis by Boralex/UDI.

Net Effects

Application of the recommended mitigation measures during operations will limit noise emissions to the general vicinity of the turbine locations and substation property. Given that the facility must comply with the requirements of the REA process and applicable MOE environmental noise guidelines, no significant net effects are anticipated.

Any adverse net effects due to noise during operation of the Project are anticipated to be short-term in duration and intermittent.

5.6 LAND-USE AND SOCIO-ECONOMIC RESOURCES

5.6.1 Areas Protected Under Provincial Plans and Policies

No areas protected under specified Provincial Plans and Policies are located within the 120 m Zone of Investigation. No potential effects are anticipated to occur and therefore no mitigation measures are necessary.

5.6.2 Existing Land Uses

Potential Effects

During the operation phase of the Project, the lands which are occupied by facility components will be removed from their present agricultural land-use; however, existing surrounding land uses will remain unchanged.

During operations there will be a temporary increase in noise and dust around the work and haul areas used by maintenance and personnel vehicles, resulting in a potential effect to adjacent land uses.

There is potential for a minor increase of traffic during operations on roadways near the Project due to maintenance vehicles. No adverse effects on existing land uses, including local businesses, are anticipated from increased traffic during operations of the Project. Therefore, no mitigation measures are required.

No local businesses are expected to be displaced as a result of operations of the Project.

Mitigation Measures

The Project is considered to be compatible with existing land use; therefore no other mitigation measures are required to address effects to the existing land use. Siting of turbines and access roads are completed with the approval of the participating landowner.

Landowners will be compensated by Boralex/UDI for agricultural or industrial land that will be taken out of production/use during the lifespan of the Project through the land lease agreements.

Mitigation measures related to dust, noise and traffic are identified in **Sections 5.5.2, 5.5.3,** and **5.6.8,** respectively.

Net Effects

Although some disturbance to adjacent land uses from noise and dust is unavoidable, it is expected to be short-term in duration, temporary, highly localized, and will be minimized through the implementation of good site practices, transportation planning, and communication with the community.

5.6.3 Hazard Lands

Three hazard lands (valleylands) are located within the 120 m Zone of Investigation. Two of the hazard lands contain Project infrastructure (i.e., underground collector lines).

Potential Effects

Where maintenance activities take place within hazard lands, there is the potential for erosion of slopes.

Mitigation

Erosion and sedimentation controls would be installed during the construction of temporary crane pads and other applicable maintenance activities, and would be the same measures described in **Section 3.3.3** of the Construction Plan Report. The sedimentation and erosion control plan will be implemented for the Project.

Net Effect

The application of these measures during operation would ensure that effects to hazard lands due to operations activities are minimized and that any potential net effects are spatially and temporary limited.

5.6.4 Recreation Areas and Features

A section of the Ontario South Coast Scenic Route runs along the Project's western boundary. This route links several tourism, recreation, agriculture and natural heritage features and destinations along the Lake Erie shoreline and is travelled by local residents and tourists throughout the year. No recreational areas or features are located within the 120 m Zone of Investigation. Land designated as Resort Area along Long Point Bay (Lake Erie) is approximately 800 m outside (south) of the Project Location.

Potential Effects

Operations activities would be limited to private land and therefore is not expected to directly affect recreation areas. There is, however, the possibility that increased noise, dust and traffic volumes during some activities related to maintenance equipment and vehicles may interfere with nearby recreational uses.

Mitigation Measures

Mitigation measures related to dust, noise and traffic are identified in **Sections 5.5.2, 5.5.3,** and **5.6.8,** respectively.

Net Effects

Noise, dust and traffic effects on the use of recreation areas during operation of the Project are anticipated to be short term and intermittent.

5.6.5 Agricultural Lands and Operations

The existing land use within the Project Location includes primarily agricultural lands. Potential effects to the agricultural lands used for the turbines access roads and collector lines are related to the change in use from agricultural to renewable energy development. However, where lands are being used for Project infrastructure, landowners are being financially compensated for the lease of the private lands, and thus offset the effect of removing the land from agricultural production.

Impacts to livestock from operation of the Project are not anticipated.

Dust emissions from operations activities are associated with vehicular traffic from maintenance and personnel vehicles. Dust emissions are expected to be short-term in duration and highly localized. No potential physical effects are anticipated on agricultural lands and operations from dust during operations of the Project, and therefore no mitigation measures are required.

5.6.6 Mineral, Aggregate and Petroleum Resources

There are no lands designated for aggregate resource extraction, including licensed pits and quarries, within the Project Study Area.

Three abandoned and 2 (unknown status) petroleum wells are located within the 120 m Zone of Investigation. A draft Petroleum Resource Operations Report has been produced by MKI and submitted to MNR (June 21, 2012). This report addresses petroleum resources within 75 m of the Project Location.

Potential Effects

Given that no mineral or aggregate resources are located in the Study Area, no potential effects are anticipated and no mitigation measures are necessary.

The Petroleum Resource Operations Report (MKI, June 2012) concludes that well F005921 is the only petroleum resource site within 75 m of the Project Location that has not been decommissioned. The well is located 27 m south of the proposed Project distribution substation area. In an extreme case a fire or small spill at the petroleum well may occur. A spill could potentially contaminate the Project site. Such an event would greatly increase the risk of a fire at the Project facility.

Mitigation Measures

The Petroleum Resource Operations Report (MKI, June 2012) suggests that to mitigate for the possible risks identified above, Project infrastructure will be located at a higher elevation. In addition, the distribution substation will be constructed on a slightly elevated concrete foundation.

As discussed in the Construction Plan Report, final infrastructure alignments will be confirmed prior to construction based on consultation with the MNR's Petroleum Resources Branch and based on technical constraints that may be identified during detailed design and engineering. Underground locates would be conducted prior to construction given the potential for unrecorded and improperly decommissioned wells.

The Emergency Response Plan (**Section 8.0**) will contain procedures for spill contingency and response plans, spill response training, notification procedures, and necessary cleanup materials and equipment. As per S.13 of the *Environmental Protection Act*, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of prescribed regulatory levels will be reported to the MOE's Spills Action Centre.

Net Effects

No adverse net effects are anticipated to mineral, aggregate or petroleum resources during operation of the Project.

5.6.7 Game and Fisheries Resources

Potential Effects

Since the Project has been sited entirely on agricultural lands, potential indirect effects to wildlife and their habitats will be temporary until the Project becomes part of the environmental "background". The mammals present on the agricultural lands are common in southern Ontario and tend to be well-adapted to human-influenced landscapes and disturbance. No impacts to traditional treaty rights are anticipated; however these will be confirmed in discussion with relevant First Nations and Métis communities as appropriate.

Investigations by the German Institute for Wild Animal Research (Institut für Wildtierforschung) show that no permanent adverse effects from wind turbine operation can be determined for game animals (Austrian Wind Power, 2007). A three-year study by the Institut für Wildtierforschung at the Veterinary University of Hanover showed that no adverse effects by wind turbines could be determined on the occurrence and behaviour of animals such as common hares, deer, red foxes, partridges and carrion crows. A survey conducted in parallel of the owners of hunting shoots in Lower-Saxony showed that the majority of hunters did not view the wind turbines as a source of disturbance for smaller game animals (Austrian Wind Power, 2007). Sixty-six percent of hunters stated that the game did not stay away from the immediate vicinity of the wind plants. Almost 60 percent of the interviewees were of the opinion that all species in their corresponding territories became accustomed to the presence and operation of the turbines, whereby the periods required for this varied from one month to five years. This study demonstrates the tolerance of various wildlife populations to the presence of wind turbines (Austrian Wind Power, 2007).

Sensory disturbance to game species may occur during the operations phase due to noise. A certain level of sensory disturbance to wildlife in the area already exists from ongoing agricultural, rural and domestic activities.

From the few studies that are available, mammals were able to adapt to various noises. Noise and its effects on wildlife appear to be habitat and species specific. If species are able to adapt easily to human-modified habitats, generally they do not seem to be adversely affected by noise.

Mitigation Measures

Masking of auditory environmental signals, such as mammal warning cries or amphibian calls, may be significant immediately underneath the turbine (Rabin et al., 2006), but the effects rapidly decline with distance from the turbine. A study of low frequency noise and vibration at a modern wind farm determined that vibration is 1/5th to 1/100th of the limit of human perception within 25 m of the turbine base (Legerton et al., 1996). While other mammals and amphibians may be more perceptive of vibration, vibration magnitude drops off significantly as distance increases (K. Smith, Aercoustics, pers. comm.).

Turbines are generally placed in agricultural land, away from woodlands, and far enough away to minimize potential effects. Siting the Project on agricultural land has largely precluded disturbance to local flora, small mammals and amphibians, natural habitat, and corridor functions. No further mitigation measures are required.

Net Effects

Once the Project is operating human activity around the facilities will decrease, thus allowing local wildlife movement patterns to quickly re-establish.

Considering the periodic nature of maintenance activities, it is likely that resident game species will adapt to the Project quickly. Consequently, no net adverse effects are anticipated during the Project to game and fishery resources.

5.6.8 Local Traffic

Potential Effects

The number of vehicles required during operation will be minimal. A small number of light trucks will be required for typical maintenance activities, however occasionally larger vehicles will be required to transport turbine and switching station components. The increase in traffic may result in short-term, localized disturbance to traffic patterns or increases in traffic volume, and/or create potential traffic safety hazards.

Mitigation Measures

There may be instances during maintenance activities where excess loads (e.g. turbine and switching station components) will require special traffic planning. In addition, widening turning radiuses and road widths and the creation of new ingress/egress nodes from the work areas may be required. As appropriate, permits will be obtained to implement these activities. As appropriate, for public safety all non-conventional loads will have front and rear escort or “pilot” vehicles accompany the truck movement on public roads.

Although there are no requirements for formal public notification of wind turbine component load movements, Boralex/UDI may provide notification of non-conventional load movements that may interfere with local traffic, with potential methods of notification including postings on the Project website. This notification will be provided in the interest of public safety, minimization of disruption of other road users, and good community relations.

Net Effects

Road safety is not expected to be an issue during operations; however, the potential for accidents along the haul routes and on-site cannot be totally disqualified. Truck traffic will increase on some roads during maintenance activities and from personnel vehicles; however this traffic will be short-term in duration and intermittent.

The effect of operating the wind project is anticipated to have a limited, short term effect on traffic.

5.6.9 Local Economy

Potential Effects

Operation of the Project is expected to continue for a minimum of approximately 20 years. Boralex/UDI may hire a specialized Operation and Maintenance Contractor for specific tasks, and, to the extent possible, local hiring will be maximized during operations, providing work for existing tradespersons and labourers. Trades that could be provided locally may include pipefitters, electricians, ironworkers, millwrights, truck drivers, and carpenters. Since it is likely that the majority of the labour force will be supplied through local and neighbouring communities, no special housing, healthcare, or food facilities will be required as part of the Project operation activities.

No local businesses or facilities, other than agricultural land uses, are located within the Project Location or immediately adjacent to the area. The operation and maintenance of the Project will result in direct, indirect and induced benefits in terms of business income and employment.

Local economic benefits will also include a minimum of 20 years of land lease payments to participating landowners in addition to municipal taxes to be paid by Boralex/UDI.

Mitigation Measures

Boralex/UDI will make all reasonable efforts, to the extent possible, to source required services and materials from local suppliers where these items are available in sufficient quantity and quality and at competitive prices.

Net Effects

The Project provides positive benefits to the local area, including the County through ongoing property tax income with no increased demands for municipal services that cannot readily be met.

5.6.10 Viewscape

Potential Effects

Siting of the facility will alter the visual landscape. However, visibility of the facility will vary from receptor to receptor based upon the following factors:

- Surficial patterns: landform – largely determined by physiography and tree cover;
- Topography: slope – the greater the slope the greater the visibility of the turbines and other project infrastructure from more vantage points;
- Observer position: viewing – distance from the facility reduces scale and the apparent size of a project is directly related to the angle between the viewer's line-of-sight and the slope upon which the project is to take place;
- Atmospheric conditions: clarity – air pollution, natural haze, fogging, and snow affect daytime and nighttime visibility; and,
- Turbine marking: lighting – primarily affecting nighttime visibility.

Mitigation Measures

Landscaping at the distribution substation property may include planting trees and shrubs where appropriate, while still ensuring that the site visibility and building security are maintained.

There are limited opportunities for potential mitigation strategies given the height of the wind turbines and the landscape patterns.

Net Effects

Some disturbance to the viewscape is unavoidable due to the height of the turbines. The changed visual landscape will be present during the life of the facility.

5.7 EXISTING LOCAL INFRASTRUCTURE

5.7.1 Provincial, Municipal and Other Major Infrastructure

Potential Effects

There are no provincial highways within the Project Study Area. There is an existing local distribution easement that runs along the south-western Project boundary, to which the Project would connect.

Municipal infrastructure in the Study Area includes County roads designated as arterial roads (Cookson Street and King Street North part of County Road 57 Norfolk) and local roads (Port Ryerse Road, Gilbert Road, Hilltop Drive, Ralph Street North and Ralph Street South).

Avalon Lane, a private road, runs south through the central portion of the Project Location and then east along Lake Erie shoreline. No Project components will be located within municipal road ROWs. Boralex/UDI will continue to consult with the Norfolk County during the REA process, regarding any potential effects to municipal interests. Boralex/UDI is committed to working with the County to obtain all necessary permits, approvals, and agreements related to the Project.

No potential effects are anticipated during operation of the Project on Provincial, Municipal or other major infrastructure other than to roadways. Potential effects to traffic during the operation of the Project are discussed in Section 5.6.7. Potential effects on Provincial, Municipal or other major infrastructure from construction of the Project are described in the Construction Plan Report.

Mitigation Measures

Permits from the MTO may be required to facilitate the transportation of components used for maintenance (e.g. cranes) on provincial highways. As appropriate, for public safety all non-conventional loads will have front and rear escort or “pilot” vehicles accompany the truck movement on public roads.

The additional traffic on the provincial highways is not expected to cause any significant traffic congestion.

Although there are no requirements for formal public notification of wind turbine component load movements, Boralex/UDI may provide notification of non-conventional load movements, with potential methods of notification including postings on the Project website. This notification will be provided in the interest of public safety, minimization of disruption of other road users, and good community relations.

Net Effects

No net effects are anticipated to provincial and local infrastructure during operation of the Project.

Net effects from traffic during the operation of the Project are discussed in **Section 5.6.8.**

5.7.2 Navigable Waters

No navigable waters will be crossed by Project infrastructure. As such, no potential effects will occur and therefore no mitigation measures are necessary.

5.7.3 Radio Communication, Radar and Seismoacoustic Systems

Potential Effects

A Communications Impact Assessment prepared by MKI (August 31, 2012) noted that the proposed turbines are not within the recommended consultation zone of radar (weather) and seismoacoustic systems. The wind turbines, however, have the potential to interfere with the following radio communication systems in the vicinity of the Project Study Area:

- Point-to-point radio communication systems above 890 MHz;
- Broadcast transmitters - radio (AM, FM) and TV (analog and digital);
- Over- the-Air receptors;
- Cellular and land mobile radio networks and point to point systems below 890 MHz;
- Satellite ground stations; and,
- VHF OmniRange beacons.

Wind turbines can affect radio communication signals in a number of ways including shadowing, mirror-type reflections, clutter or signal scattering (RABC, 2010).

Mitigation Measures

Boralex/UDI has consulted with relevant agencies and licensed providers to identify any likely effects to radio communication, radar and seismoacoustic systems. Although no effects are anticipated, in the unlikely event that signal disruption is experienced, mitigation measures are available to alleviate the impact. This may include replacing the receiving antenna with one that has a better discrimination to the unwanted signals, relocating either the transmitter or receiver, or switching to an alternate means of receiving the information (fibre optic or other means).

As recommended in the assessment, complaints of degraded quality related to television and FM radio receivers within 15 km of the wind farm should be monitored and if need be mitigated post-construction by means agreed upon by Boralex/UDI and impacted party. Boralex/UDI will review potential incidents related to interference of radio communication systems on a case by case basis.

Net Effects

It is anticipated that any interference with radio communication systems will be limited and of short-term duration given that Boralex/UDI will review potential incidents of radio communication interference on a case by case basis.

5.7.4 Aeronautical Systems

Potential Effects

The presence of wind turbines presents a potential hazard to low flying aircraft. Aviation safety lighting and marking of the turbines is required by Transport Canada's Aerodrome Safety Branch as specified in the Canada Aviation Regulations and Standards. Aviation safety lights, which serve to increase night-time visibility of the turbines to aviators, are required at the top of turbines as part of the lighting requirements. These safety lights may also brighten the night sky. Transport Canada standards state that wind farms require a red obstruction lighting system consisting of fading on and off aviation red beacons. These are used for night marking of wind turbines between the heights of 90 m and 150 m (including blade length) above ground level and spaced approximately 900 m apart. Final aviation lighting requirements will be in accordance with Transport Canada Regulations and Standards and will be confirmed prior to construction.

There are no known private or public airstrips located within the Project Study Area.

Mitigation Measures

Boralex/UDI obtained a signed and stamped Aeronautical Assessment Form from Transport Canada, and approval from NAV Canada for the Project. Confirmation has been obtained from the Department of National Defence (DND) which indicates that the Project will not interfere with any DND radar and flight operations.

Specifically with respect to local aviation concerns, Transport Canada and NAV Canada's clearance of the Project is based on an assessment of the potential impacts on, or risks to, local aviation, including potential interference with air navigation systems and flight paths in the area. These assessments include a review of the proposed locations of each of the Project's turbines.

According to Transport Canada's Aerodrome Safety Branch guidelines, a wind turbine more than 900 m from another wind turbine with a light requires its own lighting. Turbine lighting must conform to Transport Canada standards. Based on discussions with Transport Canada, all turbines will require navigational lights. In order to reduce rural light pollution, lights will be selected with the minimal allowable flash duration, narrow beam, and will be synchronized.

It should be pointed out that turbine marking and lighting are secondary safety measures for aircraft. The turbines are below the minimum flight floor of 500 feet (152.4 m) above ground level. It is illegal for aircraft to fly below 500 feet (152.4 m) unless they have been granted a special clearance for a low level flight. Low-level aircraft such as ultra-lights and crop dusters are to be familiar with the area they are flying over and are prohibited from night-time flights. Nav Canada will be responsible for updating all aeronautical charts with the turbine locations.

Routine maintenance of the turbines will include replacing safety lightning in the event of a malfunction.

Net Effects

With the application of the above mitigation measures, no adverse net effects on aeronautical activities are anticipated during operation of the facility.

5.8 WASTE MANAGEMENT AND CONTAMINATED LANDS

5.8.1 Waste Generation

Potential Effects

Lubricating and hydraulic oils associated with turbine maintenance and operation will be used for the facility, and waste materials, such as oil, grease, batteries, and air filters and a minor amount of domestic waste (i.e., garbage, recycling, and organics), will be generated during standard operation and maintenance activities.

All waste materials will require reuse, recycling, and/or disposal at an appropriate off-site facility. Improper disposal of waste material generated during operations may result in contamination to soil, groundwater, and/or surface water resources on and off the Project sites. Litter generated during operations may also become a nuisance to nearby residences if not appropriately contained and allowed to blow off site. There will be no on-site disposal of waste during the operation of the Project. Used oil will be removed from the site by a certified contractor with the appropriate manifests in place.

Mitigation Measures

During operations, Boralex/UDI and/or the Operation and Maintenance Contractor will implement a site-specific waste collection and disposal management plan, which will include good site practices such as:

- systematic collection and separation of waste materials within on-site weather-protected storage areas;
- contractors will be required to remove all waste materials from the turbine sites during maintenance activities;
- all waste materials and recycling will be transported off-site by private waste collection contractors licensed with a Certificate of Approval – Waste Management System;
- labeling and proper storage of liquid wastes (e.g. used oil, drained hydraulic fluid, and used solvents) in a secure area that will ensure containment of the material in the event of a spill. As per s.13 of the *Environmental Protection Act*, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in

excess of the prescribed regulatory levels will be reported to the MOE's Spills Action Centre;

- as appropriate, spill kits (e.g. containing absorbent cloths and disposal containers) will be provided on-site during maintenance activities and at the operation and maintenance building;
- dumping or burying wastes within the Project sites will be prohibited;
- disposal of non-hazardous waste at a registered waste disposal site(s);
- if waste is classified as waste other than solid non-hazardous, a Generator Registration Number is required from the MOE and the generator will have obligations regarding manifesting of waste. Compliance with Schedule 4 of Regulation 347 is mandatory when determining waste category; and
- implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials.

Net Effects

With the application of the mitigation measures outlined above, no net effects from waste material disposal will occur on-site during operation.

5.8.2 Spills

Potential Effects

Some materials, such as fuel, lubricating oils and other fluids associated with turbine maintenance have the potential for discharge to the on-site environment through accidental spills.

Mitigation Measures

In terms of accidental spills or releases to the environment, standard containment facilities and emergency response materials will be maintained on-site (within the turbines or substation) as required. Refuelling, equipment maintenance, and other potentially contaminating activities will occur in designated areas. As per s.13 of the *Environmental Protection Act*, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of the prescribed regulatory levels will be reported to the MOE's Spills Action Centre.

An Emergency Response Plan (**Section 8.0**) will be developed by Boralex/UDI and/or the Operation and Maintenance Contractor and will include protocols for the proper handling of material spills and associated procedures to be undertaken in the event of a spill.

Net Effects

With the application of the mitigation measures outlined above, no net effects from accidental spills or releases to the environment are anticipated.

5.9 PUBLIC HEALTH AND SAFETY

5.9.1 Turbine Blade and Structural Failure

Potential Effects

The potential exists for full or partial blade detachment from the turbine structure, resulting in damage to the landing area from the impact. Garrad Hassan Canada undertook a review of publicly-available literature on turbine rotor failures resulting in full or partial blade throws (Garrad Hassan Canada, 2007). Such events were found to be very rare; therefore data describing these events are scarce.

Root causes of blade failure have been continuously addressed through developments in best practice in design, testing, manufacture and operation; much of these developments have been captured in the International Electrotechnical Commission (IEC) standards to which all current large wind turbines comply (Garrad Hassan Canada, 2007). There has been widespread introduction of turbine design certification and approval that certifies compliance with standards and requires a dynamic test that simulates the complete life loading on the blade (Garrad Hassan Canada, 2007). The certification body also performs a quality audit of the blade manufacturing facilities and performs strength testing of construction materials. This approach has effectively eliminated blade design as a root cause of failures (Garrad Hassan Canada, 2007).

The reported main causes of blade failure include:

- Human interference with the control system;
- A lightning strike; and,
- A manufacturing defect in the blade.

Turbine control systems are subjected to rigorous specification in the design standards for wind turbines (IEC 61400-1) and exhaustive analysis in the certification process. Turbines with industry certification must have a safety system completely independent of the control system. In the event of a failure of one system, the other is designed to control the rotor speed.

Lightning protection systems for wind turbines have developed significantly over the past decade and best practices have been incorporated into the industry standards to which all modern turbines must comply. This has led to a significant reduction in events where lightning causes structural damage. A review of available literature, conducted by the Chatham-Kent

Public Health Unit (2008), revealed only four documented turbine failure issues in Ontario due to lightning strikes that required the turbine to be shut down for repair.

The occurrence of structural manufacturing defects in rotor blades has also diminished significantly due to experience and improved quality control in the industry. Design practice has evolved to improve structural margins against any manufacturing deficiencies. Even in the rare event of a blade failure in modern turbines, it is much more likely that the damaged structure will remain attached to the turbine rather than separating (Garrad Hassan Canada, 2007). Reviews of available information did not find any recorded evidence of injury to the public as a result of turbine blade or structural failure (Garrad Hassan Canada, 2007; Chatham-Kent Public Health Unit, 2008).

Given that accidents or malfunctions of the turbines are considered to be infrequent events, and turbines will be located at least the minimum regulated setback distance from any residence, the event of a failure of the structure will likely not fall beyond the setback distance and would, therefore, not affect public health and safety.

Mitigation Measures

Modern wind turbines must meet strict international engineering standards. Standards include the ability to withstand the forces of a Level 2 tornado (i.e., wind speeds of approximately 55 m/s), and structures must be built to meet earthquake loads as per the Ontario Building Code. The structural integrity of the turbines is designed to withstand wind speeds of approximately 55 m/s. However, during high wind events (i.e., greater than 24 m/s) the turbines are designed to cease operation. Turbine braking is accomplished by aerodynamic (blade pitch) control and friction brakes. The wind turbines will be designed, installed, operated and maintained according to applicable industry standards/certifications.

Boralex/UDI and the Operation and Maintenance Contractor will aim to minimize accidents and malfunctions with proper training and education of staff operating the control system. In addition, the turbines will be equipped with lightning protection systems and located at least the minimum regulated setback distance from receptors.

Net Effects

As a result of the structural integrity and design features of the turbines, no adverse net effects from structural failure are anticipated during operation of the facility.

5.9.2 Ice Fall and Shed

Potential Effects

Another potential public health and safety issue could result from the accumulation of ice on the turbine blades under specific temperature and humidity conditions. This condition is not unique to wind turbines and has the potential to occur on any structure that is exposed to the elements. In Ontario, this condition is most likely to occur in the winter months in extreme weather events. However meteorological conditions for ice formation and build-up are considered to be relatively rare within the study area. Under these conditions the turbines may be subject to ice coating from freezing rain or interception of low clouds containing super-cooled rain.

There are two potential hazards associated with ice accumulation on wind turbines:

- The danger of falling ice that may accumulate on the turbine as a result of freeze-thaw of snow and ice; and,
- The throwing of ice from the moving turbine blades.

Falling ice from an immobile turbine does not differ from other tall structures like telecommunication towers, power lines, and antenna masts. The potential ground area affected by falling ice depends to a large extent on the blade position and the prevailing wind speed and direction. Garrad Hassan Canada (2007) estimated that only very high winds may cause ice fragments of any significant mass to be blown beyond 50 m of the base of a modern, stationary 2 MW turbine (80-100 m hub height). Operating staff and landowners are briefed on this situation; therefore the risk is considered minimal (Garrad Hassan Canada, 2007).

Wind turbines typically operate when the wind speed is within the range of 4 m/s to 25 m/s; when turbines are in operation they can accumulate ice on the rotor blades. Ice fragments which detach from the rotor blades can be thrown from the turbine; any fragments would land in the plane of the turbine rotor or downwind (Garrad Hassan Canada, 2007). Throwing distance varies depending upon the rotor azimuth, rotor speed, local radius, and wind speed. Also, the geometry and mass of the ice fragments would affect the flight trajectory.

Observations have shown that the ice fragments do not maintain their shape and immediately break into smaller fragments upon detaching from a blade. This will decrease drag and potentially allow the ice fragment to be thrown greater distances. For human injury to result from ice shed, several conditions would have to exist simultaneously:

- Sustained weather conditions conducive to icing;
- Ice dislodging from the turbine blade;
- Ice pieces large enough to remain intact through the air;
- Ice traveling in a particular direction past setback guidelines; and,
- A person in the path of the ice as it lands (Garrad Hassan Canada, 2007).

A risk assessment methodology was developed by Garrad Hassan Canada and Partners, in conjunction with the Finnish Meteorological Institute and Deutsches Windenergie-Institut, as part of a research Project on the implementation of Wind Energy in Cold Climates (WECO). Guidelines produced in the WECO Project were based on a combination of numerical modelling and observations. The WECO database of observed ice fragments determined that recorded ice fragments are typically thrown to distances less than 125 m from the base of the turbine (Seifert et al., 2003).

Garrad Hassan Canada developed an Ontario-specific risk assessment methodology for ice shed based on the findings of the WECO Project. Modelling was undertaken to determine the probability of an ice fragment landing within one square metre of ground area, as a function of distance from the turbine. The model result determined that the critical ice shed distance would be approximately 220 m from a turbine. At distances greater than 220 m, the probability of ice shed reaching ground level at a mass that would cause injury decreases rapidly. The critical distance can effectively be regarded as a “safe” distance, beyond which there is a negligible risk of injury from ice shed (Garrad Hassan Canada, 2007).

Example calculations were presented in the Garrad Hassan Canada (2007) report, using data representative of a typical wind farm Project in rural southern Ontario. These conditions would be considered representative of the Port Ryerse Wind Power Project. Risk to a fixed dwelling, vehicle travelling on a road, and individual person from being struck by an ice fragment thrown from an operating wind turbine were modelled, with the following results:

- Fixed dwelling: equivalent to 1 strike per 500,000 years;
- Vehicle travelling on a road: equivalent to 1 strike per 260,000 years; and,
- Individual person: equivalent to 1 strike in 137,500,000 years.

These predictions seem markedly low; however, it is due to the fact that icing events are limited to only a few days per year. For example, Vestas Canada, which maintains turbines across Canada, has experienced no incidents related to falling ice in Canada (Jacques Whitford, 2006).

Mitigation Measures

Unlike telecommunication towers, the turbines proposed for this Project will have a solid conical tower. This design reduces the potential for ice build-up on the tower since there is no lattice or crevices where ice can accumulate.

In terms of ice shed, several control mitigation strategies are available to turbine operators. For example, when the rotor becomes unbalanced due to a change in blade weighting (e.g. caused by ice buildup), the turbine brake is automatically applied to stop the blades from turning (i.e,. it shuts itself off). The blades would not restart their movement until the imbalance is removed (e.g. the majority of ice is removed). This design feature greatly reduces the potential ice shed from the turbines on the few days per year when icing is possible.

Net Effects

Considering the design features of the turbines which act to reduce or eliminate the potential for ice accumulation, and that the nearest receptors are located at minimum required setbacks from the turbines, no adverse net effects are expected due to ice fall and shed from turbines during operation of the Project. Consequently, no additional mitigation measures have been identified.

5.9.3 Extreme Weather Events

Potential Effects

Extreme events that could occur during operation of the Project include fire, flood, temperature extremes, heavy snow, rain, hail, ice storms, tornadoes, earthquakes, and lightning strikes.

The likelihood of a fire occurring during operation is low. If a fire were to happen, it would likely occur in the fields at the base of the turbine. Fire could damage the turbine tower paint but it is unlikely that a fire would damage the turbine components within the tower.

Since there are no major waterways near the Project Location, it is unlikely that a flood would occur. Temperature extremes, to the extent that they are outside the turbine's operating range, are not expected.

No adverse effect is anticipated to the operation of the turbines from heavy snow, except to prevent access to the turbines during an emergency.

In the case of an extreme hail event, the nacelle could suffer cosmetic damage. However, the operation of the turbine would not be effected. It is unlikely that the nacelle cover would suffer structural damage. An extreme hail event may damage the turbine's meteorological sensors.

Climatic fluctuations in temperature and/or humidity are unlikely to have a significant effect on the Project. A change in the annual average air temperature or relative humidity could (slightly) affect the energy production of the Project as higher density air (corresponding to lower temperatures and lower humidity) will result in higher production since the wind power density is a linear function of the air density.

Climatic variations in rainfall or snowfall are unlikely to affect the Project. Variations in freezing precipitation (but not extreme events) could change the overall energy production through inefficiencies caused by modification of the aerodynamic profile of the turbine blade. However, such events occur for such a limited time that it is very unlikely that there would be a significant impact on energy production.

A change in the wind climate is the likeliest cause for significant impact on the Project's energy production. This results from the very high sensitivity (the cube) of wind power density to the wind speed (i.e., small changes in wind speed can result in relatively large changes in kinetic energy available for conversion to electrical energy). It is not unusual for the average wind

speed to fluctuate from year to year by up to +/- 10%. This maximum would, typically, translate into Project energy fluctuations of +/- 20 to 25%.

Mitigation Measures

Project components have been designed to withstand effects of extreme weather events as follows:

- Rain – surficial drainage patterns will remain intact and continue to convey rain water;
- Hail –turbine blades, nacelle, and tower are constructed of materials able to withstand damage from the impact of hail;
- Ice storms/freezing rain – as noted above, the turbines are designed to automatically shut down when ice load on the blades exceeds a predetermined threshold;
- Tornadoes – the blades will stop moving at wind speeds greater than 25 m/s, and generally, the structural integrity of turbines is designed to withstand gusts of greater than 59 m/s;
- Earthquakes –structures will be designed to meet the earthquake loads as per the Ontario Building Code; and
- Lightning – turbines are equipped with sophisticated lightning protection; lightning strikes are safely absorbed by conductors and the current is conducted via a spark gap and cables into the ground surrounding the foundation.

The turbines will be designed, installed, operated and maintained according to applicable industry standards/certifications.

Net Effects

Considering the design features of the turbine, which act to reduce or eliminate the potential for damage from extreme weather events, no adverse net effects from extreme weather events are anticipated during operation of the facility.

5.9.4 Third Party Damage

Potential Effects

Turbines are typically located away from roads and are in largely open areas. Nevertheless, the possibility exists for accidental collision from off-road and maintenance vehicles. Although possible, it is highly unlikely that this equipment will significantly damage the towers given their structural integrity (e.g. the rolled steel in the towers is over an inch thick, supporting foundations, and surrounding gravel pad).

Mitigation Measures

Access to the towers will be restricted to avoid potential accidents to unqualified persons.

Net Effects

As a result of restricting access of unqualified persons to the turbines, no adverse net effects from third party damage to the turbines are anticipated during operation of the Project.

6.0 Environmental Effects Monitoring Plan

The environmental effects monitoring plan for the Project has been designed to monitor implementation of the proposed protection and mitigation measures and to verify compliance of the Project with O. Reg. 359/09.

Environmental monitoring, which started with the collection of primary background data, will continue with appropriate follow-up activities during the operation of the Project. Monitoring will provide data on key functions of natural environment and socio-economic features that may be affected during construction or operation of the Project, and on the effectiveness of mitigation measures implemented as part of the Project. The monitoring procedures noted herein are linked to the potential effects and protection and mitigation measures discussed throughout **Section 5.0**.

6.1 GOALS AND OBJECTIVES

The goals of the monitoring plan are to:

- Minimize environmental effects from the Project during the operation phase;
- Minimize conflicts in the communities affected by the Project according to legal terms and to Boralex/UDI policies;
- Avoid accidents and malfunctions;
- Minimize environmental effects on natural habitats, flora and fauna;
- Avoid levies or sanctions from relevant government agencies for negligent environmental performance;
- Comply with environmental quality standards set by law; and,
- Establish measures that enhance occupational safety.

6.2 GUIDING PRINCIPLES

The following guiding principles were considered in preparation of the monitoring plan:

- Focus upon environmental, health, and safety risk prevention;
- Conform to relevant standards, codes, and practices considered in the application of safe technologies;
- Perform all activities in a safe and effective manner, by trained personnel;
- Maintain all equipment in good operating condition for protection of worker health and safety, conservation of the environment, and protection of property;

- Implement all necessary precautions to control, remove, or otherwise correct any health and safety hazards; and,
- Meet all relevant county, provincial, and federal standards that collectively ensure sufficient technical levels of safety during operation of the Project.

Building upon the above methodology, goals and objectives, and guiding principles, the monitoring plan is composed of three components: environmental management systems; programs, plans, and procedures; and monitoring and contingency requirements. Each component is discussed below.

6.3 ENVIRONMENTAL MANAGEMENT SYSTEMS

As part of the environmental monitoring objectives, several programs, plans, and procedures will be developed by Boralex/UDI, the turbine manufacturer, and/or the operation and maintenance contractor. They will guide the operation of the Project to optimize its environmental performance. However, for the programs, plans, and procedures to be effective, appropriate management structures and contract documents must be firmly established.

6.3.1 Management Structures

Boralex/UDI and/or the O&M Contractor will take steps to ensure that they have appropriately skilled personnel to carry out the environmental responsibilities as defined in this document. All organizations associated with Project development and operational activities will develop responsive reporting systems that clearly assign responsibility and accountability. As appropriate, Boralex/UDI and/or the O&M Contractor will review these reporting documents.

6.3.2 Contract Documents

Boralex/UDI is committed to operating the Project in an environmentally responsible manner and in compliance with all applicable environmental laws, regulations, and guidelines. All of Boralex/UDI contractors and subcontractors will be accountable for actions that have an adverse effect on the environment. As such, any contract documents executed by Boralex/UDI and/or the O&M Contractor will incorporate appropriate provisions from documents prepared for the REA application.

Additionally, all contractors, subcontractors, and other associates of the Project will follow the guiding principles of the monitoring program. These organizations will also comply with all relevant municipal, provincial, and federal legislation.

6.3.3 Change Management

During the operation of the Project, changes to operational plans may be required to address unforeseen or unexpected conditions or situations. Boralex/UDI and/or the O&M Contractor will be responsible for ensuring environmental and safety issues are addressed for any such changes. Boralex/UDI will undertake any significant changes to the Project programs, procedures and plans throughout the operation of the Project with the goal of avoiding or minimizing environmental effects.

6.4 PROGRAMS, PLANS, AND PROCEDURES

As appropriate, Boralex/UDI, and/or the O&M Contractor will implement the programs, plans, and procedures discussed below.

6.4.1 Operation and Maintenance Program

The operation and maintenance program, including turbine maintenance, is described in **Section 4.0.**

6.4.2 Environmental Procedures

Boralex/UDI and/or the O&M Contractor will be responsible for implementing environmental procedures during the operation phase of the Project. Individual employee responsibilities will be assigned as necessary to support the full and effective implementation of the environmental procedures. As appropriate the environmental procedures will address the following issues to prevent environmental contamination and injury to personnel:

- *Environmental calendar:* to establish the specific dates and times for environmental inspections of turbine facilities, monitoring events, and emergency notifications;
- *Spills and releases:* to identify the specific procedures for the prevention, response, and notification of spills. In addition, establish the general procedures for spill clean-up, personnel training, and material handling and storage to prevent spills;
- *Hazardous waste management:* to outline the procedures for proper identification, storage, handling, transport, and disposal of hazardous waste. In addition, the procedures will outline specific requirements for personnel training, emergency response, product review and approval, and record keeping; and,
- *Non-hazardous waste management:* to establish alternative procedures for the management and disposal of used lubricants, used drums, and general waste.

These procedures will ensure internal and external risks are fully evaluated and the information communicated to personnel in advance of any accident or malfunction.

6.4.3 Occupational Health and Safety Procedures

Boralex/UDI and/or the O&M Contractor will ensure employee health and safety is maintained throughout their employment term and will also implement the following safety procedures and protocols as appropriate in an effort to ensure employee safety is addressed throughout operation and maintenance activities:

- Personal protective equipment (PPE), including non-slip footwear, eye protection, clothing, and hardhats, will be worn by operations and maintenance personnel when on duty;
- Elevated platforms, walkways, and ladders will be equipped with handrails, toe boards, and non-slip surfaces; and,
- Electrical equipment will be insulated and grounded in compliance with the appropriate electrical code.

Incidents in the work place have the potential to cause personal injury and property damage. As appropriate, the O&M Contractor will maintain a master Incident Report that documents illnesses and accidents. Incident reporting will follow the requirements of the *Occupational Health and Safety Act*.

6.4.4 Training Program

As appropriate, Boralex/UDI and/or the O&M Contractor will develop or have an existing operations training program to ensure personnel receive appropriate training in relation to operation and maintenance programs, environmental, health, and safety procedures, and the emergency response plan. Training may include, but not be limited to, the following issues:

Facility Safety

- Accident reporting;
- Chemical and hazardous materials handling;
- Fall and arrest protection;
- Eye, ear, 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; and,
- Scaffolds and ladders.

Emergency Preparedness

- Fire preparedness and response;
- Natural disasters (i.e., extreme weather events);
- Hazardous materials and spill response;
- Medical emergencies; and,
- Rescue procedures.

6.4.5 Emergency Response Plan

A description of the emergency response plan for the Project is described in **Section 8.0**.

6.4.6 Measurement of Performance

Once performance standards have been established and personnel have been trained (and are functional in procedural operations), the next step is to monitor the performance of the facility and individuals relative to the performance standards and programs.

Specific internal audits (e.g. management team and/or process team), and external audits against the plans, safety and environmental procedures, and other policies and procedures are all part of establishing performance standards necessary to minimize risks on a continuing basis.

As appropriate a formal audit program for the Project, with regard to loss control programs (i.e., health, safety, environment, and security) will be performed regularly.

6.5 MONITORING REQUIREMENTS AND CONTINGENCY PLANS

Building upon the environmental management measures recommended to minimize potentially adverse effects, while enhancing the positive effects associated with the operation of the facility, the following operations monitoring and contingency planning program has been developed. The monitoring program is designed to allow Boralex/UDI and/or the O&M Contractor to monitor and assess the effectiveness of the proposed management measures/mitigation measures and to verify compliance of the Project with O. Reg. 359/09.

Boralex/UDI and/or the O&M Contractor will be the primary organization responsible for the implementation of the operational monitoring and contingency planning measures. Implementation of the measures will be undertaken consistent with Boralex/UDI and/or the O&M Contractor standard environmental and engineering practices.

6.5.1 Terrestrial Habitats and Significant Natural Features

Operational activities that have the potential to affect terrestrial flora and fauna include equipment operation and accidental spills and/or leaks. Stringent monitoring of operational activities is necessary to ensure terrestrial flora and fauna are protected.

As appropriate, records of vehicle maintenance will be retained and made available for periodic review by the Boralex/UDI and/or the O&M Contractor. All vehicles involved in maintenance activities must be maintained in good operating condition; all vehicles identified through the monitoring program that fail to meet the minimum emission standards will be repaired immediately or replaced as soon as practicable.

Monitoring will be required following the unlikely event of contamination from an accidental spill or leak (method for monitoring may be developed in consultation with the Spills Action Centre of the MOE). Contaminated soils will be removed and replaced as appropriate.

6.5.2 Birds and Bats

A detailed Environmental Effects Monitoring Plan for birds and bats is provided in **Appendix C**. A post-construction monitoring program has been developed for birds and bats that is consistent with guidelines provided by regulatory agencies at the time of writing. The plan gives consideration to adaptive management and operational control options. Elements of the post-construction monitoring program include:

- Bird mortality monitoring at all wind turbines will be conducted twice-weekly (3-4 day intervals) at all turbines from May 1st - October 31st and raptor mortality surveys weekly from November 1st - November 30th for three years following start of operations.

- Bat mortality monitoring at all turbines will be conducted twice-weekly (3-4 day intervals) at all turbines from May 1st - October 31st for three years following start of operations.

- Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1st - October 31st, and repeated for each searcher. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species).

- Regular reporting that includes analysis and submission of results to the MOE and MNR.

If required, mitigation techniques may include (but not limited to) operational controls, such as periodic shut-down and/or blade feathering (if annual mortality levels exceed MNR thresholds). Results will be reviewed by Boralex/UDI, MNR and other relevant agencies to determine if and when additional monitoring and/or mitigation are required.

6.5.3 Significant Wildlife Habitat

A detailed Environmental Effects Monitoring Plan for significant wildlife habitats identified within the 120 m Zone of Investigation is provided in **Appendix C.**

Post-construction disturbance monitoring programs have been developed for landbird migratory stopver areas and Pignut Hickory and include the following:

- *Landbird migratory stopover areas*: migratory studies to be completed during the migratory season (March to May and August to October), annually for three years. Specifically, migratory surveys will consist of walking transects in feature LBMS01, as there are turbines proposed in the adjacent upland areas. Transects will be walked starting at sunrise, for approximately 4 hours after sunrise.
- *Pignut Hickory Habitat:* an overall health assessment will be completed for the Pignut Hickory tree identified during NHA/EIS site investigations within 120 m of an access road.

6.5.4 Surface Water Features and Aquatic Habitat

Operation activities that have the potential to affect aquatic habitat includes accidental spills and/or leaks. Proper storage of materials (e.g. maintenance fluids) at off-site storage containers will greatly reduce the potential for accidental spills and/or leaks. Appropriate remedial measures may be completed as necessary and additional follow-up monitoring conducted as appropriate in the event of an accidental spill and/or leak. The level of monitoring and reporting will be based on the severity of the spill/leak and may be discussed with the MOE (Spills Action Centre) and MNR. Environmental inspection following spring run-off the year after construction (first year of operation) may be considered to ensure surface drainage has been maintained.

6.5.5 Environmental Noise and Public Health and Safety

The Project will follow the guidelines put in place by the MOE regarding sound levels and minimum distances for wind projects in Ontario. The key consideration is the sound level. The requirements, supported by information from the Ontario Chief Medical Officer of Health, Health Canada, and the World Health Organization (WHO) Europe and upheld by Ontario courts, ensure a project must be sited at least 550m from non-participating receptors, provided the cumulative sound level at the receptor does not exceed thresholds established by the MOE. Samsung has guaranteed the maximum sound power level from the turbines. This level has been used in calculations to ensure the sound level at non-participating receptors meets the requirements of the Regulation.

The Environmental Protection Act (EPA) requires that noise emissions for any new project must not have adverse effects on the natural environment. The REA process is the mechanism through which the controls are administered under the EPA, and Boralex/UDI commits to comply with any conditions and requirements for the approval, as directed by the MOE. In the event of a malfunctioning turbine resulting in noise emissions that are above MOE

requirements, Boralex/UDI will contact the MOE to determine the best path forward for resolving the issue. The resolution of the issue could include shutting down or reducing the nameplate capacity of the non-compliant turbine(s) until the problem is resolved. Routine turbine maintenance and electronic monitoring will also help minimize the likelihood of malfunctioning turbines resulting in excessive noise emissions.

Turbines will be monitored electronically twenty-four hours a day, seven days a week, to allow operational changes to be noted and assessed quickly. Turbine shut down will occur automatically upon detection of extreme weather. Inspections of turbines will occur after extreme weather events.

6.5.6 Local Expenditures

As was the case during the construction phase, Boralex/UDI will continue to encourage the use and procurement of local goods and services where they are available in sufficient quantities and qualities and at competitive pricing.

6.5.7 Community Relations

A Complaint Response Protocol (**Section 8.3**) has been developed to address any community concerns during operation of the Project.

7.0 Summary of Environmental Effects Monitoring Plan

The potential adverse effects, performance objectives, mitigation strategies and the monitoring/contingency plan measures of the operational stage of the Project are summarized in **Table 7.1**.

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	Section Reference
Heritage and Archaeological Resources					
Protected Properties and Heritage Resources	• No operational and maintenance activities will occur on the properties containing the built heritage resources and cultural heritage landscapes; therefore no adverse effects on heritage resources are anticipated during operations.	• N/A	• N/A	• N/A	5.2.1
Archaeological Resources	• There are no areas that will be excavated during the operation phase that will not have been assessed by a Stage 2 Archaeology Assessment; therefore no potential effects are anticipated to archaeological resources.	• N/A	• N/A	• N/A	5.2.2
Natural Heritage Resources					
Wetlands	• As no wetlands were identified, there are no anticipated impacts.	• N/A	• N/A	• N/A	5.3.1
Areas of	• As no Areas of	• N/A	• N/A	• N/A	5.3.2

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	Section Reference
Natural and Scientific Interest	Natural and Scientific Interest were identified, there are no anticipated impacts.				
Woodlands	• Contamination through accidental spills. • Dust emissions during operation and maintenance. • Erosion and sedimentation during maintenance activities.	• No spills. • Minimize duration and magnitude of emissions. • No erosion or sediment transport.	• See 'Spills'. • See 'Dust and Odour Emissions'. • See **Section 3.3.3** of the Construction Plan Report for erosion and sedimentation controls.	• See 'Spills'. • See 'Dust and Odour Emissions'. • See **Section 3.3.3** of the Construction Plan Report.	5.3.3
Provincial Parks and Conservation Reserves	• As no Provincial Parks or Conservation Reserves were identified, there are no anticipated impacts.	• N/A	• N/A	• N/A	5.3.4
Other Designated Natural Areas	• As no Other Designated Natural Areas were identified, there are no anticipated impacts.	• N/A	• N/A	• N/A	5.3.5
Significant Wildlife and Wildlife Habitat	Landbird Migratory Stopver Area: • Loss of species diversity and abundance through	Landbird Migratory Stopver Area: • Continued use of the	Landbird Migratory Stopver Area: • Post construction monitoring for disturbance and	Disturbance Monitoring for Birds *Landbird Migratory Stopver Area* : • Post construction monitoring of landbird migratory stopver area ten weeks during the migration season (March-May and August to October), with 2 surveys	5.3.6/6.5.2

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	Section Reference
	habitat displacement or avoidance. Pignut Hickory Habitat: • Loss of species habitat through removal or vegetation change.	habitat by the species that currently inhabit the feature. Pignut Hickory Habitat: • Continued existence of Pignut Hickory tree and associated habitat.	mortality. Pignut Hickory Habitat: • Post construction monitoring for disturbance.	per week, with at least 1 day between surveys, annually for three years. • Submission of annual reports to MNR and contingency measures, if required, will be determined in consultation with MNR. Disturbance Monitoring for Vegetation *Pignut Hickory Habitat*: • Overall health assessment will be completed for Pignut Hickory tree identified during NHA/EIS site investigations within 120 m of an access road, , in June 2014. • Submission of report to MNR and contingency measures, if required, will be determined in consultation with MNR. Mortality Monitoring for Birds • Post-construction monitoring of bird carcass searches twice-weekly at all turbines, May 1-October 31, and raptor mortality surveys weekly, November 1-November 30 for three years. • Potential operational controls as specified by current provincial guidance (at the time of writing, threshold is 10 bats/ turbine/year). Mitigation may include operational controls, such as periodic shut-down on select turbines or blade feathering at specific times of the year. • Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1 and October 31st, and repeated for each searcher. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species). • Regular reporting that includes analysis and submission of results to the MOE and MNR.	

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	Section Reference
Generalized Significant Wildlife Habitat	• Disturbance to wildlife. • Direct mortality to birds and bats.	• Minimize disturbance to wildlife.	• See 'Significant Wildlife and Wildlife Habitat'. • See 'Local Traffic'. • See 'Environmental Noise'.	• See 'Significant Wildlife and Wildlife Habitat'. • See 'Local Traffic'. • See 'Environmental Noise'. • See 'Dust and Odour Emissions'. • See 'Accidental Spills'.	5.3.7/6.5.2
Significant Flora and Vegetation Communities	• Dust emissions during operation and maintenance.	• Minimize duration and magnitude of emissions. • Continued existence of Pignut Hickory (S3 species) tree and associated habitat.	• See 'Dust and Odour Emission	• See 'Dust and Odour Emissions'. • See 'Significant Wildlife and Wildlife Habitat'	5.3.8
Other Flora and Vegetation Communities	• Disturbance to flora from dust emissions.	• Minimize disturbance to other flora and vegetation communities.	• See 'Dust and Odour Emissions'.	• See 'Dust and Odour Emissions'.	5.3.9
Birds	• Direct mortality.	• Minimize mortality.	• Implementation of contingency measures discussed with MNR if thresholds are exceeded.	• Post-construction monitoring of bird carcass searches twice-weekly at all turbines, May 1-October 31, and raptor mortality surveys weekly, November 1-November 30 for three years. • Mitigation as specified by current provincial guidance (at the time of writing, thresholds are: 14 birds/ turbine/year, or 10 or more birds at any one turbine, or 33 or more birds at multiple turbines on any one visit, or 2 raptors at the Project. Mitigation may include additional scoped mortality and effects monitoring and operational controls, such as periodic shut-down on	5.3.7/6.5.2

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	Section Reference
				select turbines or blade feathering at specific times of the year, depending on the species affected. • Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1 and October 31st, and repeated for each searcher. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species). • Regular reporting that includes analysis and submission of results to the MOE and MNR.	
Bats	• Direct mortality	• Minimize mortality.	• Mortality thresholds	• Post-construction monitoring of mortality rates; carcass searches twice-weekly at all turbines, May 1-October 31 for three years. • Potential operational controls as specified by current provincial guidance (at the time of writing, threshold is 10 bats/ turbine/year). Mitigation may include operational controls, such as periodic shut-down on select turbines or blade feathering at specific times of the year. • Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1 and October 31st, and repeated for each searcher. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species). • Regular reporting that includes analysis and submission of results to the MOE and MNR.	5.3.7/6.5.2
Water Bodies and Aquatic Resources					
Groundwater	• Potential contamination from accidental spills.	• No spills.	• See ‘Accidental Spills’.	• See ‘Accidental Spills’.	5.4.1

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	Section Reference
Surface Water, Fish, and Fish Habitat	• Potential contamination from accidental spills. • Erosion, sedimentation, and surface water turbidity during maintenance activities.	• No spills. • No erosion, sediment transport or surface water turbidity.	• See ‘’Accidental Spills’. • Erosion and sedimentation controls would be the same measures described in **Section 3.4.2** of the Construction Plan Report.	• See ‘Accidental Spills’. • See **Section 3.4.2** of the Construction Plan Report.	5.4.2
Air Quality and Environmental Noise					
Air Quality	• Emissions from operation and maintenance activities, including equipment and vehicles.	• Minimize duration and magnitude of emissions.	• Operations staff will operate vehicles in a manner that reduces air emissions to the extent practical, including: o Using multi-passenger vehicles as possible; and o Avoid idling vehicles. • Equipment and vehicles will be maintained in a manner that reduces air emissions, including: o Using mufflers and emission control systems as available; o Using catalytic	• None required.	5.5.1

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	Section Reference
			converters as required; o Meet emissions requirements of the MOE and/or MTO; o As appropriate, records of vehicle maintenance will be retained and made available for periodic review by Boralex/UDI and/or the Operation and Maintenance Contractor; and o All vehicles identified through the monitoring program that fail to meet the minimum emission standards will be repaired immediately or replaced as soon as practicable.		
Dust & Odour Emissions	• Dust emissions from operation and maintenance vehicles.	• Minimize duration and magnitude of emissions.	• Maintaining equipment in good running condition and in compliance with	• Adherence to Complaint Response Protocol.	5.5.2

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	Section Reference
			regulatory requirements. • Dust suppression (e.g. water) of source areas as necessary. • Covering loads of friable materials during transport.		
Environmental Noise	• Noise emitted from a turbine. • Noise emitted from traffic and/or vehicles.	• Noise at all non-participating receptors to meet MOE Guidelines.	• Adherence to all noise setback requirements. • All engines associated with maintenance equipment will be equipped with mufflers and/or silencers in accordance with MOE and/or MTO guidelines and regulations. • Noise levels arising from maintenance equipment will also be compliant with sound levels established by the MOE. • Routine Project maintenance to ensure infrastructure is operating properly and efficiently.	• Noise monitoring (if required), will be conducted in accordance with the REA for the Project. • Turbine shutdown as appropriate in the event of a malfunctioning turbine or extreme weather event. • Turbine maintenance to ensure turbines are running properly and efficiently. • Adherence to Complaint Response Protocol.	5.5.3

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	Section Reference
			• To the greatest extent possible, operations activities that could create excessive noise will be restricted to regular business hours, when residents are less sensitive to noise, and adhere to any local noise by-laws.		
Land Use and Socio-Economic Resources					
Areas Protected Under Provincial Plans and Policies	• None.	• N/A	• N/A	• N/A	5.6.1
Existing Land Uses	• Temporary increase in noise and dust levels. • Minor increase in traffic.	• Minimize disturbance to existing land uses, including local businesses. •	• See 'Environmental Noise'. • See 'Dust and Odour Emissions'. • See 'Local Traffic'.	• See 'Environmental Noise'. • See 'Dust and Odour Emissions'. • See 'Local Traffic'.	5.6.2
Hazard Lands	• Erosion of slopes due to maintenance activities.	• No erosion or sediment transport.	• Erosion and sedimentation controls would be the same measures described in **Section 3.3.3** of the Construction Plan	• See **Section 3.3.3** of the Construction Plan Report.	5.6.3

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	Section Reference
			Report. • Implement sediment and erosion control plan.		
Recreation Areas	• Potential disruption to use of recreational areas caused by effects due to traffic, noise, and dust. •	• Minimize disturbance to recreation areas.	• See 'Environmental Noise'. • See 'Dust and Odour Emissions'. • See 'Local Traffic'.	• See 'Environmental Noise'. • See 'Dust and Odour Emissions'. • See 'Local Traffic'.	5.6.4
Agricultural Lands and Operations	• Inconvenience to operations from traffic and dust.	• Minimize disturbance to agricultural lands and operations.	• See 'Dust and Odour Emissions'	• Adherence to Complaint Response Protocol.	5.6.5
Mineral, Aggregate, and Petroleum Resources	• Potential for a fire at the Project facility. • Potential contamination to Project site as a result of oil spill.	• No fire or spills.	• Project infrastructure will be sited at a higher elevation and the distribution substation on a slightly elevated concrete foundation.	• See 'Accidental Spills'.	5.6.6
Game And Fishery Resources	• Disturbance to game species from noise.	• Minimize disturbance to game resources.	• Turbines will be placed in agricultural lands away from woodlands and within REA setback requirements.	• None required.	5.6.7
Local Traffic	• Negligible increase in traffic.	• Minimize disturbance to local traffic.	• There may be instances where excess loads (e.g. turbine components)	• Adherence to Complaint Response Protocol.	5.6.8

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	Section Reference
			will require special traffic planning, widening turning radiuses and road widths and the creation of new ingress/egress nodes. • Necessary permits will be obtained. • As appropriate, for public safety all non-conventional loads will have front and rear escort or "pilot" vehicles accompany the truck movement on public roads. May provide notification of non-conventional load movements.		
Local Economy	• Increase in direct, indirect and induced employment over the operations period. • Local economic benefits from land lease payments, municipal taxes, etc.	• Create positive effects on local economy.	• To the extent possible Boralex/UDI and/or the Operation and Maintenance Contractor will source required goods and services from qualified local suppliers.	• None required.	5.6.9
Viewscape	• Disruption to viewscape from siting of Project	• Minimize potential for visual	• Landscaping at the distribution substation property.	• Adherence to Complaint Response Protocol.	5.6.10

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	Section Reference
	infrastructure.	disturbance.			
Existing Infrastructure					
Provincial, municipal and other major infrastructure	• Low potential for damage to local roads. • Permits from the MTO may be required. • See 'Local Traffic'.	• Minimize disturbance to Provincial and other major infrastructure. • See 'Local Traffic'.	• Consultation with MTO regarding any necessary agreements related to wear on roads from transportation of Project materials in addition to obtaining the required permits for use of provincial highways. • Consultation with the County regarding excess loads with potential to damage County roads. • See "Local Traffic	• See 'Local Traffic'.	5.7.1
Navigable Waters	• None	• N/A	• N/A	• N/A	5.7.2
Radio communication, radar and seismoacoustic systems	• Potential to interfere with radio communication systems.	• Minimize interference with radio communication systems.	• Boralex/UDI will consult with relevant agencies and licensed providers to identify any likely effects to radio communication, radar and seismoacoustic systems. •Complaints of degraded quality	• Adherence to Complaint Response Protocol. • Boralex/UDI will review potential incidents related to interference of radio communication systems on a case by case basis.	5.7.3

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	Section Reference
			related to television and FM radio receivers within 15 km of the wind farm will be monitored and if need be mitigated post-construction by means agreed upon by Boralex/UDI and impacted party. • In the unlikely event that signal disruption is experienced, mitigation measures may include: o Switching to an alternate means of receiving the information.		
Aeronautical Systems	• Aeronautical obstruction.	• Minimize potential hazard to low flying aircraft.	• Turbine lighting must conform to Transport Canada standards. Turbine lighting will be selected with the minimal allowable flash duration, narrow beam, and will be synchronized. • Nav Canada will be responsible for updating all aeronautical charts with the turbine locations.	• Routine maintenance of the turbines and replacement of safety lighting in the event of malfunction.	5.7.4

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	Section Reference
Waste Management and Contaminated Lands					
Waste Generation	• Improper disposal of waste material may result in contamination to soil, groundwater, and/or surface water resources on and off the Project sites. • Litter may become a nuisance to nearby residences if not appropriately contained and allowed to blow off the site.	• Ensure proper disposal of waste.	• Contractors will be required to remove all waste materials from the turbine siting areas during maintenance activities. • All waste materials and recycling will be transported off-site by private waste material collection contractors licensed with a Certificate of Approval – Waste Management System. • Dumping or burying wastes within the Project sites will be prohibited. • Labelling and proper storage of liquid wastes (e.g. used oil, drained hydraulic fluid, and used solvents) in a secure area that will ensure containment of the material in the event of a spill. As per s.13 of the *Environmental Protection Act*, all	• See 'Accidental Spills'.	5.8.1

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	Section Reference
			spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of the prescribed regulatory levels will be reported to the MOE's Spills Action Centre. • Disposal of non-hazardous waste at a registered waste disposal site(s). • If waste is classified as waste other than solid non-hazardous, a Generator Registration Number is required from the MOE and the generator will have obligations regarding manifesting of waste. • Implementation of an on-going waste management program consisting of reduction, reuse, and recycling of materials. • See 'Accidental Spills'		

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	Section Reference
Accidental Spills	• Potential contamination from accidental spills.	• No spills.	• Labelling and proper storage of liquid wastes (e.g. used oil, drained hydraulic fluid, and used solvents) in a secure area that will ensure containment of the material in the event of a spill. • As per s.13 of the *Environmental Protection Act*, all spills that could potentially have an adverse environmental effect, are outside the normal course of events, or are in excess of the prescribed regulatory levels will be reported to the MOE's Spills Action Centre. • As appropriate, spill kits (e.g. containing absorbent cloths and disposal containers) will be provided on-site during maintenance activities. • Standard containment	• Monitoring will be required following the unlikely event of contamination from an accidental spill or leak (method for monitoring may be developed in consultation with the Spills Action Centre of the MOE). • Contaminated soils will be removed and replaced as appropriate.	5.8.2/ 6.5.1

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	Section Reference
			facilities and emergency response materials will be maintained on-site as required. • Refuelling, equipment maintenance, and other potentially contaminating activities will occur in designated areas. • Spills should be reported immediately to the MOE Spills Action Centre, as applicable.		
Public Health and Safety					
Structural failure	• Public Health and Safety.	• No structural failure of the turbines or ancillary equipment.	• Adherence to required setbacks. • Design, install, operate, and maintain turbines according to applicable industry standards/certifications. • Use of lightning protection systems. • Proper training and education of staff.	• Inspections of turbines will occur after extreme events and contingency measures such as turbine shutdown will be implemented in the event of structural damage. • Turbine maintenance to ensure turbines are running properly and efficiently.	5.9.1

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	Section Reference
Ice fall and shed	• Public Health and Safety.	• Limit potential for ice throw/shed to impact pedestrians.	• Adherence to required setbacks. • Design of turbine tower reduces ice accumulation. • Automatic turbine shutdown due to weight imbalances. • Signage in areas where potential icing exists.	• Inspections of turbines will occur after extreme events and contingency measures such as turbine shutdown will be implemented in the event of structural damage and/or icing to a turbine(s). • Turbine maintenance to ensure turbines are running properly and efficiently.	5.9.2
Extreme Weather Events	• Potential damage to project infrastructure from extreme weather events.	• No structural failure of the turbines or Project equipment.	• Project components have been designed to withstand the effects from extreme events. • Design, install, operate, and maintain turbines according to applicable industry standards/certifications. • Failsafe devices are capable of shutting down the turbine blades in the event of excessive wind conditions, imbalance, or malfunction of other turbine components.	• Turbine shutdown in the event of a malfunctioning turbine or extreme weather event. • Turbine maintenance to ensure turbines are running properly and efficiently. • See 'Structural Failure'.	5.9.3

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	Section Reference
Third Party Damage	• Possibility of accidental collision from off-road and maintenance vehicles.	• Restrict access of unqualified persons to the turbine.	• Access to the towers will be restricted to avoid potential accidents to unqualified persons.	• N/A	5.9.4

8.0 Emergency Response and Communications Plan

The following sets out a description of the actions to be taken during the operation of the Project to inform the public, Aboriginal communities, and County regarding activities occurring at the Project site (including emergencies), means by which stakeholders can contact the O&M Contractor and/or Boralex/UDI, and means by which correspondence sent to the O&M Contractor and/or Boralex/UDI will be recorded and addressed.

As appropriate, Boralex/UDI and/or the Contractor will review the Emergency Response and Communications Plan prior to and during each phase of the Project. Notification of any changes to the Emergency Response and Communications Plan will be provided to stakeholders.

8.1 COMMUNICATION PLAN FOR EMERGENCIES

Boralex/UDI and/or the O&M Contractor will finalize a detailed Emergency Response Plan for each Project phase in collaboration with local Emergency Services Departments.

The Emergency Response Plan will include a plan for the proper handling of material spills and associated procedures to be undertaken during a spill event. The plan will also specify containment and clean-up materials and their storage locations. The plan will include general procedures for personnel training. As appropriate, the plan may cover response actions to high winds, fire preparedness, evacuation procedures, and medical emergencies. Developing this plan with local emergency services personnel will allow Boralex/UDI to determine the extent of emergency response resources and response actions of those involved.

The plan will include key contact information for emergency service providers, a description of the chain of communications and how information will be disseminated between Boralex/UDI and/or the O&M Contractor and the relevant responders. The plan will also indicate how Boralex/UDI and/or the O&M Contractor will contact (via phone or in-person) Project stakeholders who may be directly impacted by an emergency so that the appropriate actions can be taken to protect stakeholders health and safety.

8.2 PROJECT UPDATES AND ACTIVITIES

Boralex/UDI and/or the O&M Contractor will continue contact with Project stakeholders (public, ministries, Aboriginal communities, and the County) during the operation of the Project for as long as this seems an effective two-way channel of communication, including providing Project updates on the Project website www.udi-canada.com. As a long-term presence in the County, Boralex/UDI will continue to develop contacts and to develop local relationships and channels of communication, which could benefit the local area.

8.3 COMMUNICATIONS RESPONSE PROTOCOL

The following has been developed for the operations phase to address any reasonable concern from the public and will be implemented by Boralex/UDI and/or the O&M Contractor.

A telephone number for contacting Boralex/UDI and/or the O&M Contractor along with the mailing/email address will be posted on the Project website www.udi-canada.com and provided directly to the County and the MOE prior to operation of the Project. This information will also be provided on-site near the substation.

The telephone number for reporting of inquiries or concerns will be equipped with a voice message system used to record the name, address, date of call and telephone number of the complainant along with details of the complaint. All messages will be recorded in a Communications Response Document. Boralex/UDI and/or the O&M Contractor will endeavour to respond to messages within 48 hours. All reasonable commercial efforts will be made to take appropriate action as a result of concerns as soon as practicable. The actions taken to remediate the cause of the issue and the proposed actions to be taken to prevent reoccurrences in the future will also be recorded within the Communications Response Document. If appropriate, the MOE Spills Action Centre will be contacted to notify them of the issue. Correspondence will be shared with other stakeholders, such as the MOE, as required and/or as deemed appropriate.

Ongoing stakeholder communication will allow Boralex/UDI and the O&M Contractor to receive and respond to community issues on an ongoing basis.

8.4 PUBLIC SAFETY PLAN

In addition to the Public Safety Plan that will be developed by the Construction Contractor for the protection of public safety during the construction and decommissioning phases, Boralex/UDI and/or the O&M Contractor will prepare and implement a Public Safety Plan for operation of the Project. As previously noted and as appropriate, Boralex/UDI and/or the O&M Contractor will develop or have an existing operations training program to ensure personnel receive appropriate training in relation to operation and maintenance programs, environmental, health and safety procedures, and the Emergency Response Plan. Proper training will ensure operational safety for Project personnel.

Operational safety to minimize potential risks to the public will include:

- Signage throughout the Project area;
- Site access restrictions (with the exception of maintenance and emergency personnel);
- Development of an Emergency Response Plan; and,
- Turbine design and adherence to construction standards.

Signage may include but will not be limited to signs associated with potential risks at the Project site such as the location of buried cables, high voltage equipment, and the presence of maintenance vehicles along the access roads.

Access restrictions will include “No Trespassing” signs on the turbine access roads and turbine tower site or within the switching station. Access roads throughout the Study Area will not have restricted access (e.g. gates), thus allowing emergency vehicles to access the Project site and all turbine locations in the event of an emergency.

As previously noted, during pre-operational mobilization Boralex/UDI and/or the O&M Contractor will finalize an Emergency Response Plan for the operational activities in collaboration with emergency service providers within the County of Norfolk. The development of and proper execution of the Emergency Response Plan will help ensure public safety is maintained throughout the operation of the facility.

Potential risk to public safety as a result of accidents/malfunctions or extreme events such as fire, lightning, and tornadoes were addressed in **Section 5.9.3**. The turbines have been designed with various protective measures to address extreme events and accidents/malfunctions to reduce the potential risk to public safety. The turbines will adhere to marking and lighting requirements of the Aerodrome Safety Branch of Transport Canada. In addition, construction of the turbines is completed according to stringent national and international codes.

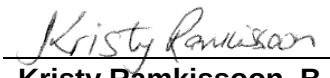
9.0 Conclusion and Signatures

This Draft Design and Operations Report for the Port Ryerse Wind Project has been prepared in accordance with O. Reg. 359/09 and the MOE's *Technical Guide to Renewable Energy Approvals* (MOE, March 2012).

This report has been prepared by Stantec for the sole benefit of Boralex/UDI, and may not be used by any third party without the express written consent of Boralex/UDI. The data presented in this report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

Respectfully submitted,

STANTEC CONSULTING LTD.



Kristy Ramkissoon, B.Sc
Environmental Planner

Fiona Christiansen, M.Sc
Senior Project Manager

BORALEX INC.

Adam Rosso
Manager of Project Development
772 Sherbrooke Ouest, Suite 200
Montréal (Québec) H3A 1G1
416-389-8942
Project e-mail:portryersewind@boralex.com

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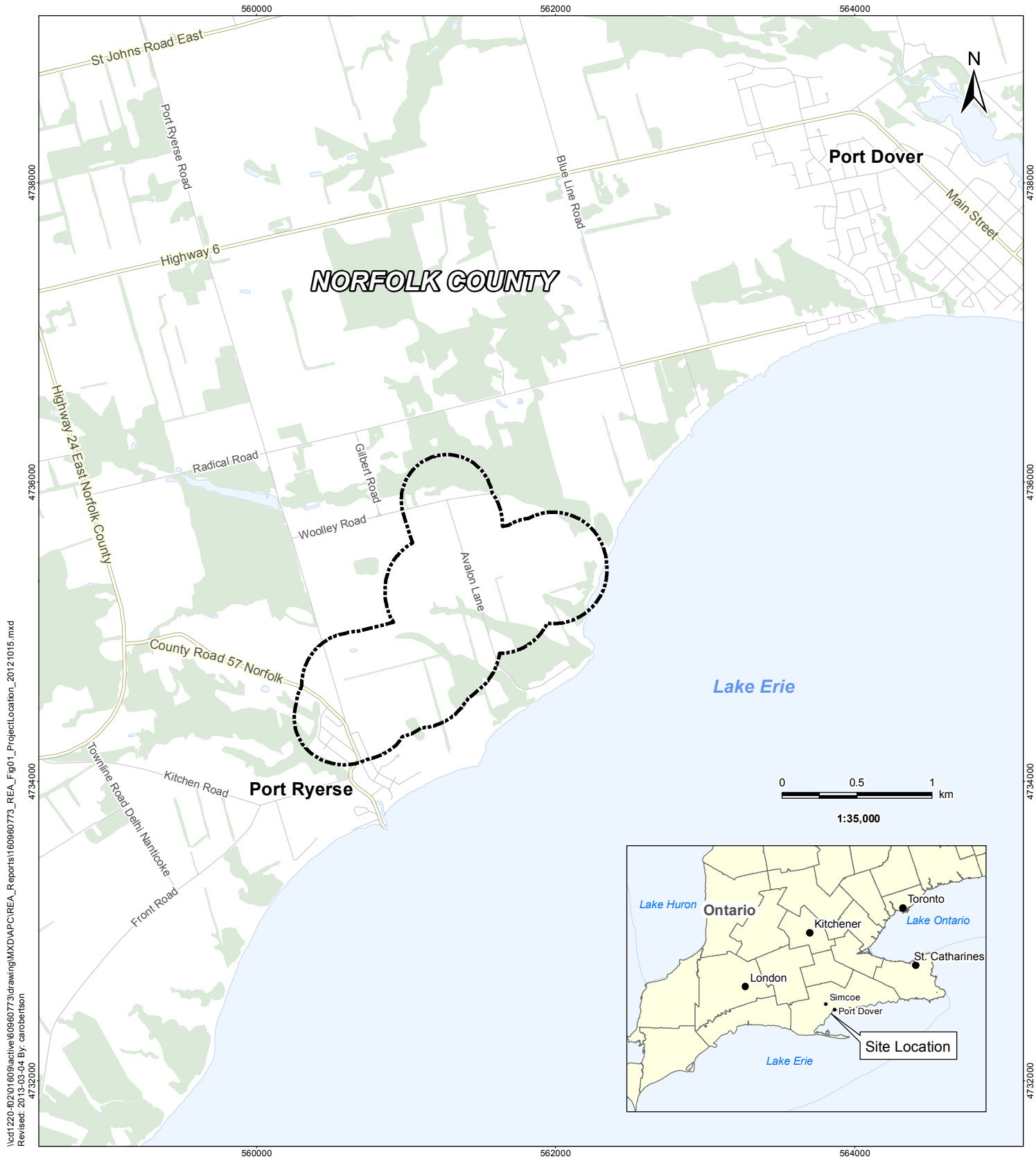
Appendix A

Figures



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Revised: 2013-03-04 By: carobertson

March 2013
160960773

Stantec

Legend

- Study Area
- Major Road
- Local Road
- Wooded Area
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.

Client/Project
Boralex/ UDI
Port Ryerse Wind Farm
Port Ryerse, Ontario

Figure No.
1

Title
Project Location

560000 561000 562000

4736000

4735000

Radical Road
Gilbert Road
Woolley Road
Port Ryerse Road
Avalon Lane
County Road 57 Norfolk
Cookson Street
Ralph Street North
Young Creek Road
King Street North
Hillcrest Drive
Ralph Street South
Port Ryerse

T1
T2
T3
T4

N

Lake Erie

0 100 200 m
1:8,500

Legend

- Participating Properties Boundary
- Zone of Investigation (120 m)
- Zone of Investigation (300 m)

Proposed Project Components

- Proposed Turbine
- MET Tower
- Bladeswept Area / Rotor Diameter (113 m)
- Proposed Access Road
- Turning Radius
- Proposed Collector Line
- Component Laydown Area and Crane Pad
- Substation/ Distribution
- Proposed Permanent Site Parking Lot

Existing Features

- Water Well Record (MOE)
- Contour Line (5m Intervals)
- Major Road
- Local Road
- Hazard Lands
- Watercourse
- Waterbody
- Wooded Area

Noise Receptors

- Participating
- Non-Participating, Occupied
- Non-Participating, Vacant

Petroleum Wells

- Abandoned Well
- Active Well
- Status Unknown

Setbacks

- Property Line Setback (99.5m)
- Road Setback (65.5m)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
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March 2013
160960773

Client/Project
Boralex/ UDI
Port Ryerse Wind Farm
Port Ryerse, Ontario

Figure No.
2

Title
Socio-Economic Features

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Revised: 2013-03-06 By: dharvey

561000 562000

4736000 4735000 4734000

N

WO03

98 m

57 m

Gilbert Road

Woolley Road

Port Ryerse Road

Avalon Lane

T4

T2

16 m

9 m

T3

SCS01

WO02

WO02

LBMS01

T1

County Road 57/ Norfolk

Cookson Street

Ryerson Street

Ralph Street North

Port Ryerse

Youngs Creek Road

King Street North

Hilltop Drive

Ralph Shea Street South

King Street North

Pond Road

Lake Erie

0 100 200 m

1:8,000

Legend

- Participating Properties Boundary
- Zone of Investigation (120 m)
- Zone of Investigation (300 m)
- Proposed Turbine
- MET Tower
- Bladeswept Area / Rotor Diameter (113 m)
- Proposed Access Road
- Turning Radius
- Proposed Collector Line
- Component Laydown Area and Crane Pad
- Substation/ Distribution
- Proposed Permanent Site Parking Lot
- Major Road
- Local Road
- Watercourse
- Waterbody
- Significant Woodland

Natural Features

- Pignut Hickory Candidate
- Significant Landbird Migratory Stopover Area (LBMS)
- Significant Pignut Hickory Habitat (SCS)
- Distances Between Features and Project Components On This Map Are Described In Detail In Table 3.9 In The NHA/ EIS
- REA Water Body

Setbacks

- REA Water Body Setback (30m)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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3. Orthographic Imagery Source: © First Base Solutions, 2011.
   Imagery taken in Spring 2010.

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March 2013
160960773

Client/Project
Boralex/ UDI
Port Ryerse Wind Farm
Port Ryerse, Ontario

Figure No.
3

Title
Significant Natural Features & Water Bodies

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Revised: 2013-03-12 By: dharvey

Appendix B

Property Line Setback Assessment Report

PORT RYERSE
WIND POWER PROJECT
PROPERTY LINE SETBACK
ASSESSMENT REPORT

File No. 160960773
March 2013

Prepared for:

Boralex Inc.
772 Sherbrooke St. West
Suite 200
Montreal QC H3A 1G1

In Association with:

UDI Renewables Corporation
492 South Coast Drive
Nanticoke, ON N0A 1L0

Prepared by:

Stantec Consulting Ltd.
Suite 1 - 70 Southgate Drive
Guelph ON N1G 4P5

Table of Contents

1.0 INTRODUCTION 1.1
1.1 PROJECT OVERVIEW 1.1
1.2 REPORT REQUIREMENTS 1.2
1.3 SETBACK REQUIREMENTS.....1.3

2.0 PROPERTY LINE SETBACK ANALYSIS 2.1
2.1 OVERVIEW OF ADJACENT PROPERTY.....2.1
2.2 BUSINESSES.....2.1
2.3 INFRASTRUCTURE 2.1
2.4 HEDGEROWS.....2.1
2.5 LAND USE ACTIVITIES – AGRICULTURAL.....2.2

3.0 CLOSURE 3.1

List of Tables

Table 1.1: Property Line Setback Assessment Report Requirements: O. Reg. 359/09.....1.2

List of Appendices

Appendix A Figures
Appendix B Individual Property Line Setback Assessment

1.0 Introduction

1.1 PROJECT OVERVIEW

Boralex Inc. (Boralex), in association with UDI Renewables Corporation (UDI), is proposing to develop the Port Ryerse Wind Power Project (the Project) east of the hamlet Port Ryerse in Norfolk County , Ontario, in response to the Government of Ontario's initiative to promote the development of renewable electricity in the province. The Project was awarded a Feed-In-Tariff (FIT) contract with the Ontario Power Authority (OPA) on February 25, 2011. Further information on the Project can be found on the Project-specific website at http://www.udi-canada.com. Boralex Inc. is a power producer whose core business is dedicated to the development and operation of renewable energy facilities. Further information on Boralex can be found at http://www.Boralex.com/en/.

The Renewable Energy Approval (REA) process for the Port Ryerse Project was originally initiated by UDI, with the assistance of M.K. Ince and Associates Ltd. Boralex is considering acquisition of the Project from UDI and retained Stantec Consulting Ltd. (Stantec) to complete the REA Application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the Act of the Environmental Protection Act (O. Reg. 359/09). According to subsection 6(3) of O. Reg. 359/09, the Project is classified as a Class 4 Wind Facility and will follow the requirements identified in O. Reg. 359/09 for such a facility.

The Project Study Area is generally bounded by i) Woolley and Gilbert Roads to the north; ii) Port Ryerse Road to the west; iii) Hay Creek to the east and iv) Avalon Lane to the south (**Appendix A**). The proposed Project Location includes all parts of the land in, on, or over which the Project is proposed. The Project Location, including all Project infrastructure, is sited on privately-owned lands, where landowners have entered into a lease agreement with Boralex/UDI. Permissions to access these properties have been obtained through verbal discussions with landowners, as a requirement of their signed agreements with Boralex /UDI.

Three wind turbine models were initially assessed as part of the REA process, the Siemens SWT 3.0 113, ENERCON E-92 2.35 MW and ENERCON E-82 E2 2.3MW; however one turbine model has been selected as the preferred alternative; the Siemens SWT 3.0 113.

The Project will include four Siemens SWT 3.0 113 wind turbine generators. The 3.0 MW turbines will be customized to a nameplate capacity of 2.5 MW for this Project. The total maximum installed nameplate capacity of all four turbines will not exceed 10 MW. Other basic components include step-up transformers located adjacent to the base of each turbine (step up voltage from approximately 0.69 kV to 27.6 kV), a 27.6 kV underground collector system, fibre optic data lines, a distribution substation, a permanent parking lot (if required), a meteorological tower and turbine access roads.

Temporary components during construction include laydown areas at the turbine locations and crane pads. No operations and maintenance building or transmission line is anticipated to be required for the Project. No Project components are located within municipal road Rights of Way (ROWs).

The 27.6 kV underground collector lines will transport the electricity generated from each turbine to the distribution substation located on private property east of Port Ryerse Road. Directional bore techniques will be used where the underground collector lines cross valleylands and watercourses. At the substation, a dip-pole connection will be made directly into the local distribution system.

1.2 REPORT REQUIREMENTS

Under O. Reg. 359/09, Class 3, 4, and 5 wind projects are subject to property line setback requirements to located turbines a distance equal to the hub height from a non-participating property line. A turbine may be sited closer to the property line (to a limit of the length of the turbine blade plus ten metres from the property line) if the applicant submits a Property Line Setback Assessment Report to fulfil the requirement of subsection 53 (3) of O. Reg. 359/09.

The purpose of the Property Line Setback Assessment Report is to provide a review of potential adverse impacts and preventative measures for wind turbines located within the prescribed setback from non-participating parcels of land (i.e. where there is no agreement with the land owner specifically permitting a closer setback).

This Property Line Setback Assessment Report is one component of the REA application for the Project, and has been prepared in accordance with O. Reg. 359/09, and the Ministry of the Environment's (MOE's) "Technical Guide to Renewable Energy Approvals" (MOE, March 2012).

Table 1.1: Property Line Setback Assessment Report Requirements: O. Reg. 359/09

Requirements	Completed	Section Reference
As part of an application for the issues of a renewable energy approval or a certificate of approval in respect of the construction, installation or expansion of the wind turbine, the person who is constructing, installing or expanding the wind turbine submits a written assessment,		
1. Demonstrating that the proposed location of the wind turbine will not result in adverse impacts on nearby business, infrastructure, properties or land use activities, and	✓	Section 2.0, Appendix B
2. Describing any preventative measures that are required to be implemented to address the possibility of any adverse impacts.	✓	Section 2.0, Appendix B

1.3 SETBACK REQUIREMENTS

All of the proposed turbine sites meet the minimum setback requirement of at least 550 metres from the nearest non-participating noise receptor. Of the four turbines being assessed for the Project, Turbines 1 and 2 are located closer to a non-participating property line than the hub height of the turbine (i.e., 99.5 m). In addition, both turbines are located further than the length of the turbine blade plus ten metres (i.e., 65 m) from a property line. Mapping of each turbine location within the setback is provided in **Appendix A**.

In accordance with Section 53 of O. Reg 359/09, this report has been prepared to:

- Demonstrate that the proposed location of the wind turbine will not result in adverse impacts on nearby business, infrastructure, properties or land use activities; and
- Describe any preventative measures that are required to be implemented to address the possibility of any adverse impacts.

2.0 Property Line Setback Analysis

This section summarizes the features over which Project turbine locations overlap the 99.5 m setback, potential adverse impacts on those features, and preventative measures to address potential adverse impacts. Mapping of each potential turbine location analyzed is provided in **Appendix A**. The detailed analysis for each turbine, including the distance of each potential turbine site from a property boundary, and the distance of setback overlap, is provided in **Appendix B**.

2.1 OVERVIEW OF ADJACENT PROPERTY

Turbine 1 is 67.6 m from an adjacent property line. Turbine 2 is 65.5 m from an adjacent property line. Lands within the overlap areas are zoned as agricultural.

2.2 BUSINESSES

The portion of the property within the setback overlaps for Turbines 1 and 2 is agricultural. As the overlap for both turbines is within agricultural lands, no businesses are present, and the turbines will not impact business operations in the overlap. No preventative measures are necessary.

2.3 INFRASTRUCTURE

No infrastructure, such as agricultural buildings, roads, railways or electrical transmission lines is present in the overlap areas for Turbines 1 and 2. As no infrastructure is present, no adverse impacts will occur and no preventative measures are necessary.

2.4 HEDGEROWS

Turbine 1 setback overlaps with a hedgerow.

Potential Adverse Impacts

Adverse impacts to hedgerows, including vegetation damage and disturbance to related wildlife may occur in the unlikely event of a turbine collapse.

Preventative Measures

The turbines would be constructed and designed by professional engineers, undergo regular maintenance and monitoring by operational staff, and contain automatic shutdown mechanisms in instances such as extreme weather. All of these measures are standard best practices detailed in the REA documents. Additional mitigation measures for vegetation, including damage and disturbance to related wildlife habitat, are outlined in the REA documents. Given the above measures, no additional preventative measures are required for the changes in setback.

2.5 LAND USE ACTIVITIES – AGRICULTURAL

Turbines 1 and 2 setback overlaps with agricultural land.

Potential Adverse Impacts

Adverse impacts to agricultural land, including crop damage and soil compaction, may occur in the unlikely event of turbine collapse.

Preventative Measures

The turbines will be constructed and designed by professional engineers, undergo regular maintenance and monitoring by operational staff, and contain shutdown mechanisms in instances such as extreme weather or malfunction.

In the event that turbine collapse does occur, the Project's Emergency Response Plan will be implemented and landowners will be advised immediately of any damages.

In the unlikely event of damage to agricultural land due to turbine collapse, landowners would be compensated by Boralex/UDI for any crop damage. Other mitigation measures are outlined in the REA documents to mitigate soil compaction. Given the above measures, no additional preventative measures are required for the changes in setback.

3.0 Closure

This Property Line Setback Assessment Report for the Port Ryerse Wind Power Project has been prepared by Stantec for Boralex/UDI in accordance with Ontario Regulation 359/09.

This report has been prepared by Stantec for the sole benefit of Boralex/UDI, and may not be used by any third party without the express written consent of Boralex/UDI. The data presented in this report are in accordance with Stantec's understanding of the Project as it was presented at the time of reporting.

STANTEC CONSULTING LTD.

Kristy Ramkissoon, B.Sc
Environmental Planner

Fiona Christiansen, M.Sc
Senior Project Manager

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Appendix A

Figures

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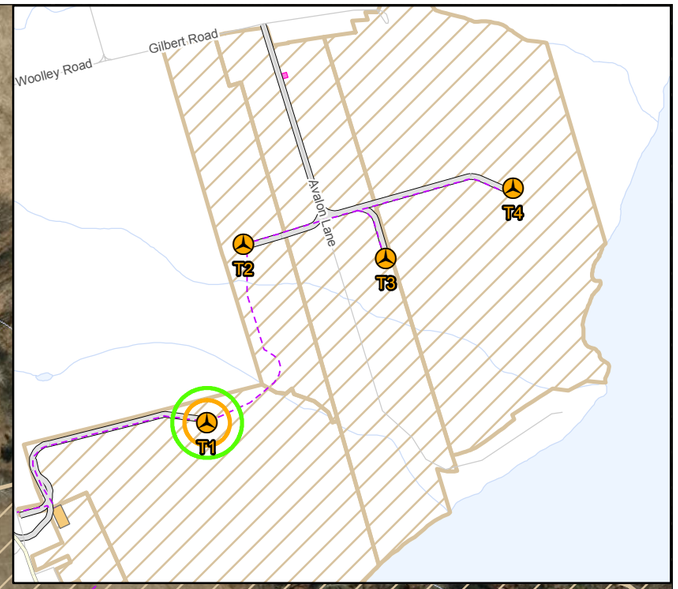
N



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Revised: 2013-03-04 By: carobertson

Legend

- Zone of Investigation (120 m)

Proposed Project Components

- Proposed Turbine
- Proposed Access Road
- Turning Radius
- Proposed Collector Line
- Substation/ Distribution
- Proposed Permanent Site Parking Lot

Existing Features

- Major Road
- Local Road
- Participating Properties Boundary
- Watercourse
- Waterbody

Setbacks

- Turbine Blade Length Plus 10m (65m)
- Hub Height (99.5m)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
3. Orthographic Imagery Source: © First Base Solutions, 2011.
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March 2013
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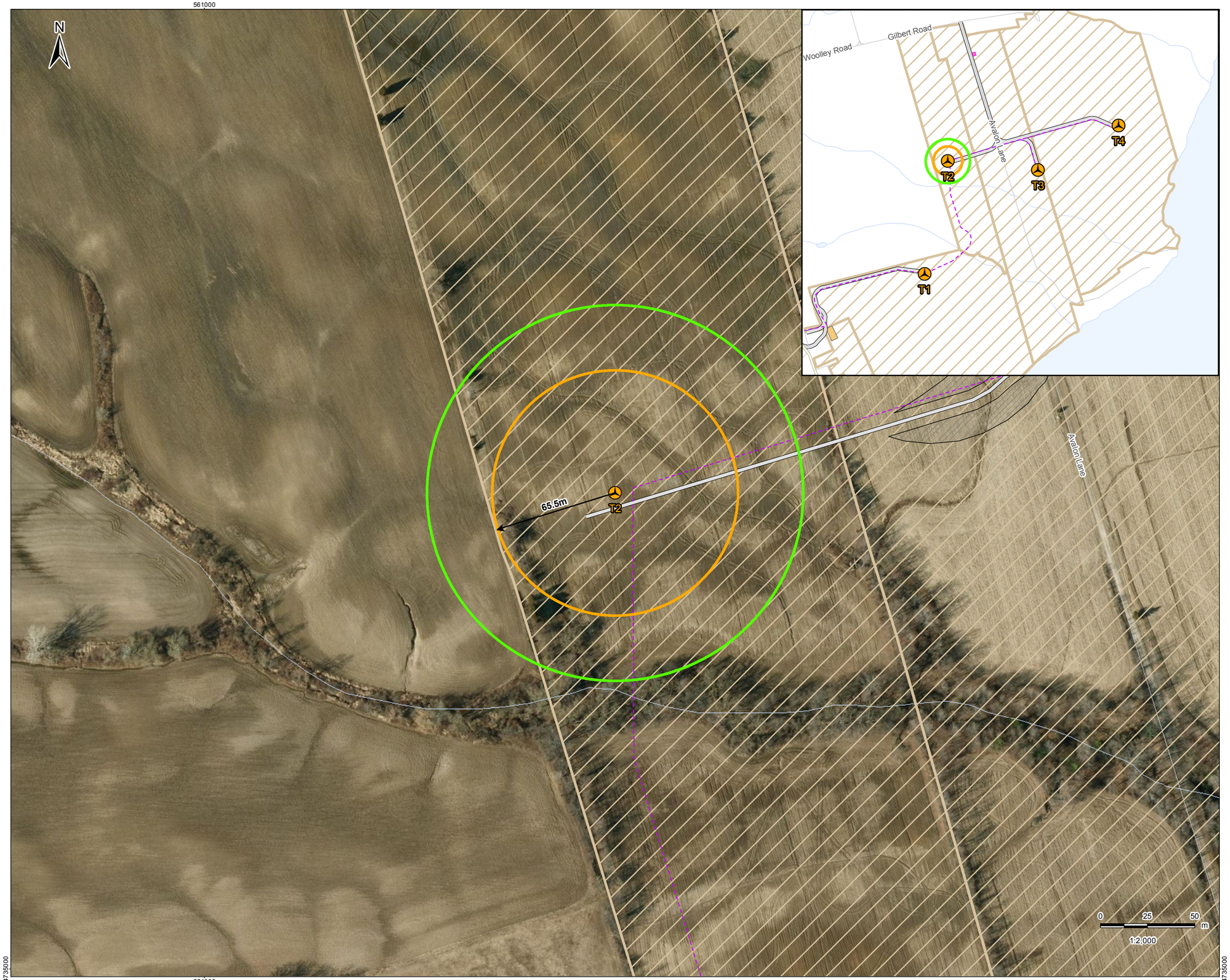
Client/Project
Boralex/ UDI
Port Ryerse Wind Farm
Port Ryerse, Ontario

Figure No.
T1

Title
Siemens SWT-3.0-113 Property Line Setback Assessment



Legend

- Zone of Investigation (120 m)

Proposed Project Components

- Proposed Turbine
- Proposed Access Road
- Turning Radius
- Proposed Collector Line
- Substation/ Distribution
- Proposed Permanent Site Parking Lot

Existing Features

- Major Road
- Local Road
- Participating Properties Boundary
- Watercourse
- Waterbody

Setbacks

- Turbine Blade Length Plus 10m (65m)
- Hub Height (99.5m)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
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Client/Project
Boralex/ UDI
Port Ryerse Wind Farm
Port Ryerse, Ontario

Figure No.
T2

Title
Siemens SWT-3.0-113 Property Line Setback Assessment

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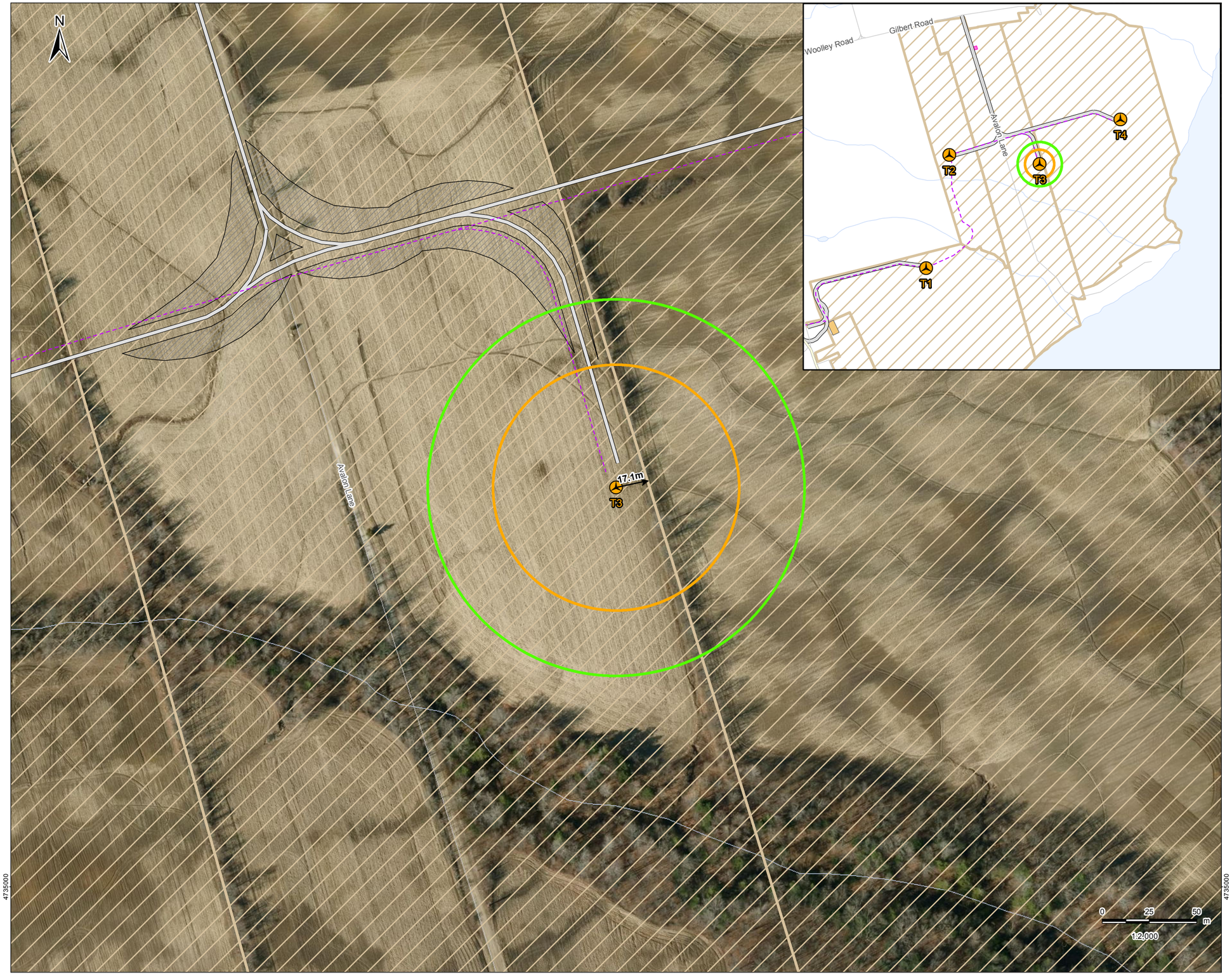
Revised: 2013-03-04 By: carobertson



Legend

- Zone of Investigation (120 m)

Proposed Project Components

- Proposed Turbine
- Proposed Access Road
- Turning Radius
- Proposed Collector Line
- Substation/ Distribution
- Proposed Permanent Site Parking Lot

Existing Features

- Major Road
- Local Road
- Participating Properties Boundary
- Watercourse
- Waterbody

Setbacks

- Turbine Blade Length Plus 10m (65m)
- Hub Height (99.5m)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
3. Orthographic Imagery Source: © First Base Solutions, 2011.
   Imagery taken in Spring 2010.

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March 2013
160960773

Client/Project
Boralex/ UDI
Port Ryerse Wind Farm
Port Ryerse, Ontario

Figure No.
T3

Title
Siemens SWT-3.0-113 Property Line Setback Assessment

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Revised: 2013-03-04 By: carobertson

Appendix B

Individual Property Line Setback Assessment

Appendix B: Property Line Assessment Summary

Turbine ID	Distance to Property Line (m)	Distance of Overlap (m)	Features Within Overlap	Potential Adverse Impacts	Preventative Measures
Turbine 1	67.6	31.9	Infrastructure: ☐ Land Use and Businesses ☒ Hedgerows: ☒ Woodlots : ☐ Watercourses: ☐ Building/Structure : ☐	Adverse impacts to agricultural land, including crop damage and soil compaction, may occur in the unlikely event of turbine collapse. Adverse impacts to hedgerows, including vegetation damage and disturbance to related wildlife habitat, may occur in the unlikely event of turbine collapse.	The turbine will be constructed and designed by professional engineers, undergo regular maintenance and monitoring by operational staff, and contain shutdown mechanisms in instances such as extreme weather or malfunction. In the event that turbine collapse does occur, the Project's Emergency Response Plan will be implemented and landowners will be advised immediately of any damages. In the unlikely event of damage to agricultural land due to turbine collapse, landowners would be compensated by Boralex/UDI for any crop damage. Other mitigation measures are outlined in the REA documents to mitigate soil compaction and vegetation loss. Mitigation measures for vegetation, including damage and disturbance to related wildlife habitat, are outlined in the REA documents.
Turbine 2	65.5	34	Infrastructure: ☐ Land Use and Businesses ☒ Hedgerows: ☐ Woodlots: ☐ Watercourses: ☐ Building/Structure : ☐	Adverse impacts to agricultural land, including crop damage and soil compaction, may occur in the unlikely event of turbine collapse.	The turbine will be constructed and designed by professional engineers, undergo regular maintenance and monitoring by operational staff, and contain shutdown mechanisms in instances such as extreme weather or malfunction. In the event that turbine collapse does occur, the Project's Emergency Response Plan will be implemented and landowners will be advised immediately of any damages. In the unlikely event of damage to agricultural land due to turbine collapse, landowners would be compensated by Boralex/UDI for any crop damage. Other mitigation measures are outlined in the REA documents to mitigate soil compaction and vegetation loss.

Appendix C

Environmental Effects Monitoring Plan

Ministry of
Natural Resources
Renewable Energy Operations Team
300 Water St.
Peterborough, ON
K9J 8M5

Ministère des
Richesses naturelles

Ontario

January 21, 2013

Mr Adam Rosso
Boralex Inc.
772 Sherbrook St. West, Suite 200
Montreal, Quebec
H3A 1G1

RE: Natural Heritage Section of the EEMP for Port Ryerse Wind Power Project

Dear Mr. Adam Rosso:

MNR has reviewed the Natural Heritage section of the Environmental Effects Monitoring Plan (EEMP) for the Port Ryerse Wind Power Project located in Norfolk County, submitted January 3, 2013. The final document is titled Port Ryerse Wind Power Project Environmental Effects Monitoring Plan for Wildlife and dated January 2013.

This letter confirms that the EEMP was prepared in respect of birds and bats in accordance with the Ministry of Natural Resources:

- *Birds and Bird Habitats: Guidelines for Wind Power Projects(2011)*
- *Bats and Bat Habitats: Guidelines for Wind Power Projects (2011)*

Post-construction monitoring for the Port Ryerse Wind Power Project will include the following:

i. Avoidance/Disturbance Monitoring for Landbird Migratory Stopover Habitat (LBMS01)

If, based on results of pre-construction monitoring, wildlife habitats are found to be significant the following post-construction monitoring will be implemented:

i. Bald Eagle Winter Perching Habitat (SCS03)
ii. Pignut Hickory Habitat (SCS01)

Additional pre-construction monitoring to provide comprehensive baseline data is required for:

i. Landbird Migratory Stopover Habitat (LBMS01)

MNR expects the information contained in the natural heritage section of the EEMP to be considered in MOE'S Renewable Energy Approval decision, and if approved, be implemented by the applicant.

If you wish to discuss, please contact Jim Beal at jim.beal@ontario.ca or 705-755-3203.

Sincerely,

Sharon Rew
A/Southern Region Planning Manager
Southern Region MNR

cc. Mitch Wilson, District Manager, Aylmer District, MNR
Jim Beal, Renewable Energy Operations Team, Coordinator, MNR
Narren Santos, Environmental Approvals Access & Service Integration Branch, MOE
Zeljko Romic, Environmental Approvals Access & Service Integration Branch, MOE
Katherine St James, Stantec

PORT RYERSE WIND POWER PROJECT

ENVIRONMENTAL EFFECTS MONITORING PLAN FOR WILDLIFE

File No.: 160960773
January 2013

Prepared for:

Boralex Inc.
772 Sherbrooke St. West
Montreal QC H3A 1G1

In Association with:

UDI Renewables Corporation
492 South Coast Drive
Nanticoke ON N0A 1L0

Prepared by:

Stantec Consulting Ltd.
Suite 1 - 70 Southgate Drive
Guelph ON N1G 4P5

Table of Contents

1.0 INTRODUCTION 1.1
1.1 PROJECT OVERVIEW 1.1
1.2 REPORT REQUIREMENTS 1.2

2.0 PRE-CONSTRUCTION HABITAT USE SURVEYS 2.1
2.1 PURPOSE AND TIMING 2.1
2.2 METHODS 2.1

3.0 POST-CONSTRUCTION MONITORING PROGRAM 3.1
3.1 PURPOSE AND TIMING 3.1
3.2 PRIMARY DATA COLLECTION 3.2
3.2.1 Bird Mortality Monitoring 3.6
3.2.2 Bat Mortality Monitoring 3.7
3.3 REPORTING AND REVIEW OF RESULTS 3.8

4.0 ADAPTIVE MANAGEMENT PROGRAM 4.1
4.1 MORTALITY MONITORING 4.1
4.1.1 Birds 4.1
4.1.1.1 Contingency Plan for Mass Mortality of Birds 4.2
4.1.2 Bats 4.3
4.1.2.1 Contingency Plan for Continued Significant Bat Mortality 4.4

5.0 BEST MANAGEMENT PRACTICES 5.1
5.1 DATA MANAGEMENT 5.1
5.2 BAT TISSUE SAMPLES 5.1

6.0 CLOSURE 6.1

7.0 REFERENCES 7.1

List of Tables

Table 1: Ground Cover Visibility Classes (MNR, 2011a) 3.3

Table of Contents

List of Appendices

Appendix A Tables

Table 1.1: Summary of Potential Negative Effects, Mitigation Measures and Monitoring for the Port Ryerse Wind Power Project – Construction and Operation

Table 1.2: Summary of Environmental Effects Monitoring Plan for Operation of the Port Ryerse Wind Power Project

1.0 Introduction

1.1 PROJECT OVERVIEW

Boralex Inc. (Boralex), in association with UDI Renewables Corporation (UDI), are proposing to develop Phase 1 and Phase 2 of the Port Ryerse Wind Power Project ("the Project") east of the hamlet Port Ryerse, within the Norfolk County, Ontario. The proposed Project Location for this report includes all parts of the land in, on or over which the Project is proposed.

The Renewable Energy Approval (REA) process for the Port Ryerse Project was originally initiated by UDI, with the assistance of M.K. Ince and Associates Ltd. Boralex is considering acquisition of the Project from UDI and retained Stantec Consulting Ltd. (Stantec) to complete the REA Application, as required under Ontario Regulation 359/09 - Renewable Energy Approvals under Part V.0.1 of the Act of the Environmental Protection Act (O. Reg. 359/09). According to subsection 6(3) of O. Reg. 359/09, the Project is classified as a Class 4 Wind Facility and will follow the requirements identified in O. Reg. 359/09 for such a facility.

The Project Study Area is generally bounded by i) Woolley and Gilbert Roads to the north; ii) Port Ryerse Road to the west; iii) Hay Creek to the east and iv) Avalon Lane to the south. The proposed Project Location includes all parts of the land in, on, or over which the Project is proposed. The Project Location, including all Project infrastructure, is sited on privately-owned lands, where landowners have entered into a lease agreement with Boralex/UDI. Permissions to access these properties have been obtained through verbal discussions with landowners, as a requirement of their signed agreements with Boralex /UDI.

The basic components of the Project include four Siemens SWT 3.0 113 wind turbine generators (3 MW turbines that will be customized to 2.5 MW for this Project), with a total maximum installed nameplate capacity of 10 MW, step-up transformers located adjacent to the base of each turbine (step up voltage from approximately 0.69 kV to 27.6 kV), a 27.6 kV underground collector system, fibre optic data lines, a distribution substation, a permanent parking lot (if required), a meteorological tower and turbine access roads. Temporary components during construction include laydown areas at the turbine locations and crane pads. No operations and maintenance building or transmission line is anticipated to be required for the Project. No Project components are located within municipal road Rights of Way (ROWs).

The 27.6 kV underground collector lines will transport the electricity generated from each turbine to the distribution substation located on private property east of Port Ryerse Road. Directional bore techniques will be used where the underground collectors lines cross valleylands and watercourses. At the substation, a dip-pole connection will be made directly into the Hydro One Networks Inc. (HONI) distribution system.

1.2 REPORT REQUIREMENTS

This Environmental Effects Monitoring Plan ("EEMP"), which includes the Post-Construction Monitoring Plan is one component of the Renewable Energy Approval ("REA") application for the Project, and has been prepared in accordance with O. Reg. 359/09, the Ontario Ministry of Natural Resources' (MNR's) *Approval and Permitting Requirements Document for Renewable Energy Projects* (MNR, 2009), the Ministry of Environment's ("MOE") *Technical Guide to Renewable Energy Approvals* (MOE, 2011), MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNR, 2011b) and MNR's *Birds and Bird Habitats: Guidelines for Wind Power Projects* (MNR, 2011a).

As discussed in the Project's Natural Heritage Assessment and Environmental Impact Study ("NHA/EIS"), primary data were collected through bird and wildlife baseline studies in the Project Study Area. These data were augmented with secondary data from published and unpublished sources to generate a dataset from which to assess the potential effects of the Project.

The potential environmental effects to wildlife and wildlife habitat and associated mitigation measures, based upon this dataset, ornithological advice, and professional opinion, among other factors, are provided in **Section 5** of the NHA/EIS and summarized in **Table 1.1, Appendix A** of this EEMP. Additionally, wildlife and wildlife habitat post-construction monitoring commitments are summarized in **Section 5.3** of the NHA/EIS. These commitments provide the first step of confirming the predictions of the EIS and provide the basis from which actions contained in the EEMP may stem.

The purpose of this EEMP is to outline post-construction monitoring survey requirements to address potential negative environmental effects for birds and bats, to assess the effectiveness of the proposed mitigation measures and to verify compliance of the Project with applicable provincial and federal legislation and guidelines. This monitoring plan provides details on habitat use studies for several features identified or treated as significant wildlife habitat in the NHA/EIS, including migratory landbird stopover areas and Bald Eagle wintering habitat. Should the results of the habitat use studies result in the determination that these habitats are considered significant (as determined by the Proponent or their agents and confirmed by MNR), the monitoring plan will be expanded to include additional post-construction habitat disturbance monitoring, This EEMP also details the post-construction wildlife monitoring program for mortality monitoring of birds and bats.

Based on the MNR bird and bat guidance documents referenced above, post-construction mortality monitoring should begin on May 1st of the year that the wind power project is fully operational. If full project commissioning is delayed, post-construction monitoring of a partially completed project should not be delayed for longer than 1 year. If the project is constructed in phases, mortality monitoring for each phase should coincide with the commencement of operation of that phase.

2.0 Pre-Construction Habitat Use Surveys

2.1 PURPOSE AND TIMING

As per the requirements of Appendix D of the Natural Heritage Assessment Guide for Renewable Energy Projects (MNR, 2011a), habitat use studies must be undertaken to determine the actual use of the habitat prior to any construction activities occurring within 120 m of the habitat. In **Section 5.2** of the NHA/EIS, the Proponent committed to undertake habitat use studies due to the location of select Project components within 120 m of candidate significant wildlife habitat for migratory landbird stopover areas and Bald Eagle wintering habitat. Methodologies for undertaking the habitat use studies for candidate significant wildlife habitat are described in the following sections. If the habitat is deemed significant as a result of habitat use studies, the mitigation proposed in **Table 1.1, Appendix A** of this EEMP will be applied. However, if the feature is deemed not significant, no mitigation will be applied for that feature.

2.2 METHODS

Migratory Landbird Stopover Area

Appendix D of the *Natural Heritage Assessment Guide for Renewable Energy Projects* ("NHA Guide") (MNR, 2011c), identifies that an operational impact may occur when a wind turbine is located within 120 m of a significant migratory landbird stopover area. As per the requirements of Appendix D of the NHA Guide, due to the location of proposed turbines within 120 m of LBMS01, the proponent must commit to undertaking studies to determine the actual use of the habitat by migratory landbirds prior to any construction activities occurring within 120 m of the habitat.

Monitoring Frequency and Timing:

The candidate woodlot will be surveyed twice weekly for a total of 20 visits in the fall 2012 and 20 visits in the spring 2013. The first visit in the fall will begin in mid-August and will continue through late October. The first visit in the spring will begin in mid-March and will continue through late March. Visits should begin approximately at sunrise and extend no more than 4 hours after sunrise. Severe weather events will be avoided, which would include high winds and/or heavy precipitation, to minimize any survey bias associated with variability in weather conditions.

Survey Methods:

Survey methods consist of slowly walking linear transects through and along the edges of the habitat. The pre-selected transect routes are shown on the attached figure and attempt to capture the range of habitats available in this woodlot. The transect routes will be flagged and

delineated in the field using handheld GPS units on the first field visit. All surveys will be conducted between sunrise and 4 hours after sunrise.

Due to the complex boundary and size of this feature, timing constraints do not allow for point counts to be included in the methods. The linear transects proposed are judged to be sufficient to adequately assess the significance of this feature.

Data Collection:

Observers will record the following information: date, names of observers, time (start and end for each transect), duration of time it took to walk the transect, weather conditions (temperature, % cloud cover, Beaufort wind scale, visibility, precipitation), GPS track of each transect, species observed, total number of individuals of each species, behaviour (foraging, mobbing, migration, flying, perching, perched on ground, swimming), and height category (using woodlot or fly-over). Although these surveys are targeting landbirds, all bird observations will be recorded. All birds documented as flyovers or otherwise not using the woodland as a stopover habitat will be clearly indicated at the time of observation. Any birds observed to be using the woodlot while the observer is traveling between transects will also be recorded.

Given the size and characteristics of the forest communities containing LBMS01, and the historic diversity of bird species in the Project Study Area, it is anticipated that this habitat could potentially support large numbers of fall and/or spring migrants. Migratory songbirds and all migrant raptor species are known to occur within the area, identified in the Draft Significant Wildlife Habitat Ecoregion 7E Criterion Schedule (MNR, 2012).

Bald Eagle Winter Perching Habitat Surveys

As per the requirements of Appendix D of the NHA Guide, due to the location of proposed turbines and collector lines within 120 m of the feature, the proponent must commit to undertaking studies to determine the actual use of the habitat prior to any construction activities occurring within 120 m of the habitat. As per the requirements of Appendix D of the NHA Guide, due to the location of proposed turbine 4 (T4) and overhead lines (transmission or distribution) in proximity of feature SCS03, the proponent must commit to undertaking studies to determine the actual use of the habitat by Bald Eagles prior to any construction activities occurring within 120 m of the habitat.

The presence of a Bald Eagle using this perching tree annually would make this habitat significant. Methods proposed follow the ‘behavioural study’ guidelines provided in the December 2011 *Bird and Bird Habitats: Guidelines for Wind Power Projects* (MNR 2011a). The habitat would then be delineated based on the behaviour of observed Bald Eagles: the areas used by the Bald Eagles for perching plus the surrounding vegetation communit(ies) (determined by Ecological Land Classification), protecting the habitat function and form, will then constitute the significant habitat.

Monitoring Frequency and Timing:

The candidate perching tree will be surveyed three times in winter 2012/2013, which will consist of one visit every three weeks beginning in mid-December. Visits will include a 3-hour survey between 11am and 2pm, focused on this tree and the surrounding habitat. Weather conditions will influence the timing of the visits, as severe weather and poor visibility conditions will be avoided.

Survey Methods:

A 3-hour survey focused on the perching tree and surrounding habitat will be conducted from a nearby vantage point. The observer will remain in or near the vehicle in order to reduce stress on any perched Bald Eagles. Binoculars will be used for observations.

Data Collection:

Observers will record the following information: date, names of observers, time (start and end for each survey), weather conditions (temperature, % cloud cover, Beaufort wind scale, visibility, precipitation), GPS point of observation, species observed, behaviour (foraging, mobbing, migration, flying , perching, perched on ground, swimming), number of passes, height category (using tree/woodlot or fly-over), flight direction, direction, and distance from user. Although these surveys are targeting Bald Eagles, all bird observations will be recorded.

Based on previous observations within the Study Area, Bald Eagle presence has been confirmed within the area; approximately 230 m southeast of T4 along the shore of Lake Erie, in the winter of 2011/2012.

Pignut Hickory Habitat

The primary mitigation strategy for this feature is to ensure all project components are located outside of pignut hickory habitat. As per the requirements of Appendix D of the NHA Guide (MNR, 2011c), due to the location of proposed access roads within 120 m of SCS01, the proponent must commit to undertaking studies to determine confirmed presence of pignut hickory prior to any construction activities occurring within 120 m of the habitat.

Health assessment surveys for any pignut hickory identified within 120 metres of an access road will be conducted for a minimum of 1 year. All pignut hickories identified during botanical surveys (Section 4.1.3 of NHA) will be flagged and have a GPS recording. Trees will be given a preliminary assessment to determine retainable status. If pignut hickory is located within 120 metres of an access road, and is deemed retainable, post-construction monitoring for pignut hickory will incorporate an overall health assessment to monitor any stress or damage in June, 2014.

Summary

Should the results of the habitat use studies result in the determination that these habitats are considered significant (as determined by the Proponent or their agents and confirmed by MNR), the monitoring plan will be expanded to include additional post-construction habitat disturbance monitoring. If a determination of significance is made, the results of the habitat use studies will constitute the baseline for habitat disturbance monitoring. Methodologies implemented in undertaking the habitat use studies will be replicated during habitat disturbance monitoring, and undertaken as per the schedule presented in **Table 1.2, Appendix A**. If required, post-construction habitat disturbance monitoring will take place for a minimum of one (1) year for: pignut hickory habitat and health status; and a minimum of three (3) years for: migratory landbirds and Bald Eagle wintering habitat.

3.0 Post-Construction Monitoring Program

3.1 PURPOSE AND TIMING

The purpose of the wildlife post-construction monitoring program is to identify performance objectives, assess the effectiveness of the proposed mitigation measures and to identify contingency measures that will be implemented if performance objectives cannot be met. Furthermore, any unanticipated potentially significant adverse environmental effects discovered during the post-construction monitoring program will be mitigated as described in **Section 4.0**. Post-construction monitoring for wildlife and wildlife habitat recommended in the NHA/EIS includes the following:

- *Bird and bat mortality monitoring:* twice weekly (3-4 day intervals) mortality monitoring at all 4 turbines beginning May 1 to October 31. Weekly monitoring for raptors at the 4 turbines will continue until November 30. Monitoring will be conducted for a period of three years. Searcher efficiency and carcass removal trials will be conducted each year according to current MNR guidance documents.

- *Potential disturbance effects to Pignut Hickory:* an initial tree health assessment will be *conducted* prior to construction to determine if the Pignut Hicktory tree is retainable. If so, a post-construction health assessment will be conducted to monitor any changes overall tree condition. All health assessments will be conducted by a certified arborist.

- *Potential disturbance effects to landbird migratory stopover areas:* migratory studies to be completed during the migratory season (August to October and March to May), annually for three years. Specifically, migratory surveys will consist of walking transects in feature LBMS01, as there are turbines proposed in the adjacent upland areas. Transects *will* be walked starting at sunrise, for approximately 4 hours after sunrise. These methods will follow those of the pre-construction surveys as detailed in **Section 2.2**.

- *Potential disturbance effects to Bald Eagle wintering perching habitat:* a 3-hour survey where *ideal* perching habitat will be monitored from a nearby vantage point. The observer will remain in or near the vehicle in order to reduce stress on any perched Bald Eagles. Binoculars will be used for observations. The candidate perching tree will be surveyed three times in winter 2012/2013, consisting of one visit ever three weeks beginning in mid-December. Each survey will be 3 hours in duration, and will take place between 11am and 2pm. These methods will follow those of the pre-construction surveys as detailed in **Section 2.2**.

3.2 PRIMARY DATA COLLECTION

Mortality monitoring of birds and bats will be conducted within a 50 m radius from each turbine base. Physical carcass searches and data collection will be conducted by field personnel skilled at identifying birds and bats by sight. All carcasses found will be photographed and recorded/labelled with the following information; species, sex, date, time, location (UTM coordinates), carcass condition, searcher, injuries, ground cover, and distance and direction to nearest turbine. Carcasses in good condition will be placed in a heavy-duty plastic bag and stored in an on-site freezer for later use in searcher efficiency and scavenger removal trials. The following details will be followed regarding carcasses collected:

- The estimated number of days since death, and condition of each carcass collected will be recorded in one of the following categories:
  - Fresh
  - Early decomposition
  - Moderate decomposition
  - Advanced decomposition
  - Complete decomposition
  - Scavenged
- Carcasses of the following species found during bat mortality searches will be stored in a freezer and used in carcass removal or searcher efficiency trials, assuming they are in reasonable condition:
  - Lasionycteris noctivagans (Silver-haired Bat)
  - Lasiurus cinereus (Hoary Bat)
  - Lasiurus borealis (Eastern Red Bat)
- Because of white-nose syndrome contamination risks, the following species will not be used in carcass removal or searcher efficiency trials (carcasses of these species may be sent to the Canadian Cooperative Wildlife Health Centre for analysis of white-nose syndrome):
  - *Myotis septentrionalis* (Northern Long-eared Bat)
  - *Myotis lucifugus* (Little Brown Bat)
  - *Myotis leibii* (Eastern Small-footed Bat)
  - *Perimyotis subflavus* (Tricolored Bat)
  - *Eptesicus fuscus* (Big Brown Bat)

Field data collection sheets will also include weather conditions such as wind speed and precipitation, ground cover visibility class, the estimated number of days since death, and condition of each carcass collected.

Although all reasonable effort will be made to conduct surveys as scheduled, surveys will not be conducted if weather (e.g. lightning, severe fog) presents safety concerns. Weather conditions will be noted when surveys were not conducted as scheduled, and every attempt will be made to complete the missed survey(s) as soon as possible.

The detailed monitoring methods, including duration, frequency and survey locations are discussed in the following sections.

All 4 turbines will be selected to provide representative coverage of the habitats and layout of the Project Location and will exclude any turbines where vegetation cover precludes searches (i.e. Visibility Classes 3 and 4 [MNR, 2011a]). The search area of each turbine will be mapped into visibility classes according to the following table:

Table 1: Ground Cover Visibility Classes (MNR, 2011a)

% Vegetation Cover	Vegetation Height	Visibility Class
≥90% bare ground	≤15%cm tall	Class 1 (Easy)
≥25% bare ground	≤15cm tall	Class 2 (Moderate)
≤25% bare ground	≤25% >30cm tall	Class 3 (Difficult)
Little or no bare ground	≥25% >30cm tall	Class 4 (Very Difficult)

Portion Area Searched

Most birds and bats will fall within 50 m of the turbine base (MNR, 2011a and b) and therefore this distance represents the maximum recommended search area. This value will be used to determine the portion of area searched (P_s). When the entire 50 m radius search area is searched, P_s will equal 100%. If portions of the 50 m radius search area are impossible or futile to search due to site conditions, P_s will be adjusted accordingly based on the searchers' ongoing estimates of the proportion of the search area that was physically searched. If feasible, a GPS will be used to delineate the search area and calculate the P_s.

The area searched will be determined for each turbine by mapping searchable areas on a grid (by visibility class) and counting the number of searched grid cells within 50 m. A GPS will be used as often and consistently as possible to avoid bias in determining the P_s. A map of the actual search area for each turbine searched and a description of areas deemed to be unsearchable due to vegetation height, type, slope, etc., will be provided in the monitoring report and maps of the varying search areas will be made available to review agencies. The aggregate area of those cells will be divided by the total area within a 50 m radius circle to determine the percent area searched for that turbine (Ps_x, where x is the turbine number).

$$Ps_x = \frac{\text{actual area searched}}{\pi r^2}$$

The overall Ps for the facility will be calculated as the average of Ps_1 through Ps_4.

This approach to mortality monitoring will facilitate any potential correlation between mortality occurrences, turbine location, habitat/land use features, weather conditions and season.

Searcher Efficiency Trials

Searcher efficiency trials require a known number of discreetly marked carcasses to be placed around a regularly monitored wind turbine. Searchers examine the wind turbine area, and the number of carcasses that they find is compared to the number of carcasses placed. Searcher efficiency trials will typically be conducted once in each of spring, summer and fall, but will be repeated if searchers change during the monitoring year. Searcher efficiency trials are designed to correct for carcasses that may be overlooked by surveyors during the survey periods. Searcher efficiency trials involve a "tester" that places bird and bat carcasses under turbines prior to the standard carcass searches to test the searcher's detection rate. Each trial will consist of a minimum of 10 carcasses per searcher, per visibility class, per season and will coincide with the regular carcass searches. No more than 3 trial carcasses would be placed at any one time. Trial carcasses will be placed randomly within the search area and the location will be recorded (UTM coordinates) to ensure easy retrieval by the "tester" at the end of the trial day. Trial carcasses will be marked with a unique identifying mark and should be as fresh as possible, with bat carcasses making up at least one third of the carcass removal trials and birds comprising another third, if available, or small brown mammals or dark-coloured poultry chicks. The searcher will not be notified when they are participating in an efficiency trail to avoid potential search biases.

Searcher efficiency (Se) is calculated for each searcher as follows:

$$Se = \frac{\text{number of test carcasses found}}{\text{number of test carcasses placed} - \text{number of test carcasses scavenged}}$$

A weighted average, or "overall Se", will be calculated to account for varying survey effort between searchers. The overall Se will be calculated as follows:

$$Se_o = Se_1(n_1/T) + Se_2(n_2/T) + Se_3(n_3/T) + Se_4(n_4/T)$$

where:	Se_o	is the overall searcher efficiency;
	Se_1 – Se_4	are individual searcher efficiency ratings;
	n_1 – n_4	are number of turbines searched by each searcher
	T	is the total number of turbines searched by all searchers.

Carcass Removal Trials

Levels of carcass scavenging must be determined through carcass removal trials. In these trials, carcasses are planted around the wind turbines and monitored until they disappear or have completely decomposed (generally 2 weeks). Carcass removal trials will be conducted once per season (spring, summer, and fall) and will involve a minimum of 10 bird and bat carcasses as fresh as possible, with bat carcasses making up at least one third of the trial carcasses and birds comprising another third, if available, or dark-coloured poultry chicks. If available, at least one raptor carcass will be used for some trials. A maximum of 5 trial carcasses will be placed at any one time to avoid flooding the area with carcasses.

Discreetly marked test carcasses (e.g. clipping of ear, wing, leg, hole punching of ear) will be placed out singly at turbines and distributed across the monitored turbines before dusk using gloves and boots to avoid imparting human smell. These trials involve the distribution of carcasses in different substrate/habitat types and visibility classes being searched, at known locations at each wind turbine generator being monitored, followed by monitoring every 3-4 days in conjunction with carcass searches, checking to determine the rate of removal. The average carcass removal time is a factor in determining the estimated bird and bat mortality. Carcass removal trials are designed to correct for carcasses that are removed by predators before the search period. Proportions of carcasses remaining after each search interval are pooled to calculate the overall scavenger correction factor:

$$Sc = \frac{n_{visit1} + n_{visit2} + n_{visit3} + n_{visit4}}{n_{visit0} + n_{visit1} + n_{visit2} + n_{visit3}} \text{ where}$$

Sc is the proportion of carcasses not removed by scavengers over the search period

$\mathbf{n_{visit0}}$ is the total number of carcasses placed

$\mathbf{n_{visit1} - n_{visit4}}$ are the numbers of carcasses remaining on visits 1 through 4

Corrected Mortality Estimates

In addition to total bird and bat mortalities observed, estimated mortality rates will also consider the results of searcher efficiency, carcass removal trials and portion area searched. MNR recommends the following formula to calculate the estimated bird and bat mortality:

$\mathbf{C = c / (S_{e0} \times S_c \times P_s)}$, where

C is the corrected number of bird or bat fatalities

c is the number of carcasses found

$\mathbf{S_{e0}}$ is the weighted proportion of carcasses expected to be found by searchers (overall searcher efficiency)

S_c is the proportion of carcasses not removed by scavengers over the search period

P_s is the portion of the area searched.

3.2.1 Bird Mortality Monitoring

Background

Data from wind projects currently operating in Ontario and around the world indicates that very low numbers of bird fatalities occur as result of wind power projects (MNR, 2011a). Data from Ontario and the United States indicates that approximately two birds per year are killed by individual turbines, which is very low compared to other existing sources of human caused avian mortality (MNR, 2011a). Birds can be killed through collisions with turbine blades and towers, meteorological towers and maintenance vehicles. Mortality rates and patterns can be affected by density and behaviour of birds found in the area, the presence of landscape features such as ridges, valleys, peninsulas and shorelines and weather conditions.

Monitoring

Post-construction bird mortality monitoring surveys may identify specific species and/or specific periods of high bird mortality or specific turbines/turbine groups linked to bird morality. This information can be used to established protocols for operational mitigation and inform adaptive management. Bird mortality monitoring will be conducted according to MNR's *Birds and Bird Habitats: Guidelines for Wind Power Projects* (MNR, 2011a). **Table 1.2, Appendix A** of this EEMP summarizes the post-construction wildlife monitoring program for mortality monitoring of birds.

Mortality monitoring at 4 turbines (100% of the total number of turbines contained within the Project) with minimally-vegetated ground cover (i.e., Visibility Classes 1 and 2 [MNR, 2011a]) within a 50 m radius using transects spaced 5.0 -6.0 m apart starting from the base of the wind turbine will be conducted twice-weekly (3-4 day intervals) beginning May 1 to October 31. Monitoring for raptors will continue at the 4 turbines until November 30. Monitoring of all 4 turbines for raptor fatalities will take place once monthly from May 1 through October 31, and weekly throughout November. This will occur for a three year period.

Authorization under the *Migratory Bird Convention Act, 1994* ("MBCA") will be required for handling carcasses of migratory birds. Likewise, carcasses of threatened or endangered species are covered under the *Endangered Species Act, 2007* ("ESA") or the federal *Species at Risk Act* ("SARA") and raptor carcasses are covered under the *Fish and Wildlife Conservation Act* ("FWCA"). The Proponent and its agents will consult with the MNR and Environment Canada/Canadian Wildlife Service prior to commencing the field program to ensure proper permits and/or procedure are in place to collect, possess, transport and utilize bird carcasses for scientific purposes. Any injured birds will be transported to an authorized wildlife rehabilitator or veterinarian for care. Staff conducting carcass searches will have a list of local rehabilitators on hand should an injured bird be found.

Other permits, approvals, authorizations, etc., are not likely to be required from the MNR or Environment Canada to permit the monitoring activities contemplated in this Plan.

3.2.2 Bat Mortality Monitoring

Background

Bat mortality has been documented at wind power facilities in a variety of habitats across North America. Nearly every monitored wind power facility in the United States and Canada has reported bat mortality with minimum annual mortality varying from < 1 to 50 bat fatalities/turbine/year (MNR 2006). The majority of bat fatalities at wind power facilities occur in the late summer and fall, and the long-distance migratory bats (i.e., Hoary Bat, Eastern Red Bat, Silver-haired Bat) appear to be most vulnerable to collisions with moving turbine blades. Specific factors causing bat mortality and affecting species vulnerability to wind turbine mortality remain unclear, although recent evidence from Alberta suggests that air pressure differences in the blade vortices may contribute to bat mortality (barotrauma).

Monitoring

In Ontario, the post-construction monitoring season for bats is based on bat activity patterns, covering spring activity through fall swarming and migration and is consistent with the post-construction monitoring season for birds; thus occurring from May 1- October 31. Bat mortality monitoring will be conducted according to MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (2011b). In general, the mortality monitoring requirements for bats will be captured in conjunction with bird mortality monitoring, as described in **Section 3.2.1** and in **Table 1.2, Appendix A** of this EEMP. Any injured bats will be transported to an authorized wildlife rehabilitator or veterinarian for care. Staff conducting carcass searches will have a list of local rehabilitators on hand should an injured bird be found. The post-construction monitoring program for bat mortality is summarized below:

- Bat mortality monitoring will be conducted twice-weekly (3-4 day intervals) within minimally-vegetated portions (i.e., Visibility Classes 1 and 2 [MNR, 2011b]) of a 50 m search area radius from the base of 4 turbines beginning May 1 to October 31st for a three-year period in accordance with MNR guidelines. This time period includes the core season when resident and migratory bats are active. Bat mortality monitoring will be conducted in conjunction with other monitoring activities (birds) for efficiency.
- Searcher efficiency and carcass removal trials will be conducted seasonally (spring, summer, and fall) between May 1 and October 31st. Searcher efficiency and carcass removal rates are known to be more variable for bats than for birds throughout the year and depending on habitat (in part due to the relative size of the species).

Searchers handling bat carcasses will take reasonable precautions (e.g., gloves, tools etc.) to protect their personal health. All searchers will ensure they have updated rabies pre-exposure vaccinations. Biological material will be disposed of in a way to ensure that it does not pose a public or environmental health risk and in accordance with any applicable federal or provincial.

3.3 Reporting and Review of Results

Annual post-construction monitoring reports will summarize and analyze the results of all wildlife surveys. Reports will be submitted to the MOE and MNR within three months of the conclusion of the November mortality monitoring.

The monitoring program will be reassessed by MNR and the Proponent at the end of each monitoring year. Pending the reassessment results, the program methods and frequencies may be reasonably modified to better reflect the findings.

4.0 Adaptive Management Program

The adaptive management program described in this section outlines performance objectives, and contingency measures that will be implemented should the performance objectives not be met.

Contingency plans address immediate mitigation actions necessary in case of a significant bird or bat mortality event, or if mitigation actions fail. Contingency measures may include an adaptive management approach. An adaptive management program allows mitigation measures to be implemented in the event that unanticipated potentially significant adverse environmental effects are observed. Potentially significant adverse effects will be assessed through review of the annual report.

The following sections describe the procedures for notifications, reporting, and adaptive management for mortality and disturbance effects monitoring.

4.1 MORTALITY MONITORING

All bird and bat mortality will be reported in the annual report submission. Mortality rate is expressed as the number of fatalities per turbine per year (e.g., from May 1 to November 30). Mortality of all species of conservation concern in EcoRegion 5E (MNR, 2012) will be highlighted in the annual post-construction monitoring reports. A threshold approach will be used to identify and mitigate significant bird and bat mortality resulting from the operation of wind turbines.

4.1.1 Birds

Post-construction mitigation, including operational controls, will be considered if annual mortality of birds exceeds any of the following thresholds defined by the MNR (2011a):

- 14 birds/turbine/year at individual turbines or turbine groups; or
- 2 raptors per wind power project (when <10 turbines).
- Or if bird mortality during a single mortality monitoring survey exceeds:
- 10 or more birds at any one turbine; or
- 33 or more birds (including raptors) at multiple turbines.

Mortality levels maintained below these thresholds are considered unlikely to affect bird populations (MNR 2011a).

Any and all observed mortality of species at risk (i.e., a species listed as Endangered, Threatened or Special Concern under Schedule 1 of the federal SARA or a species listed on the Species at Risk in Ontario list as Extirpated, Endangered, or Threatened under the provincial ESA) that occurs will be reported within 48 hours to MNR.

For turbines located outside 120 m of bird Significant Wildlife Habitat (SWH), two years of subsequent scoped mortality and cause and effects monitoring is required where a significant annual mortality threshold has been exceeded. Following scoped monitoring, post-construction monitoring (e.g. operational mitigation) and effectiveness monitoring may be required at individual turbines where a mortality effect has been identified or significant annual mortality persists.

For turbines located within 120 m of LBMS01 which is significant migratory bird habitat, immediate post-construction mitigation (including operational mitigation), as identified in the Environmental Impact Study, and three years of effectiveness monitoring will be required where monitoring identifies significant annual bird mortality or disturbance effects associated with bird SWH.

Avoidance-disturbance effects monitoring may also be required. MNR will be engaged to initiate an appropriate response plan as set out in the MNR's Bird Guidelines (2011a). The response plan would include an analysis of the species, timing and distribution of fatalities to determine potential risk factors leading to mortality. The analysis may include an evaluation of the mortality data and/or behavioural studies to better refine when and where species are most at risk of collision. The results of this analysis will be used to develop operational mitigation measures, which may include the following:

- Periodic shut-down of select turbines at specific times of year, when mortality risks to the affected bird species is particularly high (i.e., migration)[1];
- Blade feathering at specific times of year, when mortality risks to the affected bird species is particularly high (i.e., migration); or
- An alternate plan agreed to between the Proponent and MNR.

4.1.1.1 Contingency Plan for Mass Mortality of Birds

To date, there have been no recorded events of mass mortality of birds at wind farms in Ontario. The various post-construction monitoring projects in Ontario typically record between 0 to 2 bird fatalities at individual turbines during any one survey, with only a single record of 3 birds fatalities observed at one turbine during a single visit (Friesen, 2011). As such, the risk of a mass mortality event for birds is anticipated to be very low.

[1] MNR 2011a

In the event of a mass mortality event, defined as 10 or more bird fatalities at any one turbine, or 33 or more bird fatalities (including raptors) at multiple turbines on a single survey, the following steps will be implemented:

1. MNR will be notified of the event within 48 hours and will be provided with any available details (e.g. species, number and distribution of turbines involved).

2. An emergency search of all turbines in the Project will be conducted as soon as practicable to determine the extent and the distribution of the mortality event.

3. An analysis of the results of the emergency search will be completed to identify potential risk factors (e.g., weather conditions, proximity to natural heritage features) leading to the mortality event.

4. Based on the risk factors identified, additional mitigation and scoped monitoring recommendations will be developed in conjunction with MNR with the goal of avoiding future mortality events.

4.1.2 Bats

Operational mitigation is required where annual post-construction mortality monitoring exceeds 10 bats/turbine/year (MNR, 2011b).This threshold of 10 bats/turbine/year has been determined based on bat mortality reported at wind power projects in Ontario and comparison with jurisdictions across North America.

Operational mitigation to be implemented includes changing the wind turbine cut-in speed to a wind speed of 5.5 m/s (measured at hub height) or feathering of wind turbine blades when wind speeds are below 5.5 m/s.

The majority of bat mortalities from wind turbine operations occur during fall migration. Where post-construction monitoring indicates that annual bat mortality threshold of 10/bats/turbine/year has been exceeded, operational monitoring will be implemented across the wind power project from sunset to sunrise, from July 15-September 30 and will continue for the duration of the project. If site specific monitoring indicates a shifted peak mortality period (due to higher latitude projects), operational mitigation may be shifted to match the peak mortality, with mitigation maintained for a minimum of 10 weeks. Any shift in the operational mitigation period to match peak mortality will be determined in consultation with the MNR. Where post-construction mitigation is applied, an additional 3 years of effectiveness monitoring is required, as set out in the MNR’s Bat Guidelines (MNR, 2011b).

4.1.2.1 Contingency Plan for Continued Significant Bat Mortality

Additional mitigation measures may be implemented in the event of continued significant bat mortality (i.e., more than 10 bats/turbine/year) after the mitigation measures outlined in Section 3.1.2 have been implemented. Should the cut-in speed mitigation be implemented and the bat mortality thresholds continue to be exceeded, the Proponent will work with the MNR to reasonably determine additional mitigation and scoped monitoring requirements.

5.0 Best Management Practices

The Proponent will include the following best management practices as part of the post-construction monitoring program (as outlined in MNR, 2011a and 2011b).

5.1 DATA MANAGEMENT

All pre- and post-construction data, collected in accordance with MNR guidance and reported to the MOE, will be submitted to the joint Canadian Wildlife Service – Canadian Wind Energy Association – Bird Studies Canada – Ontario Ministry of Natural Resources Wind Power and Birds Monitoring Database.

5.2 BAT TISSUE SAMPLES

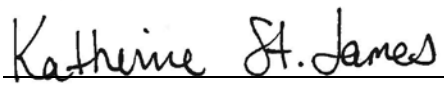
Tissue samples from bat carcasses may be used in a number of DNA analyses to provide insight into population size and structure, as well as the geographic origin migrants. The Proponent will contact the local MNR office prior to disposing bat carcasses, to determine if this type of research is occurring in the area.

6.0 Closure

This Environmental Effects Monitoring Plan for the Port Ryerse Wind Power Project has been prepared in accordance with O. Reg. 359/09, s. 23.1, the MNR's *Approval and Permitting Requirements Document for Renewable Energy Projects* (MNR, 2009), the *MOE's Technical Guide to Renewable Energy Approvals* (MOE, 2011), MNR's *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNR, 2011b) and MNR's *Birds and Bird Habitats: Guidelines for Wind Power Projects* (MNR, 2011a).

Stantec Consulting Ltd. prepared this Environmental Effects Monitoring Plan for the Proponent for the Port Ryerse Wind Power Project. The Proponent is committed to implementing the appropriate protection and mitigation measures as they apply to the construction and operation of the proposed Project.

STANTEC CONSULTING LTD



Katherine St James, M.Sc.
Terrestrial Ecologist

Fiona Christiansen, M.Sc.
Senior Project Manager

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Appendix A

Tables

Table 1.1 Summary of Potential Negative Effects, Mitigation Measures and Monitoring for the Port Ryerse Wind Power Project – Construction and Operation

Unique Feature ID	Potential Negative Environmental Effects	Performance Objective	Mitigation Strategy	Construction Monitoring Plan		Contingency Measure
				Monitoring Locations	Frequency of Monitoring	
Significant Woodlands (W002 and W0033)	Accidental damage to critical root zones AND Accidental loss of trees or damage to limbs	Prevent damage to the critical root zones AND Prevent accidental loss of trees or damage to limbs	Clearly delineate work area using a barrier such as a silt fence to avoid accidental encroachment on the feature that would lead to damage of trees and root zones. Workers will be advised not to trespass beyond the boundary of the marked area	Check silt fencing along the periphery of significant woodlands	Daily when construction activities occur within the immediate vicinity of significant woodlands and when inclement weather is anticipated (i.e. rain events)	Any tree limbs or root zones that are accidentally damaged by construction activities will be pruned using proper arboricultural techniques
			Erect silt fencing to prevent sedimentation within critical root zones Implement a sedimentation and erosion control plan Any issues should be resolved in a timely fashion	Check silt fencing along the periphery of feature significant woodlands to make sure it is fully functional	Daily when construction activities occur within the immediate vicinity of significant woodlands and when inclement weather is anticipated (i.e. rain events)	Any build-up of sediment beyond the silt fence will be cleaned up and removed to avoid risk of further spread of sediment.
			Stockpile materials >30m from woodland edge. Where this is not possible stockpiles will be covered when not in use, especially during rain events or high wind events.	All stockpiles within 30m of significant woodlands (if applicable)	All covers on stockpiles to be put in place and checked when inclement weather events anticipated (i.e. high winds, rain events)	Sediment will be removed if it is found to accumulate within the root zones of significant woodlands
			Re-vegetate disturbed areas with fast growing native species as soon as construction activity within the disturbed areas is complete.	Check that seed grows in areas of disturbance within one growing season	Once after seeding area	Replant areas where seed does not grow to ensure vegetation establishes within the growing season
			All maintenance activities, vehicle refueling or washing and chemical storage will be located more than 30m from significant woodlands	Not required	Not required	Keep emergency spill kits on site Implement MOE spill action plan if necessary Dispose of waste material through authorized and approved offsite vendors
			Implement infiltration (i.e. minimize paved surfaces and design roads to promote infiltration) techniques to the maximum extent possible to avoid changes in soil moisture and compaction	Not required	Not required	Not required
			Locate horizontal directional drill entry/exit pits at least 30m from any significant natural feature	Check distance to natural features to location of entry pits	Once at time of drilling	Move entry pit to 30 m prior to drilling under feature
			Collect drill cuttings as they are generated and place in a soil bin or bag for off-site disposal	Not required	Not required	Not required
			Restore and re-vegetate entry/exit pits to pre-construction conditions as soon as possible after construction	Check that seed grows in areas of disturbance within one growing season	Once after seeding area	Replant areas where seed does not grow to ensure vegetation establishes within the growing season

Table 1.1 Summary of Potential Negative Effects, Mitigation Measures and Monitoring for the Port Ryerse Wind Power Project – Construction and Operation

Unique Feature ID	Potential Negative Environmental Effects	Performance Objective	Mitigation Strategy	Construction Monitoring Plan		Contingency Measure
				Monitoring Locations	Frequency of Monitoring	
Significant Wildlife Habitat (LBMS01, SCS01, and SCS03)	Habitat avoidance/disturbance caused by noise and dust	Prevent habitat avoidance/disturbance of caused by noise and dust generation, especially during sensitive breeding season	Avoid where possible construction within 120m of significant migratory landbird stopover habitat from April-May and August-October. Construction to be completed outside of the Bald Eagle wintering timeframe of mid-November to late February within 400 m of the delineated Bald Eagle habitat.	Not required	Not required	Not required
			Implement standard construction site best management practices to prevent fugitive dust generation and off site transport across the project location	Visual monitoring of visible dust plumes during construction throughout construction site	Ongoing	Not required
			Re-vegetate disturbed areas with fast growing native species as soon as construction activity within the disturbed areas is complete.	Check that seed grows in areas of disturbance within one growing season	Once after seeding area	Replant areas where seed does not grow to ensure vegetation establishes within the growing season

** Pre-construction survey required to verify significance of this feature. If significant the following mitigation measures, monitoring plan and contingency measures will be implemented

Table 1.2: Summary of Environmental Effects Monitoring Plan for Operation of the Port Ryerse Wind Power Project

Potential Negative Effect	Mitigation Strategy	Performance Objective	Monitoring Plan					Contingency Measures
			Methods	Location	Frequency	Rationale	Reporting	
Disturbance Monitoring for Vegetation								
Disturbance to Pignut Hickory Habitat	Post-construction Disturbance Monitoring Program The overall health of any pignut hickory trees monitored and compared to pre-construction conditions. In addition to monitoring of stress and disturbance levels, the species observed should be recorded and compared to pre-construction conditions.	MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction monitoring to determine if an ecologically significant disturbance/avoidance effect to pignut hickory and pignut hickory habitat is occurring, and whether such effect is attributed to the access roads and not external factors. These discussions will determine whether contingency measures will be undertaken.	Botanical survey Initial health assessment to determine if tree(s) are retainable Post-construction health assessment to monitor any changes overall tree condition All health assessments will be conducted by a certified arborist Methods are outlined in detail in this Environmental Effects Monitoring Plan.	Feature SCS01, if determined to be significant as a result of habitat use studies; presence of pignut hickory trees.*	Initial botanical survey and health assessment to determine if any pignut hickory identified in the Study Area to take place in late spring, summer or early fall. Monitoring retainable status and overall health assessment for one year post-construction.	Abundance and overall health status of pignut hickory (S3 species) within 120 m of project location will be monitored for any changes in health.	Report will be submitted to MNR with the following anticipated date: February 2015	Where post-construction monitoring identifies ecologically significant pignut hickory habitat, the proponent, MNR and other relevant agencies will determine if and when additional monitoring and/or mitigation is required and work together to develop a contingency plan. The best available science and information should be considered when determining appropriate mitigation.
Disturbance Monitoring for Birds								
Landbird Migratory Stopover Area	Situating wind turbines outside of migrant habitat. Post-construction Disturbance Monitoring Program. The migrant density landbird migrants (combined and individual), within the habitat, will be monitored and compared to pre-construction conditions. In addition to density, the area-sensitive species observed should be monitored and compared to pre-construction conditions. The draft SWH Ecoregion 7E Criterion Schedule (MNR, 2012) specifies migratory songbirds and migrant raptor species be monitored.	Continued use of the habitat by the species that currently inhabit the feature. MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction monitoring to determine if an ecologically significant disturbance/avoidance effect to migrant birds is occurring, and whether such effect is attributed to the wind turbines and not external factors. These discussions will determine whether contingency measures will be undertaken.	Studies completed during fall migration period (August-October). Evaluation methods followed “Bird and Bird Habitats: Guidelines for Wind Power Projects” for woodland migratory bird stopover areas A combination of standardized walking transects established within and along the edge of candidate habitat, were conducted in the early morning hours. A commitment has been made to complete pre-construction surveys of habitat use during the spring migration season as well to provide full baseline information. Methods are outlined in detail in this Environmental Effects Monitoring Plan.	In feature LBMS01	Ten weeks during the migration season (March-May and August to October), with 2 surveys per week, with at least 1 day between surveys, annually for three years.	Landbird migratory stopover areas can reflect relative importance of the site, with presence of species of conservation concern. Other factors of importance include species diversity, abundance, size of site and habitat diversity.	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Should performance objectives not be met: • Compare declines to population trends noted through province or continent-wide breeding bird surveys • develop additional studies to determine extent of disturbance effect MNR will be consulted on contingency measures which may include: • For turbines located outside of 120 m of bird SWH, 2 years of subsequent scoped mortality monitoring is required where a significant annual mortality threshold has been exceeded. • For turbines located within 120 m of bird SWH, immediate post-construction mitigation (including operation mitigation) and 3 years of effectiveness monitoring may be required.
Bald Eagle Winter Perching Habitat	Situating wind turbines outside of Bald Eagle habitat. Post-construction Disturbance Monitoring Program. Bald Eagle occurrences (combined and individual),	If pre-construction surveys indicate that this habitat is significant, the MNR will be contacted to discuss mitigation and contingency measures. Significant Bald Eagle Winter Perching Habitat would require the continued use of the habitat by the species that currently inhabit the feature.	Study area will be surveyed through driving surveys, targeting areas suitable for Bald Eagle perching. Surveys will consist of monitoring candidate trees for Bald Eagle perching.	In feature SCS03**	Three surveys during the winter (December – February), each survey 3 weeks apart. Survey on a clear sunny day for maximum visibility.	Bald Eagle winter feeding and roosting areas reflect relative importance of the site. This is based off of abundance, size, habitat quality, level of disturbance, and location (if present) of roost.	Pre-construction: A report will be submitted to the MNR providing the results of pre-construction surveys, and the evaluation of significance of this	Upon submission of annual post-construction monitoring reports to MNR, it will be determined in consultation with MNR whether contingency measures are required and the contingency measures to be undertaken.

Table 1.2: Summary of Environmental Effects Monitoring Plan for Operation of the Port Ryerse Wind Power Project

Potential Negative Effect	Mitigation Strategy	Performance Objective	Monitoring Plan					Contingency Measures
			Methods	Location	Frequency	Rationale	Reporting	
	within the habitat, will be monitored and compared to pre-construction conditions.	MNR, along with the proponent and other relevant agencies, will collectively review the results of the post-construction monitoring to determine if an ecologically significant disturbance/avoidance effect to Bald Eagle is occurring, and whether such effect is attributed to the wind turbines and not external factors. These discussions will determine whether contingency measures will be undertaken.	Monitoring will occur between 11am and 2pm from a clear vantage point in the vehicle. Surveys to take place during the winter of 2012/2013, starting mid-December.				feature (February 2013). If significant, post-construction reports will be provided: Annual Reports will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	
Mortality Monitoring for Birds and Bats								
Direct mortality to birds through turbine collisions	Post-construction mortality monitoring program	Maintain mortality below thresholds	Post-construction monitoring of mortality rates; carcass searches Methods are outlined in detail in this Environmental Effects Monitoring Plan	At all 4 turbines for all birds and raptors	Conducted twice-weekly (3-4 day intervals) at all 4 turbines from May 1-October 31. Weekly monitoring for raptors will continue until November 30. Monitoring to be conducted for three years.	Bird and Bird Habitats: Guidelines for Wind Power Projects, 2011	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Post-construction mitigation, including operational controls, will be implemented if annual mortality of birds exceeds any of the following thresholds defined by the MNR (2011a): • 14 birds/turbine/year at individual turbines or turbine groups; • 0.2 raptors/turbine/year (all raptors) across a wind power project; or • 0.1 raptors of provincial conservation concern/turbine/year across a wind power project. Or if bird mortality during a single mortality monitoring survey exceeds: • 10 or more birds at any one turbine; or • 33 or more birds (including raptors) at multiple turbines. MNR will be consulted on contingency measures to be implemented.
Direct mortality to bats through turbine collisions	Post-construction mortality monitoring program	Maintain mortality below thresholds	Post-construction monitoring of mortality rates; carcass searches Methods are outlined in detail in this Environmental Effects Monitoring Plan	At all 4 turbines	Conducted twice-weekly (3-4 day intervals) at all 4 turbines from May 1-October 31. Monitoring to be conducted for three years.	Bats and Bat Habitats: Guidelines for Wind Power Projects, 2011	Annual Report will be submitted to MNR with the following anticipated dates: February 2015 February 2016 February 2017	Operational mitigation is required where annual post-construction mortality monitoring exceeds 10bats/turbine/year (MNR, 2011). MNR will be consulted on contingency measures to be implemented.

* 1 year of post-construction monitoring is required for the habitats that are determined to be significant through habitat use studies/pre-construction monitoring surveys.
** If habitat is deemed significant as a result of habitat use studies, mitigation proposed in Table 1.1 of this EEMP will be applied. However, if the feature is deemed not significant, no mitigation will be applied for that feature

PORT RYERSE WIND POWER PROJECT

NOISE ASSESSMENT REPORT

Revision 4

For

BORALEX

Adam Rosso

By

J. R. Salmon
S. J. Corby

2013 September 3

Zephyr North Ltd.

850 LEGION ROAD UNIT 20
BURLINGTON ON L7S 1T5
CANADA

Phone: 905-335-9670
Fax: 905-335-0119
Internet: Info@ZephyrNorth.com

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Table of Contents

1 INTRODUCTION....6
1.1 Purpose....6
1.2 Revision 0....6
1.3 Revision 1....6
1.4 Revision 2....6
1.5 Revision 3....6
1.6 Revision 4....7
1.7 Brief Project Description....7
1.8 Reporting Details....7
1.9 Sound Level Limits for Wind Farms....8
2 PROJECT LAYOUT....9
2.1 Project Site....9
2.2 Project Details....9
2.3 Municipal Zoning....10
2.4 Adjacent Projects....10
2.5 Substations....10
3 DESCRIPTION OF RECEPTORS....12
3.1 Definition....12
3.2 Determination....12
3.3 Vacant Lots....12
3.4 Methodology....13
4 DESCRIPTION OF SOURCES....14
4.1 Wind Turbines....14
4.1.1 Port Ryerse Wind Power Project....14
4.1.1.1 Siemens SWT-3.0-113 (Max Power 2500 kW)....14
4.2 Transformer Substations....15
5 NOISE EMISSION RATINGS....16
5.1 Turbine Noise Definition Standard....16
5.2 Wind Turbines....16
5.2.1 Port Ryerse Wind Power Project....16
5.2.1.1 Siemens SWT-3.0-113 (Max Power 2500 kW)....16
5.3 Site-Specific Vertical Wind Shear Exponent....18
5.4 Substations....18
5.4.1 Port Ryerse Wind Power Project....18

5.4.1.1 Substation....18
6 IMPACT ASSESSMENT....19
6.1 Methodology....19
6.2 Specific Parameters....19
6.3 Additional parameters and conditions....20
6.4 Results....20
7 NOISE LEVEL SUMMARY TABLES....22
8 NOISE LEVEL ISOPLETH MAP....30
9 EXAMPLE CALCULATION....32
9.1 Method of Calculation....32
9.1 Example....33
10 CONCLUSIONS....35
11 REFERENCES....36
12 APPENDIX A — TURBINE, RECEPTOR, VACANT LOT AND PARTICIPANT LOCATIONS....38
13 APPENDIX B — ADDITIONAL DOCUMENTATION....45

List of Figures

Figure 1-1 Project location map....7
Figure 2-1 Project site map....11
Figure 5-1 SWT-3.0-113 (MP 2500 kW) wind speed sensitivity test....17
Figure 8-1 40 dBA noise isopleth map for 1.5 and 4.5 m receptor heights....31

List of Tables

Table 5-1 Siemens SWT-3.0-113 (Max Power 2500 kW) — Wind turbine acoustic emissions summary....18
Table 6-1 Highest noise levels at receptors....21
Table 7-1 Receptor noise level summary table....22
Table 7-2 Vacant lot surrogate receptor noise level summary table....28
Table 7-3 Participant noise level summary table....29
Table 9-1 Sample calculation for receptor and turbine....33
Table 9-2 Sample calculation for single receptor and multiple turbines....34

1 INTRODUCTION

1.1 Purpose

This Noise Assessment Report (NAR) describes the results of a noise impact study for Boralex Inc. in association with UDI Renewables Corporation's proposed Port Ryerse Wind Power Project (PRWPP).

1.2 Revision 0

Revision 0 was the original Noise Assessment Report.

1.3 Revision 1

In Revision 1 the Siemens SWT-2.483-113 project turbine model was replaced with a generic turbine model characterized by minimum and maximum hub heights of 99.5 and 108.4 m respectively, and a maximum broadband source sound power level of 103.7 dBA with commensurate octave band source sound power levels determined as the "predictable worst case".

Receptor, participant, and VLSR details were updated.

1.4 Revision 2

Revision 2 described the project using four Siemens SWT-3.0-113 wind turbine generators. It was noted that each of the 3.0 MW turbines would be customized to a nameplate capacity of 2.897 MW or less with the total maximum installed nameplate capacity of all four turbines not to exceed 10 MW.

Receptor, participant, VLSR, and vacant lot details were updated.

1.5 Revision 3

For Revision 3, the project was comprised of four Siemens SWT-3.0-113 wind turbine generators. Each of the nominal 3.0 MW turbines was customized to a nameplate capacity of 2.500 MW with a total maximum installed nameplate project capacity of 10 MW.

Receptor, participant, VLSR and vacant lot details were updated, and expanded to include all those within 2 km of any project turbine.

1.6 Revision 4

For the present revision (Revision 4), the following items have been addressed.

As requested by the Ontario MoE, it is confirmed that the "sample calculation in octave band for the worst case POR" is presented. (Note that this has not changed from the previous revision.)

VLSR and vacant lot details were updated. Descriptions of numbers of receptors, VLSRs, participants and vacant lots (Section 3.2) within 1,500 and 2,000 m of project turbines respectively were updated.

The requested "Excel spreadsheet containing the UTM coordinates of all sources and point of receptions" was updated for submission to the Ontario MoE with the present revision of the NAR.

1.7 Brief Project Description

The Port Ryerse Wind Power Project is located to the east of the hamlet of Port Ryerse in Norfolk County on the north shore of Lake Erie.

The project will include four Siemens SWT-3.0-113 wind turbine generators. The 3.0 MW turbines will be customized to a nameplate capacity of 2.500 MW with a total maximum project nameplate capacity of 10 MW. Other basic components of the wind farm include step-up transformers located adjacent to the base of each turbine, a 27.6 kV underground electrical collector system, fibre optic data lines, a distribution substation, a permanent parking lot (if required), a meteorological mast, and turbine access roads.

Figure 1-1 shows the location of the project within the province of Ontario.

Figure 1-1 Project location map.

1.8 Reporting Details

This report has been prepared to meet all reporting requirements related to wind project noise for a *Renewable Energy Approval* (REA) under the *Green Energy and Green Economy Act 2009* (Government of Ontario, 2009)

A noise impact assessment was carried out for this project under Section 55.(3) of O. Reg 359/09 (Government of Ontario, 2009b)

and amendments (O.Reg. 521/10, Government of Ontario, 2010; O.Reg. 231/11, Government of Ontario, 2011; O.Reg. 195/12, Government of Ontario, 2012). The assessment methodology and calculations conform to the ISO 9613-2 International Standard (ISO, 1996). Results of the analysis have been interpreted using Ministry of Environment Guidelines (MoE, 2008). This latter document generally provides guidelines and clarifications for the application of MoE regulations document NPC-232 (MoE, 1995) to wind farm projects.

The MoE (2008) Guidelines document prescribes receptor noise level limits based on an analysis of typical wind-induced background noise levels, and tabulates these limits as functions of the ambient 6, 7, 8, 9, and 10 ms^{-1} wind speeds measured at 10 m above ground level (a.g.l.). Note that the receptor noise level limits must be met for noise produced by other project hardware such as substation transformers in addition to noise produced by the wind turbines.

This report will show that the estimated noise levels generated by the project turbines and other hardware meet the MoE (2008) prescribed limits at all qualified receptors.

1.9 Sound Level Limits for Wind Farms

MoE (2008) lists the sound level limits for wind farms (based on the NPC-205 and NPC-232 publications and a consideration of the background ambient wind-induced sound level) as follows. Note that noise contributions from project switching, transformer, and substations must be included.

Summary of Sound Level Limits for Wind Turbines

Wind speed (ms^{-1}) at 10 m height	4	5	6	7.0	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 Area, dBA	45.0	45.0	45.0	45.0	45.0	49.0	51.0
Reference wind induced background sound level L_{90}, dBA	30.0	31.0	33.0	36.0	38.0	42.0	44.0

2 PROJECT LAYOUT

2.1 Project Site

Figure 2-1 shows the Port Ryerse Wind Power Project. Typical topographic map features along with project details are shown on the map.

Within the project domain the topography can be characterized as very gently rolling to the point of being almost flat. On the land portion of Figure 2-1, the contour lines (5 m contour interval) confirm this. Note that the general topographic elevation in the land portion of the project area is approximately 200 m above sea level (a.s.l). In the southern portion lies Lake Erie with its surface at 174 m a.s.l.

The surface roughness of the project domain is typical of Ontario rural terrain with a heterogeneous mixture of agricultural fields, woodlots, farm buildings, dwellings, and rural settlements.

The primary activity in this area is agriculture.

The PRWPP site features a population density typical of southern Ontario rural communities — a relatively sparse population in the countryside except for a small number of settlement clusters (villages and towns). The hamlet of Port Ryerse lies immediately to the southwest of the project site.

2.2 Project Details

Figure 2-1 shows the properties that have been optioned for lease to the project proponent (Boralex Inc., in association with UDI Renewables Corporation) along with prospective turbine, point of reception (receptor), vacant lot surrogate receptor (VLSR), participating point of reception (participant), and vacant lot locations. Turbine numbers are designated with the prefix 'T', receptors with 'R', VLSRs with 'V', and participants with 'P'.

As specified by O.Reg 359/09, the Port Ryerse Wind Power Project is a Class 4 Wind Project.

The PRWPP will consist of four Siemens SWT-3.0-113 (Max power 2500 kW) turbines for a project capacity of 10.0 MW. The project turbines are numbered T1

to T4 in Figure 2-1. The project stretches for a distance of about 1.6 km parallel to the shore of Lake Erie. Turbines are located from about 0.4 km to 1.2 km from the shoreline. A listing of all PRWPP turbine locations can be found in Section 12 .

The Ontario NPC designation for the project properties would generally be Class 3 — Rural. Typical background sound levels for these areas would be generated by residential, agricultural, and small commercial activities, ambient sound from wind, vehicle noise from regional roads, and ambient wave noise near the shoreline of Lake Erie. For the purposes of this report, all areas have been considered to be NPC Class 3.

2.3 Municipal Zoning

Typically, the project area is zoned as Agricultural.

2.4 Adjacent Projects

It is understood that there are no existing or planned wind projects within 5 km of the Port Ryerse Wind Power Project. The Port Dover portion of Capital Power Corporation's Port Dover and Nanticoke Wind Project lies about 8 km to the east-northeast along the Lake Erie shoreline past the town of Port Dover.

2.5 Substations

There is no transformer substation associated with this small project. There will be low voltage step-up transformers associated with each of the turbines with low and high voltages of approximately 690 V and 27.6 kV respectively. These will be located directly adjacent to the base of each turbine.

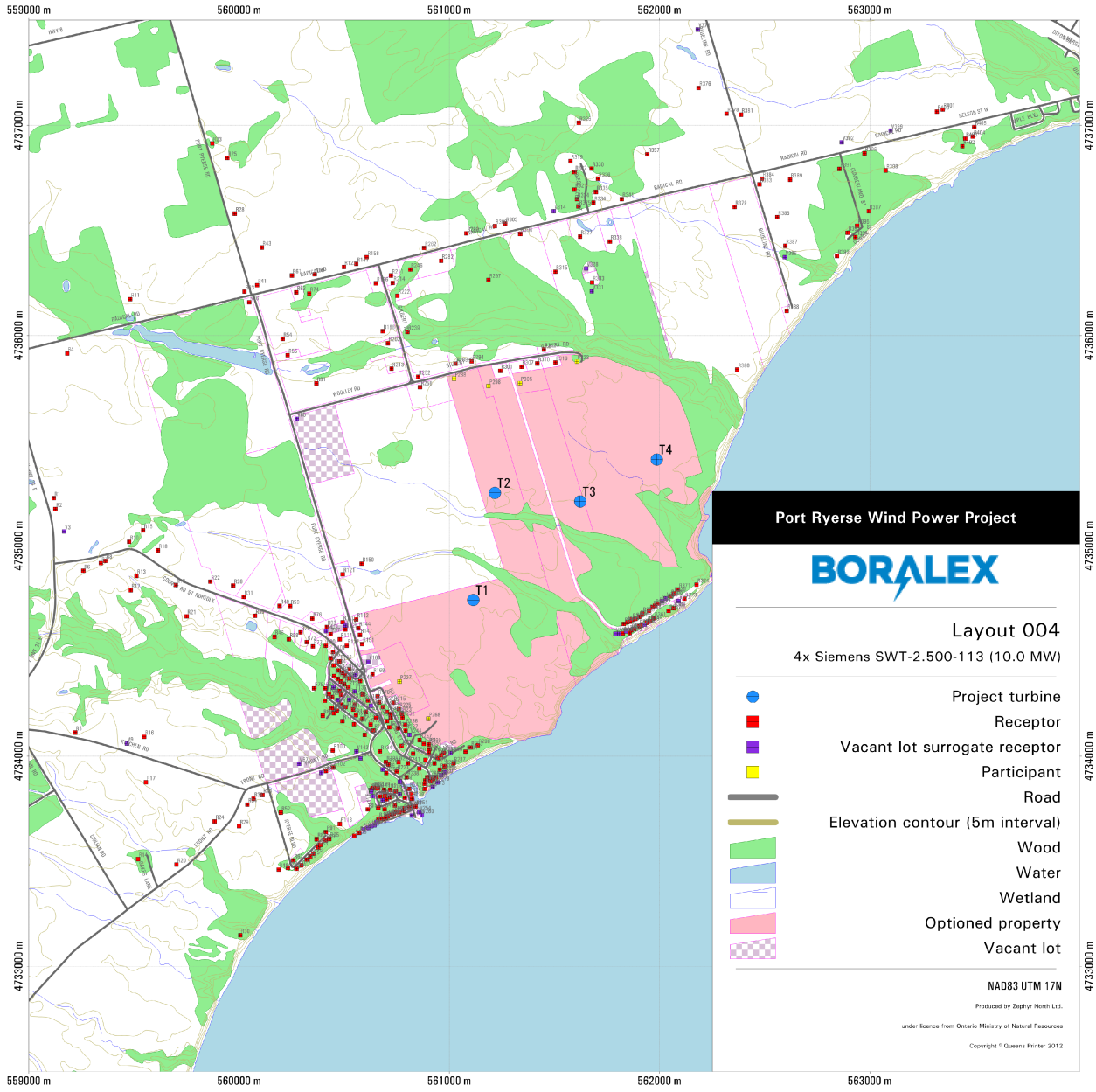

Figure 2-1 Project site map.

3 DESCRIPTION OF RECEPTORS

3.1 Definition

Receptors (non-participating points of reception), vacant lot surrogate receptors (VLSRs), and participants (participating points of reception) are defined in Ontario MoE NPC-232 (MoE, 1995b) and Noise Guidelines (MoE, 2008) publications, and in Ontario O.Reg. 359/09 and proposed amendments (Government of Ontario; 2009b, 2010, 2011, 2012).

3.2 Determination

Receptors and participants were identified through mapping, aerial photographs, and on-site surveys of the area by Borelex Inc. Typically, for this area receptors are residential dwellings of individuals and families not associated with the subject project. Section 12 lists the locations and details of all known receptors and participants situated within a minimum of 2.0 km of any project turbine. Their locations are also shown in Figure 2-1. All receptors within 1.5 km of any PRWPP wind turbine have been included and reported in this noise impact analysis. All receptors have been considered to be designated as rural (NPC Class 3).

For the purpose of noise assessment, participants have been defined as dwellings occupied by landowners who receive financial compensation for the placement of project hardware (turbines, cables, roads, substations, *etc.*) on their properties.

For information, 290 receptors, 49 VLSRs, and 6 participants (total 345) have been identified within 2.0 km of any PRWPP turbine; 49 vacant lots have also been identified within 2.0 km of any project turbine; 257 receptors, 45 VLSRs, and 6 participants (total 308) have been identified within 1.5 km of any PRWPP turbine; x vacant lots have also been identified within 1.5 km of any project turbine.

3.3 Vacant Lots

The MoE (2008) Noise Guidelines also require prediction of the noise levels on "...vacant lots that have been zoned by the local municipality to permit residential

or similar noise-sensitive uses...". Therefore, all vacant lots within approximately 2.0 km of any turbine or substation in the PRWPP were identified as those lots defined by the complete set of cadastral parcel fabric which did not contain a receptor dwelling, nor a participant dwelling, nor project infrastructure (turbine, cable, substation, *etc.*), and were obviously not road rights-of-way, public property, industrial or commercial property, *etc*. A 1 ha "building envelope within the vacant lot property that would reasonably be expected to contain the use, and that conforms with the municipal zoning by-laws in effect" was also identified for each of the vacant lots by determining a location within the lot where the predicted noise level would be below the allowed maxima. A 'vacant lot surrogate receptor' (VLSR) located in the 1 ha building envelope and designated with a height of 4.5 m was created for the purpose of noise estimation. The VLSRs are listed in Section 12 (Appendix A).

3.4 Methodology

ISO 9613-2 modelling was carried out for all receptors, participants and VLSRs.

Typically, a resultant sound pressure level for each receptor/ VLSR/participant is determined as stipulated in Section 6.3.1 of MoE (2008) where there is no qualifying transformer within the project, and as stipulated in Section 6.3.2 where there is a qualifying transformer. In the case of this project, where there is no substation and transformers, Section 6.3.1 was used.

The heights of dwellings designated as 1-, 2-, and 3-storeys were set to be 1.5, 4.5, and 7.5 m respectively.

For areas where there is such a high density of receptors that it would be impractical (and tedious for the reader) to include them all, a comprehensive selection of sample receptors (HDSRs, High Density Sample Receptors) were designated. These specific receptors were sampled so as to represent the cluster of all receptors in such a way that the sample receptors would be those subject to the maximum sound pressure levels from the surrounding turbines. Typically, receptors at all corners, along all boundaries, and in the centre of the high density cluster were chosen with (generally) a maximum separation of 200 m between sample receptors where possible. All sample receptors were assigned a height of 4.5 m to ensure that any 2-storey residences within the cluster were represented.

As noted above, participating receptors (referred to herein as participants) have also been surveyed and are shown in Figure 2-1 and listed in Section 12 . Estimates of sound pressure levels were made for the participant locations.

It should be noted that the receptors, participants and VLSRs listed in Section 12 include those that are closer than or equal to 1,500 m from any project turbine or qualifying substation transformer (if existent) noise source.

4 DESCRIPTION OF SOURCES

4.1 Wind Turbines

4.1.1 Port Ryerse Wind Power Project

The turbines proposed for the Port Ryerse Wind Project are manufactured by Siemens Wind Systems A/S (www.siemens.com) of Germany. Siemens Wind Power A/S is a relative newcomer to the ranks of wind turbine manufacturers. However, it entered the market by purchasing the long-standing and experienced Bonus turbine manufacturing company. The turbine model proposed is the Siemens SWT-3.0-113 (Max power 2500 kW).

4.1.1.1 Siemens SWT-3.0-113 (Max Power 2500 kW)

The Siemens SWT-3.0-113 (Max Power 2500 kW) is a noise- and power-reduced member of the Siemens SWT-3.0-113 turbine family.

The following table summarizes this turbine's characteristics.

	Siemens SWT-3.0-113 (Max Power 2500 kW)
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	2,500 kW
Rotor diameter; swept area	113.0 m; 10,000 m^2
Operational rotation rate	6.0 to 15.5 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	3 to 5 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	12 to 13 ms^{-1}
Gearbox	none
Generator; speed	synchronous permanent magnet generator
Turbine transformer	external, at base of tower

	Siemens SWT-3.0-113 (Max Power 2500 kW)
Braking system	aerodynamic primary brake by full-span pitching with hydraulic activation; 3 caliper hydraulic brake at generator rear end
Yaw system	active, externally geared, passive friction brake

4.2 Transformer Substations

As noted previously, there is no substation associated with this project.

5 NOISE EMISSION RATINGS

5.1 Turbine Noise Definition Standard

The commonly accepted global wind turbine noise definition Standard is IEC-61400-11 (IEC, 2002). The MoE (2008) Guidelines require that, "...acoustic emission information must be determined and reported in accordance with the international standard CAN/CSA-C61400-11-07." Fortunately, these two Standards are completely equivalent as confirmed in the preamble to the description of the CAN/CSA-C61400-11-07 Standard (CSA, 2007) as follows.

> "**CSA Preface**
> This is the first edition of CAN/CSA-C61400-11, Wind turbine generator systems - Part 11: Acoustic noise measurement techniques, which is an adoption without modification of the identically titled IEC (International Electrotechnical Commission) Standard 61400-11 (edition 2:2002 consolidated with amendment 1:2006). At the time of publication, IEC 61400-11:2002+A1:2006 is available from IEC in English only. CSA will publish the French version when it becomes available from IEC."

In this report, the IEC-61400-11 and CAN/CSA-C61400-11-07 Standards have been used interchangeably.

5.2 Wind Turbines

5.2.1 Port Ryerse Wind Power Project

5.2.1.1 Siemens SWT-3.0-113 (Max Power 2500 kW)

Siemens SWT-3.0-113 (Max Power 2500 kW) turbine source sound power level broadband data for 10 m (a.g.l.) wind speeds of 4 to 12 ms^{-1} to cut-out (25 ms^{-1}) and octave band data for 10 m wind speeds of 6, 7, 8, 9, and 10 ms^{-1} were provided in Siemens Wind Power A/S documentation supplied by Boralex Inc. This documentation is shown in Section 13 .

The broadband and octave band noise information was used with a power law wind shear exponent of 0.50 (see below for derivation) to synthesize / interpolate / extrapolate octave band source sound power levels for 10 m a.g.l. wind speeds of 6, 7, 8, 9, and 10 ms^{-1} as required by MoE (2008).

In addition, sensitivity tests were performed with the 'raw' (*i.e.*, unadjusted) 'Manufacturer's emission levels'. Figure 5-1 shows the results of these tests for a series of 4.5 m height receptors placed at 50 m intervals between 550 and 1500 m from a single SWT-3.0-113 (Max Power 2500 kW) turbine. The graph shows the receptor sound pressure level as a function of distance from the turbine using each of the raw octave band source sound power level sets corresponding to the 10 m a.g.l. 6, 7, 8, 9, and 10 ms^{-1} wind speeds. The "predictable worst case" for all distances occurs for the10 m a.g.l. 7 ms^{-1} wind speed. As a consequence of these tests, for this turbine the 10 m a.g.l. 7 ms^{-1} wind speed set of octave band source sound power levels has been used for all noise assessment calculations in the ISO 9613-2 modelling sound propagation.

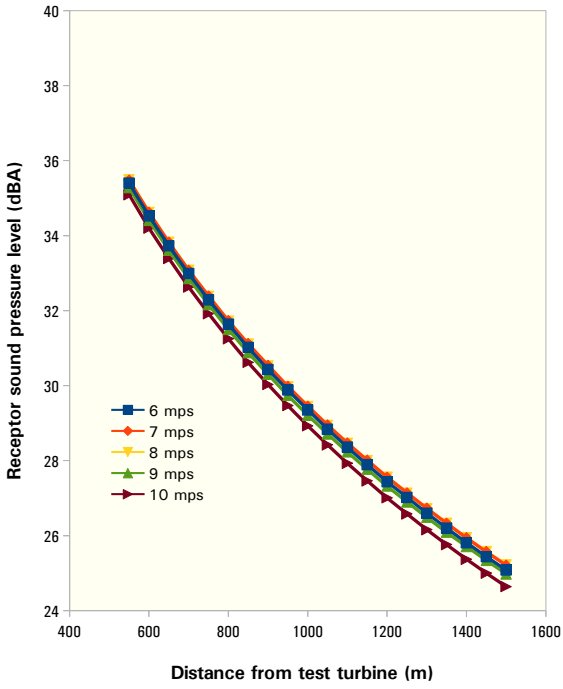

Figure 5-1 SWT-3.0-113 (MP 2500 kW) wind speed sensitivity test.

In the documentation shown in Section 13 , Siemens Wind Power A/S states that, "Typical, not warranted tonal audibility for the SWT-3.0-113 wind turbine generators shall not exceed 2 dB as determined in accordance with IEC 61400-11:2002." No tonal penalty has been applied to this turbine.

The 10 m a.g.l. wind speed broadband and octave band source sound power levels for the Siemens SWT-3.0-113 (Max Power 2500 kW) turbine for a hub height of 99.5 m are shown in Table 5-1. Note that the 'Adjusted emission levels' for *all* wind speeds have all been set to those corresponding to the 'Manufacturer's emission levels' 10 m a.g.l. 7 ms^{-1} wind speed set of octave band source sound power levels since these correspond to the MoE-defined "predictable worst case" as shown above.

Table 5-1 Siemens SWT-3.0-113 (Max Power 2500 kW) — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-3.0-113 (Max Power 2500 kW)										
Rating: 2,500 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.50										
	Octave band sound power level (dB)									
	Manufacturer's emission levels (10 m a.g.l)					Adjusted emission levels (10 m a.g.l.)				
Wind speed (ms^{-1})	6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
Frequency (Hz) 63	115.7	116.1	117.7	117.8	117.5	116.1	116.1	116.1	116.1	116.1
125	108.7	109.1	109.1	108.6	107.8	109.1	109.1	109.1	109.1	109.1
250	105.0	105.1	104.0	103.4	102.7	105.1	105.1	105.1	105.1	105.1
500	98.1	98.0	97.6	97.4	97.2	98.0	98.0	98.0	98.0	98.0
1000	95.0	94.9	95.0	94.9	95.2	94.9	94.9	94.9	94.9	94.9
2000	92.9	92.8	93.9	94.0	94.7	92.8	92.8	92.8	92.8	92.8
4000	90.2	90.8	90.8	92.6	92.9	90.8	90.8	90.8	90.8	90.8
8000	103.0	83.0	85.2	85.2	85.2	83.0	83.0	83.0	83.0	83.0
A-weighted	102.4	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5	102.5

5.3 Site-Specific Vertical Wind Shear Exponent

Boralex Inc. in association with UDI Renewables is presently unable to provide a site-specific summer night-time vertical wind shear exponent from *in situ* measurements. As a consequence, Zephyr North has used the extremely conservative value of 0.50 for this quantity in adjustments for hub-height winds speeds with respect to determination of "Adjusted emission levels". The 0.50 value is higher than any value that Zephyr North has previously reviewed or calculated for the north shore of Lake Erie.

However, it is important to note that no summer night-time vertical wind shear adjusted octave band source sound power levels were used in the ISO 9613-2 modelling. Rather, the 'unadjusted Manufacturer's emission levels' for the (10 m a.g.l.) 7 ms^{-1} wind speed set of octave band source sound power levels were used since these correspond to the MoE-defined "predictable worst case"

5.4 Substations

5.4.1 Port Ryerse Wind Power Project

5.4.1.1 Substation

As noted above, there is no transformer substation associated with this project.

6 IMPACT ASSESSMENT

6.1 Methodology

Cumulative turbine and transformer (where existent) sound levels were estimated at each of the receptors using the methodology of the ISO 9613-2 Standard (ISO, 1996). Wind turbine and transformer (where existent) octave band and A-weighted sound power values, standardized meteorological conditions, turbine/transformer locations, receptor/ VLSR/ participant locations, and characteristics were used to determine the A-weighted sound pressure levels at all receptors.

6.2 Specific Parameters

a)

Analysis was carried out for turbine source sound power levels in eight octave bands (63 to 8,000 Hz) corresponding to 10 m (a.g.l.) ambient wind speeds of 6, 7, 8, 9, and 10 ms^{-1}.

b)

ISO 9613-2 parameters, as prescribed in the MoE (2008) Noise Guidelines were set as follows:

Ambient air temperature: 10 C
Ambient humidity: 70 %

The required atmospheric attenuation coefficients to be used in the ISO 9613-2 modelling of noise propagation are prescribed in MoE (2008). These have been used in the present assessment, and are shown in the following table.

Atmospheric Absorption Coefficients								
Centre Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Atmospheric Absorption Coefficient (dB/km) from MoE (2008)	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

c)

The ISO 9613-2 Standard term for Ground Attenuation was calculated using the "General" Method (Section 7.3.1 of the Standard). Ground factors were assigned the following values within limits as stipulated by the MoE (2008) Guidelines.

Source ground factor: 1.0 (soft ground)
Middle ground factor: 0.8 (soft ground)
Receptor ground factor: 0.5 (hard/soft ground)

6.3 Additional parameters and conditions

Sound pressure levels were not calculated for any receptor for which there was no PRWPP turbine closer than 1,500 m.

For any receptor, turbines further than 5,000 m away were not included in the calculations.

No additional adjustments were made for wind speed or direction since the ISO 9613-2 Standard assumes worst-case conditions for these parameters with respect to noise impact.

6.4 Results

Results are reported in Tables 7-1, 7-2 and 7-3 found in Section 7 and the noise level isopleth map of Section 8 .

As a brief summary, Table 6-1 below is a sorted list of the receptors and VLSRs with the 25 highest sound pressure levels determined in the analysis.

Table 6-1 Highest noise levels at receptors.

Receptor ID	SPrL (dBA)	Height (m)	Nearest Turbine	Project / Other	Distance (m)
R343	38.6	4.5	T3	P	618
R316	38.6	4.5	T4	P	668
R362	38.5	4.5	T3	P	609
R365	38.5	4.5	T3	P	612
R364	38.5	4.5	T3	P	613
V366	38.5	4.5	T3	P	616
R353	38.5	4.5	T3	P	616
R370	38.5	4.5	T3	P	623
R307	38.5	4.5	T2	P	613
R310	38.5	4.5	T2	P	647
R301	38.4	4.5	T2	P	581
V339	38.4	4.5	T3	P	651
V406	38.3	4.5	T3	P	657
V344	38.2	4.5	T3	P	655
R150	38.1	4.5	T1	P	558
R374	38.0	4.5	T4	P	626
V410	37.9	4.5	T3	P	661
V372	37.7	4.5	T3	P	666
R312	37.7	4.5	T2	P	721
R345	37.7	1.5	T3	P	616
R349	37.7	1.5	T3	P	613
R355	37.6	1.5	T3	P	609
R360	37.6	1.5	T3	P	609
R371	37.6	1.5	T3	P	627
R347	37.6	1.5	T3	P	619
R351	37.6	1.5	T3	P	617
WindFarm layout file: PRy12-Trbn-WFL004.csv					

7 NOISE LEVEL SUMMARY TABLES

Table 7-1 Receptor noise level summary table.

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R19	Residence	4.5	1417	T1	29.8	29.8	29.8	29.8	29.8	40.0	43.0	45.0	49.0	51.0
R21	Residence	4.5	1366	T1	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R22	Residence	4.5	1254	T1	30.9	30.9	30.9	30.9	30.9	40.0	43.0	45.0	49.0	51.0
R26	Residence	4.5	1144	T1	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
R31	Residence	4.5	1093	T1	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
R34	Residence	4.5	1449	T1	28.9	28.9	28.9	28.9	28.9	40.0	43.0	45.0	49.0	51.0
R36	Residence	4.5	1478	T2	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
R38	Residence	4.5	1410	T1	29.1	29.1	29.1	29.1	29.1	40.0	43.0	45.0	49.0	51.0
R39	Residence	4.5	1042	T1	32.3	32.3	32.3	32.3	32.3	40.0	43.0	45.0	49.0	51.0
R44	Residence	4.5	1366	T1	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
R46	Residence	4.5	962	T1	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R49	Residence	4.5	921	T1	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R52	Residence	4.5	1365	T1	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
R54	Residence	4.5	1247	T2	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R55	Residence	4.5	1183	T2	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R58	Residence	4.5	897	T1	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R59	Residence	4.5	873	T1	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R61	Residence	4.5	1415	T2	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R63	Residence	4.5	1343	T2	30.5	30.5	30.5	30.5	30.5	40.0	43.0	45.0	49.0	51.0
R70	Residence	4.5	836	T1	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R72	Residence	4.5	818	T1	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R73	Residence	4.5	1468	T1	28.7	28.7	28.7	28.7	28.7	40.0	43.0	45.0	49.0	51.0
R74	Residence	4.5	1296	T2	30.8	30.8	30.8	30.8	30.8	40.0	43.0	45.0	49.0	51.0
R75	Residence	4.5	1445	T1	28.9	28.9	28.9	28.9	28.9	40.0	43.0	45.0	49.0	51.0
R76	Residence	4.5	771	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R77	Residence	4.5	794	T1	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R78	Residence	4.5	1427	T1	29.0	29.0	29.0	29.0	29.0	40.0	43.0	45.0	49.0	51.0
R79	Residence	4.5	867	T1	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R80	Residence	4.5	1347	T2	30.5	30.5	30.5	30.5	30.5	40.0	43.0	45.0	49.0	51.0
R81	Residence	4.5	996	T2	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
R82	Residence	4.5	1360	T1	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R83	Residence	4.5	1390	T1	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R84	Residence	4.5	1373	T1	29.3	29.3	29.3	29.3	29.3	40.0	43.0	45.0	49.0	51.0
R86	Residence	4.5	903	T1	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R87	Residence	4.5	853	T1	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R88	Residence	4.5	821	T1	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R89	Residence	4.5	1343	T1	29.5	29.5	29.5	29.5	29.5	40.0	43.0	45.0	49.0	51.0
R90	Residence	4.5	734	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R91	Residence	4.5	1308	T1	29.8	29.8	29.8	29.8	29.8	40.0	43.0	45.0	49.0	51.0
R92	Residence	4.5	1073	T1	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R93	Residence	4.5	709	T1	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R94	Residence	4.5	818	T1	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R95	Residence	4.5	1327	T1	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
R96	Residence	4.5	734	T1	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R97	Residence	4.5	697	T1	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R98	Residence	4.5	847	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R99	Residence	4.5	815	T1	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R100	Residence	4.5	979	T1	32.3	32.3	32.3	32.3	32.3	40.0	43.0	45.0	49.0	51.0
R101	Residence	4.5	711	T1	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R102	Residence	4.5	1039	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R104	Residence	4.5	733	T1	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R105	Residence	4.5	854	T1	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R106	Residence	4.5	755	T1	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
R107	Residence	4.5	836	T1	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R109	Residence	4.5	747	T1	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R110	Residence	4.5	722	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R111	Residence	4.5	770	T1	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R112	Residence	4.5	700	T1	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R113	Residence	4.5	1241	T1	30.2	30.2	30.2	30.2	30.2	40.0	43.0	45.0	49.0	51.0
R114	Residence	4.5	661	T1	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R115	Residence	4.5	774	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R116	Residence	4.5	739	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R117	Residence	4.5	800	T1	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R118	Residence	4.5	848	T1	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R119	Residence	4.5	712	T1	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R120	Residence	4.5	631	T1	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R121	Residence	4.5	633	T1	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R122	Residence	4.5	1292	T2	30.9	30.9	30.9	30.9	30.9	40.0	43.0	45.0	49.0	51.0
R123	Residence	4.5	733	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R124	Residence	4.5	708	T1	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R125	Residence	4.5	625	T1	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R126	Residence	4.5	794	T1	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R127	Residence	4.5	640	T1	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R128	Residence	4.5	726	T1	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R130	Residence	4.5	698	T1	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R132	Residence	4.5	676	T1	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R133	Residence	4.5	773	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R134	Residence	4.5	819	T1	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R135	Residence	4.5	1256	T1	30.1	30.1	30.1	30.1	30.1	40.0	43.0	45.0	49.0	51.0
R137	Residence	4.5	752	T1	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R140	Residence	4.5	782	T1	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R141	Residence	4.5	1273	T2	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R142	Residence	4.5	564	T1	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R144	Residence	4.5	562	T1	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R145	Residence	4.5	1233	T1	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
R147	Residence	4.5	564	T1	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R148	Residence	4.5	662	T1	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R150	Residence	4.5	558	T1	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
R151	Residence	4.5	569	T1	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R152	Residence	4.5	773	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R153	Residence	4.5	691	T1	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R156	Residence	4.5	824	T1	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R157	Residence	4.5	740	T1	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R158	Residence	4.5	1275	T2	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R159	Residence	4.5	1115	T1	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
R162	Residence	4.5	692	T1	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R164	Residence	4.5	767	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R166	Residence	4.5	1026	T1	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R168	Residence	4.5	596	T1	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R170	Residence	4.5	1013	T1	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
R171	Residence	4.5	780	T1	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
R175	Residence	4.5	727	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R176	Residence	4.5	1146	T2	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
R178	Residence	4.5	646	T1	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
R179	Residence	4.5	1005	T1	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
R180	Residence	4.5	1086	T1	31.4	31.4	31.4	31.4	31.4	40.0	43.0	45.0	49.0	51.0
R181	Residence	4.5	1135	T1	31.0	31.0	31.0	31.0	31.0	40.0	43.0	45.0	49.0	51.0
R182	Residence	4.5	661	T1	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R183	Residence	4.5	1035	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R184	Residence	4.5	847	T1	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R186	Residence	4.5	1126	T1	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R188	Residence	4.5	936	T2	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R190	Residence	4.5	666	T1	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R191	Residence	4.5	998	T1	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
R192	Residence	4.5	1082	T1	31.4	31.4	31.4	31.4	31.4	40.0	43.0	45.0	49.0	51.0
R193	Residence	4.5	1024	T1	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R194	Residence	4.5	1116	T1	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
R195	Residence	4.5	877	T1	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
R196	Residence	4.5	921	T1	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R197	Residence	4.5	1035	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R198	Residence	4.5	672	T1	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R199	Residence	4.5	708	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R200	Residence	4.5	1106	T1	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
R202	Residence	4.5	874	T2	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R203	Residence	4.5	881	T1	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
R204	Residence	4.5	726	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R206	Residence	4.5	987	T1	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R207	Residence	4.5	1018	T1	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
R208	Residence	4.5	671	T1	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R209	Residence	4.5	1096	T1	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
R210	Residence	4.5	685	T1	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R211	Residence	4.5	1145	T2	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
R213	Residence	4.5	768	T2	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R214	Residence	4.5	1111	T2	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R215	Residence	4.5	619	T1	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R216	Residence	4.5	1085	T1	31.4	31.4	31.4	31.4	31.4	40.0	43.0	45.0	49.0	51.0
R217	Residence	4.5	1047	T1	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
R219	Residence	4.5	985	T1	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R220	Residence	4.5	1075	T1	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R221	Residence	4.5	893	T1	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
R222	Residence	4.5	1046	T2	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R223	Residence	4.5	707	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R224	Residence	4.5	850	T1	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R225	Residence	4.5	628	T1	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R226	Residence	4.5	1068	T1	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R230	Residence	4.5	773	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R231	Residence	4.5	638	T1	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R232	Residence	4.5	654	T1	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R233	Residence	4.5	1057	T1	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
R234	Residence	4.5	997	T1	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R235	Residence	4.5	1042	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R236	Residence	4.5	677	T1	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R237	Residence	4.5	700	T1	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R238	Residence	4.5	901	T1	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R239	Residence	4.5	871	T2	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R241	Residence	4.5	837	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R242	Residence	4.5	949	T1	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R243	Residence	4.5	1031	T1	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R246	Residence	4.5	1136	T2	32.3	32.3	32.3	32.3	32.3	40.0	43.0	45.0	49.0	51.0
R247	Residence	4.5	968	T1	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R249	Residence	4.5	989	T1	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R250	Residence	4.5	785	T1	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
R251	Residence	4.5	1021	T1	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
R252	Residence	4.5	662	T2	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R256	Residence	4.5	842	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R257	Residence	4.5	714	T1	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R258	Residence	4.5	615	T2	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R261	Residence	4.5	724	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R262	Residence	4.5	1212	T2	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R263	Residence	4.5	905	T1	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R264	Residence	4.5	928	T1	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R265	Residence	4.5	890	T1	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
R266	Residence	4.5	793	T1	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R267	Residence	4.5	871	T1	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R269	Residence	4.5	719	T1	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R270	Residence	4.5	758	T1	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R271	Residence	4.5	739	T1	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R272	Residence	4.5	887	T1	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
R274	Residence	4.5	873	T1	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R275	Residence	4.5	799	T1	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R276	Residence	4.5	863	T1	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R277	Residence	4.5	770	T1	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R279	Residence	4.5	824	T1	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R281	Residence	4.5	755	T1	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R282	Residence	4.5	1132	T2	32.5	32.5	32.5	32.5	32.5	40.0	43.0	45.0	49.0	51.0
R283	Residence	4.5	742	T1	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R284	Residence	4.5	803	T1	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R287	Residence	4.5	783	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R289	Residence	4.5	642	T2	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R291	Residence	4.5	723	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R292	Residence	4.5	1241	T2	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R293	Residence	4.5	702	T1	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R294	Residence	4.5	636	T2	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R296	Residence	4.5	692	T1	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R297	Residence	4.5	1012	T2	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R300	Residence	4.5	1269	T2	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R301	Residence	4.5	581	T2	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R303	Residence	4.5	1281	T2	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R306	Residence	4.5	1237	T2	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R307	Residence	4.5	613	T2	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R310	Residence	4.5	647	T2	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R312	Residence	4.5	721	T2	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R315	Residence	4.5	1015	T4	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R316	Residence	4.5	668	T4	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R319	Residence	4.5	1476	T4	30.1	30.1	30.1	30.1	30.1	40.0	43.0	45.0	49.0	51.0
R321	Residence	4.5	1342	T4	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R322	Residence	4.5	1422	T4	30.5	30.5	30.5	30.5	30.5	40.0	43.0	45.0	49.0	51.0
R324	Residence	4.5	1294	T4	31.4	31.4	31.4	31.4	31.4	40.0	43.0	45.0	49.0	51.0
R325	Residence	4.5	1259	T4	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R327	Residence	4.5	1121	T4	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
R330	Residence	4.5	1417	T4	30.4	30.4	30.4	30.4	30.4	40.0	43.0	45.0	49.0	51.0
R333	Residence	4.5	897	T4	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
R334	Residence	4.5	1257	T4	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R335	Residence	4.5	1304	T4	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R336	Residence	4.5	1364	T4	30.7	30.7	30.7	30.7	30.7	40.0	43.0	45.0	49.0	51.0
R338	Residence	4.5	1060	T4	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R341	Residence	4.5	1249	T4	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
R342	Residence	1.5	659	T3	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R343	Residence	4.5	618	T3	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R345	Residence	1.5	616	T3	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R346	Residence	1.5	668	T3	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R347	Residence	1.5	619	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R348	Residence	1.5	658	T3	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R349	Residence	1.5	613	T3	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R350	Residence	1.5	659	T3	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R351	Residence	1.5	617	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R352	Residence	1.5	655	T3	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R353	Residence	4.5	616	T3	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R354	Residence	1.5	657	T3	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R355	Residence	1.5	609	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R356	Residence	1.5	657	T3	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R357	Residence	4.5	1453	T4	29.8	29.8	29.8	29.8	29.8	40.0	43.0	45.0	49.0	51.0
R358	Residence	1.5	614	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R359	Residence	1.5	660	T3	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R360	Residence	1.5	609	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R361	Residence	1.5	657	T3	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R362	Residence	4.5	609	T3	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R364	Residence	4.5	613	T3	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R367	Residence	1.5	669	T3	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R368	Residence	1.5	622	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R369	Residence	1.5	674	T3	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
R370	Residence	4.5	623	T3	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R371	Residence	1.5	627	T3	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R373	Residence	1.5	676	T4	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R374	Residence	4.5	626	T4	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R379	Residence	4.5	1256	T4	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
R380	Residence	4.5	574	T4	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R383	Residence	4.5	1396	T4	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
R384	Residence	4.5	1426	T4	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
R385	Residence	4.5	1287	T4	30.2	30.2	30.2	30.2	30.2	40.0	43.0	45.0	49.0	51.0
R387	Residence	4.5	1186	T4	30.9	30.9	30.9	30.9	30.9	40.0	43.0	45.0	49.0	51.0
R388	Residence	4.5	939	T4	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R389	Residence	4.5	1473	T4	29.0	29.0	29.0	29.0	29.0	40.0	43.0	45.0	49.0	51.0
R390	Residence	4.5	1292	T4	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R393	Residence	4.5	1409	T4	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R394	Residence	4.5	1418	T4	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R395	Residence	4.5	1464	T4	28.9	28.9	28.9	28.9	28.9	40.0	43.0	45.0	49.0	51.0

Table 7-2 Vacant lot surrogate receptor noise level summary table.

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
V65	VLSR	4.5	1007	T2	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
V67	VLSR	4.5	1138	T1	31.0	31.0	31.0	31.0	31.0	40.0	43.0	45.0	49.0	51.0
V85	VLSR	4.5	1095	T1	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
V103	VLSR	4.5	784	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
V108	VLSR	4.5	802	T1	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V131	VLSR	4.5	757	T1	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
V136	VLSR	4.5	714	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
V139	VLSR	4.5	664	T1	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
V143	VLSR	4.5	910	T1	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
V149	VLSR	4.5	926	T1	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
V154	VLSR	4.5	1209	T1	30.5	30.5	30.5	30.5	30.5	40.0	43.0	45.0	49.0	51.0
V161	VLSR	4.5	1194	T1	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
V163	VLSR	4.5	579	T1	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
V165	VLSR	4.5	700	T1	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
V167	VLSR	4.5	1180	T1	30.7	30.7	30.7	30.7	30.7	40.0	43.0	45.0	49.0	51.0
V169	VLSR	4.5	1050	T1	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
V173	VLSR	4.5	1171	T1	30.8	30.8	30.8	30.8	30.8	40.0	43.0	45.0	49.0	51.0
V177	VLSR	4.5	1151	T1	30.9	30.9	30.9	30.9	30.9	40.0	43.0	45.0	49.0	51.0
V185	VLSR	4.5	1046	T1	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
V189	VLSR	4.5	914	T1	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
V228	VLSR	4.5	933	T1	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
V229	VLSR	4.5	989	T1	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
V244	VLSR	4.5	710	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
V248	VLSR	4.5	1066	T1	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
V254	VLSR	4.5	1041	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
V260	VLSR	4.5	1053	T1	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
V273	VLSR	4.5	911	T1	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
V278	VLSR	4.5	885	T1	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
V280	VLSR	4.5	848	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
V285	VLSR	4.5	830	T1	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
V286	VLSR	4.5	736	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
V314	VLSR	4.5	1278	T4	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
V328	VLSR	4.5	968	T4	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V331	VLSR	4.5	858	T4	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
V339	VLSR	4.5	651	T3	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
V344	VLSR	4.5	655	T3	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
V365	VLSR	4.5	612	T3	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
V366	VLSR	4.5	616	T3	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
V372	VLSR	4.5	666	T3	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V386	VLSR	4.5	1139	T4	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
V406	VLSR	4.5	657	T3	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
V407	VLSR	4.5	1034	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
V408	VLSR	4.5	620	T1	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V409	VLSR	4.5	716	T1	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
V410	VLSR	4.5	661	T3	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0

Table 7-3 Participant noise level summary table.

Participating Receptor ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6.0	7.0	8.0	9.0	10.0
P227	Residence	4.5	523	T1	37.5	37.5	37.5	37.5	37.5
P268	Residence	4.5	604	T1	36.3	36.3	36.3	36.3	36.3
P288	Residence	4.5	577	T2	37.8	37.8	37.8	37.8	37.8
P298	Residence	4.5	509	T2	39.2	39.2	39.2	39.2	39.2
P305	Residence	4.5	536	T2	39.5	39.5	39.5	39.5	39.5
P323	Residence	4.5	601	T4	38.7	38.7	38.7	38.7	38.7

8 NOISE LEVEL ISOPLETH MAP

Figure 8-1 is a noise-level isopleth map of the sound pressure levels (dBA) generated by all qualified sources over the project region. Note that this map does not correspond to any specific 10 m a.g.l. wind speed. This is because the MoE "predictable worst case" octave band source sound power levels taken directly from "unadjusted" manufacturer's octave band source sound power levels have been used for the project turbine type (see Section 5.2.1.1). For information, the "predictable worst case" for the project turbines has been determined to occur for octave band source sound power levels corresponding to the 10 m a.g.l. wind speed of 7 ms^{-1} for the SWT-3.0-113 (Max Power 2500 kW).

The noise levels are calculated for receptors with 1.5 m (1 storey) and 4.5 m (2 storeys) heights.

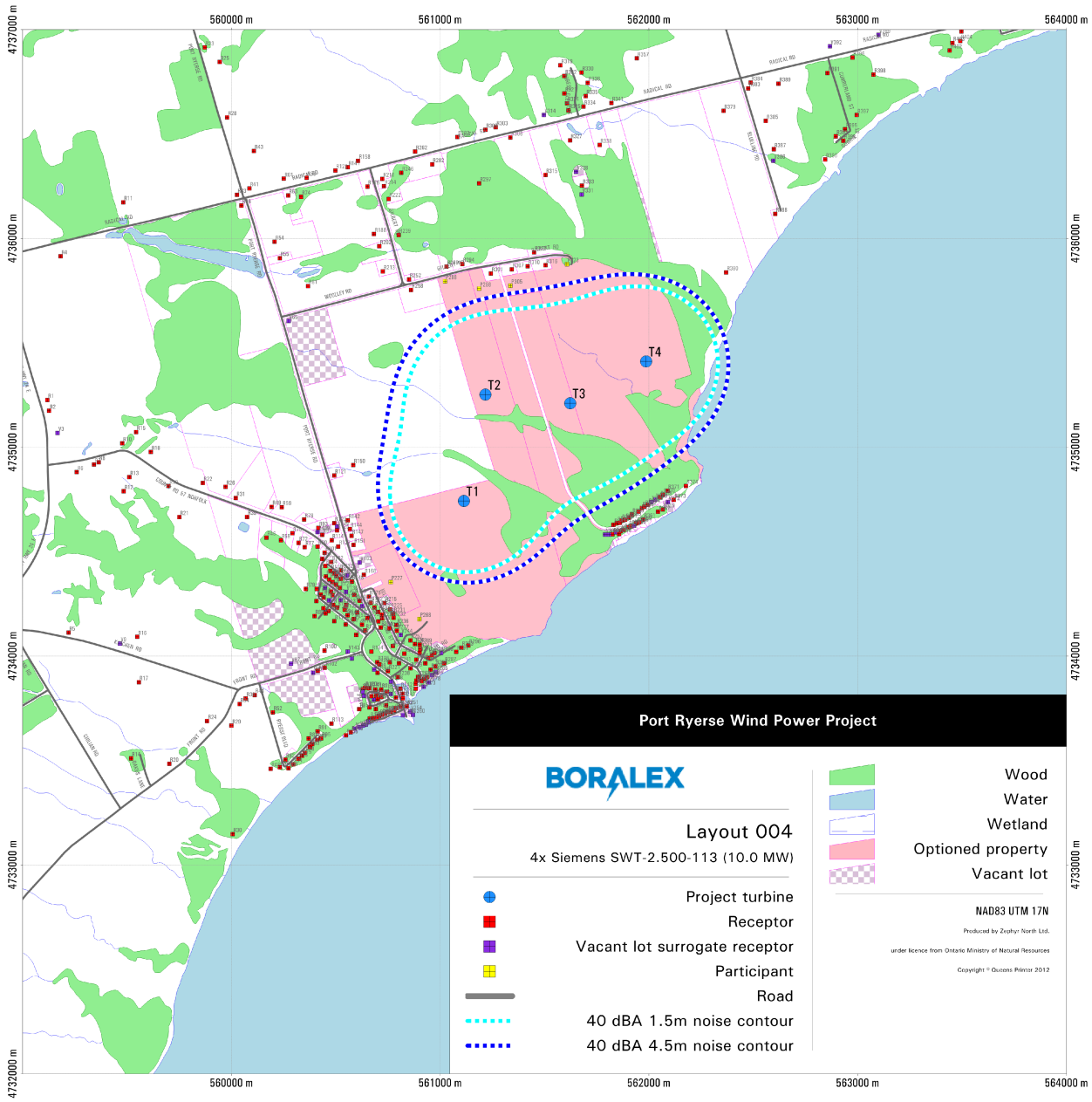

Figure 8-1 40 dBA noise isopleth map for 1.5 and 4.5 m receptor heights.

9 EXAMPLE CALCULATION

9.1 Method of Calculation

The calculation of cumulative receptor noise levels from turbines and transformers uses the methodology of ISO 9613-2 (ISO, 1996).

The calculation is based on equation (5) from ISO 9613-2 shown here:

$$L_{AT}(DW) = 10\log_{10}\left\{\sum_{i=1}^{n}\left[\sum_{j=1}^{8} 10^{0.1\left[L_{ft}(ij)+A_f(j)\right]}\right]\right\}$$

where

$L_{AT}(DW)$ is the equivalent continuous A-weighted downwind sound pressure level at a receptor location,

n is the number of turbines,

$A_f(j)$ is the standard A-weighting for octave band j,

j is an index indicating the eight standard octave-band mid-band frequencies from 63 Hz to 8 kHz,

$L_{fT}(ij) \equiv L_{fT}(DW)$ is the equivalent continuous downwind octave-band sound pressure level at a receptor location for turbine i and octave band j, and is given by

$$L_{ft}(DW) = L_W + D_C - A$$

where

L_W is the octave-band sound power level, in decibels, produced by the point sound source relative to a reference sound power of one picowatt,

D_C is the directivity correction in decibels,

A is the octave-band attenuation, in decibels, that occurs during propagation from the turbine to receptor, and is given by

$$A = A_{\text{div}} + A_{atm} + A_{gr} + A_{\text{bar}} + A_{misc}$$

where

A_{div} is the attenuation due to geometrical divergence,

A_{atm} is the attenuation due to atmospheric absorption,

A_{gr} is the attenuation due to the ground effect,

A_{bar} is the attenuation due to a barrier,

A_{misc} is the attenuation due to miscellaneous other effects,

A_{atm} is given by

$$A = \frac{\alpha d}{1000}$$

where

α is the atmospheric attenuation coefficient, in decibels per kilometre, for each octave band at the midband frequency,

d is the distance from the turbine to the receptor.

Note also that A_{bar} and A_{misc} are not used here.

9.1 Example

The following sample calculation presents intermediate octave-band results of calculations for A-weighted sound pressure levels. All model parameters are the same as previously tabulated.

Table 9-1 lists the intermediate sound pressure levels calculated at receptor R343 due to the single turbine T3. Receptor and turbine are separated by 618 m. Note that the

Table 9-1 Sample calculation for receptor and turbine.

Intermediate calculations for receptor R343 and turbine T3						
Octave band	**Mid-band frequency (Hz)**	**L_W (dBA)**	**A_{div} (dB)**	**A_{atm} (dB)**	**A_{gr} (dB)**	**L_{fT}(DW) (dBA)**
1	63	89.9	66.8	0.1	-3.0	26.0
2	125	93.0	66.8	0.2	1.0	24.9
3	250	96.5	66.8	0.6	-0.1	29.1
4	500	94.8	66.8	1.2	-0.7	27.6
5	1000	94.9	66.8	2.3	-0.7	26.5
6	2000	94.0	66.8	6.0	-0.8	21.9
7	4000	91.8	66.8	20.3	-0.8	5.5
8	8000	81.9	66.8	72.3	-0.8	-56.5

resultant A-weighted sound pressure level at R343 due to turbine T3 alone is 34.3 dBA.

In the table:

L_W is the octave-band sound power level, in decibels, produced by the point sound source relative to a reference sound power of one picowatt,

A_{div} is the attenuation due to geometrical divergence,

A_{atm} is the attenuation due to atmospheric absorption,

A_{gr} is the attenuation due to the ground effect, $L_{fT}(DW)$ is the equivalent continuous downwind octave-band sound pressure level.

Table 9-2 shows intermediate octave band values of the calculations for the A-weighted sound pressure levels at receptor R343 due to all turbines and transformers (if existent) within 5,000 m of the receptor. The resultant A-weighted sound pressure level at R343 due to all turbines is 38.6 dBA.

Table 9-2 Sample calculation for single receptor and multiple turbines.

Intermediate calculations for R343 and multiple turbines										
Turbine ID	Distance (m)	Turbine L_{ft} contribution (dB) in frequency band (Hz)								Turbine L_{AT} (dBA)
		63	125	250	500	1000	2000	4000	8000	
T1	726	50.8	39.5	36.2	29.2	24.7	18.3	-0.5	-69.4	32.7
T2	875	49.2	37.8	34.4	27.3	22.6	15.2	-7.0	-88.4	30.8
T3	618	52.2	41.0	37.7	30.8	26.5	20.7	4.5	-55.4	34.3
T4	797	50.0	38.7	35.3	28.2	23.7	16.8	-3.6	-78.6	31.8

10 CONCLUSIONS

This noise impact assessment for the proposed Port Ryerse Wind Power Project has determined that the estimated sound pressure levels at receptors and vacant lot surrogate receptors (VLSRs) in the project area comply with the Ontario Ministry of Environment sound level limits at all qualified points of reception.

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12 APPENDIX A — TURBINE, RECEPTOR, VACANT LOT AND PARTICIPANT LOCATIONS

This appendix contains lists of turbine, receptor, vacant lot surrogate receptor (VLSR), and participant locations. Coordinates are given in the Universal Transverse Mercator (UTM) Zone 17 North projection. The datum is North American Datum 1983 (NAD83, Canada).

Turbines

Project Name: Port Ryerse Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17N

Identifier	Equipment Make and Model	X(E,m)	Y(N,m)	Remarks
T1	Siemens SWT 2.500-113	561114	4734743	PRWPP
T2	Siemens SWT 2.500-113	561217	4735252	PRWPP
T3	Siemens SWT 2.500-113	561623	4735211	PRWPP
T4	Siemens SWT 2.500-113	561987	4735411	PRWPP

Transformer Stations

Project Name: Port Ryerse Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17N

There will not be a transformer station within the Port Ryerse Wind Power Project.

Points of Reception (Receptors)

Table - Point of Reception Locations
Project Name: Port Ryerse Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17N

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
R19	Residence	4.5	3	559699	4734814
R21	Residence	4.5	3	559750	4734665
R22	Residence	4.5	3	559863	4734829
R26	Residence	4.5	3	559972	4734811
R31	Residence	4.5	3	560021	4734757
R34	Residence	4.5	3	560040	4733770
R36	Residence	4.5	3	560049	4736158
R38	Residence	4.5	3	560068	4733797
R39	Residence	4.5	3	560075	4734667
R44	Residence	4.5	3	560112	4733814
R46	Residence	4.5	3	560168	4734567
R49	Residence	4.5	3	560193	4734715
R52	Residence	4.5	3	560198	4733731
R54	Residence	4.5	3	560207	4735984
R55	Residence	4.5	3	560231	4735906
R58	Residence	4.5	3	560237	4734555
R59	Residence	4.5	3	560242	4734713
R61	Residence	4.5	3	560251	4736286
R63	Residence	4.5	3	560272	4736206
R70	Residence	4.5	3	560292	4734588
R72	Residence	4.5	3	560321	4734542
R73	Residence	4.5	3	560321	4733508
R74	Residence	4.5	3	560334	4736200
R75	Residence	4.5	3	560339	4733523
R76	Residence	4.5	3	560348	4734654
R77	Residence	4.5	3	560351	4734522
R78	Residence	4.5	3	560352	4733536
R79	Residence	4.5	3	560356	4734322
R80	Residence	4.5	3	560360	4736291
R81	Residence	4.5	3	560367	4735772
R82	Residence	4.5	3	560369	4733605
R83	Residence	4.5	3	560377	4733565
R84	Residence	4.5	3	560387	4733578
R86	Residence	4.5	3	560398	4734192
R87	Residence	4.5	3	560408	4734264
R88	Residence	4.5	3	560409	4734322
R89	Residence	4.5	3	560411	4733599
R90	Residence	4.5	3	560413	4734525
R91	Residence	4.5	3	560413	4733639
R92	Residence	4.5	3	560414	4733930
R93	Residence	4.5	3	560417	4734615
R94	Residence	4.5	3	560429	4734295
R95	Residence	4.5	3	560430	4733606
R96	Residence	4.5	3	560435	4734465
R97	Residence	4.5	3	560436	4734581
R98	Residence	4.5	3	560441	4734229
R99	Residence	4.5	3	560442	4734281
R100	Residence	4.5	3	560446	4734027
R101	Residence	4.5	3	560447	4734496
R102	Residence	4.5	3	560448	4733945
R104	Residence	4.5	3	560450	4734432

R105	Residence	4.5	3	560451	4734204
R106	Residence	4.5	3	560452	4734381
R107	Residence	4.5	3	560465	4734216
R109	Residence	4.5	3	560469	4734367
R110	Residence	4.5	3	560474	4734408
R111	Residence	4.5	3	560477	4734310
R112	Residence	4.5	3	560478	4734451
R113	Residence	4.5	3	560479	4733677
R114	Residence	4.5	3	560480	4734555
R115	Residence	4.5	3	560485	4734292
R116	Residence	4.5	3	560485	4734355
R117	Residence	4.5	3	560488	4734245
R118	Residence	4.5	3	560492	4734167
R119	Residence	4.5	3	560492	4734396
R120	Residence	4.5	3	560492	4734637
R121	Residence	4.5	3	560493	4734865
R122	Residence	4.5	3	560498	4736326
R123	Residence	4.5	3	560500	4734342
R124	Residence	4.5	3	560503	4734385
R125	Residence	4.5	3	560505	4734602
R126	Residence	4.5	3	560506	4734233
R127	Residence	4.5	3	560512	4734525
R128	Residence	4.5	3	560519	4734327
R130	Residence	4.5	3	560524	4734370
R132	Residence	4.5	3	560525	4734412
R133	Residence	4.5	3	560543	4734222
R134	Residence	4.5	3	560547	4734152
R135	Residence	4.5	3	560549	4733621
R137	Residence	4.5	3	560550	4734245
R140	Residence	4.5	3	560556	4734195
R141	Residence	4.5	3	560557	4736341
R142	Residence	4.5	3	560558	4734650
R144	Residence	4.5	3	560568	4734609
R145	Residence	4.5	3	560572	4733635
R147	Residence	4.5	3	560575	4734576
R148	Residence	4.5	3	560576	4734357
R150	Residence	4.5	3	560583	4734915
R151	Residence	4.5	3	560585	4734533
R152	Residence	4.5	3	560587	4734178
R153	Residence	4.5	3	560589	4734293
R156	Residence	4.5	3	560598	4734101
R157	Residence	4.5	3	560602	4734209
R158	Residence	4.5	3	560607	4736372
R159	Residence	4.5	3	560612	4733747
R162	Residence	4.5	3	560614	4734265
R164	Residence	4.5	3	560626	4734151
R166	Residence	4.5	3	560629	4733839
R168	Residence	4.5	3	560635	4734389
R170	Residence	4.5	3	560639	4733848
R171	Residence	4.5	3	560640	4734123
R175	Residence	4.5	3	560651	4734182
R176	Residence	4.5	3	560651	4736248
R178	Residence	4.5	3	560658	4734285
R179	Residence	4.5	3	560660	4733846
R180	Residence	4.5	3	560662	4733755
R181	Residence	4.5	3	560663	4733701
R182	Residence	4.5	3	560667	4734256
R183	Residence	4.5	3	560670	4733808
R184	Residence	4.5	3	560670	4734022
R186	Residence	4.5	3	560682	4733703

R188	Residence	4.5	3	560683	4736021
R190	Residence	4.5	3	560685	4734233
R191	Residence	4.5	3	560689	4733840
R192	Residence	4.5	3	560692	4733747
R193	Residence	4.5	3	560693	4733810
R194	Residence	4.5	3	560698	4733707
R195	Residence	4.5	3	560698	4733971
R196	Residence	4.5	3	560700	4733920
R197	Residence	4.5	3	560701	4733794
R198	Residence	4.5	3	560703	4734211
R199	Residence	4.5	3	560704	4734166
R200	Residence	4.5	3	560708	4733714
R202	Residence	4.5	3	560708	4735963
R203	Residence	4.5	3	560710	4733960
R204	Residence	4.5	3	560715	4734137
R206	Residence	4.5	3	560718	4733839
R207	Residence	4.5	3	560719	4733805
R208	Residence	4.5	3	560721	4734199
R209	Residence	4.5	3	560721	4733720
R210	Residence	4.5	3	560723	4734181
R211	Residence	4.5	3	560723	4736285
R213	Residence	4.5	3	560725	4735842
R214	Residence	4.5	3	560731	4736251
R215	Residence	4.5	3	560734	4734255
R216	Residence	4.5	3	560736	4733726
R217	Residence	4.5	3	560741	4733765
R219	Residence	4.5	3	560745	4733830
R220	Residence	4.5	3	560749	4733732
R221	Residence	4.5	3	560750	4733928
R222	Residence	4.5	3	560753	4736189
R223	Residence	4.5	3	560756	4734133
R224	Residence	4.5	3	560759	4733971
R225	Residence	4.5	3	560760	4734224
R226	Residence	4.5	3	560763	4733734
R230	Residence	4.5	3	560774	4734049
R231	Residence	4.5	3	560775	4734203
R232	Residence	4.5	3	560777	4734183
R233	Residence	4.5	3	560780	4733740
R234	Residence	4.5	3	560788	4733801
R235	Residence	4.5	3	560788	4733753
R236	Residence	4.5	3	560791	4734148
R237	Residence	4.5	3	560792	4734121
R238	Residence	4.5	3	560797	4733900
R239	Residence	4.5	3	560801	4736017
R241	Residence	4.5	3	560803	4733966
R242	Residence	4.5	3	560809	4733844
R243	Residence	4.5	3	560810	4733758
R246	Residence	4.5	3	560814	4736314
R247	Residence	4.5	3	560820	4733821
R249	Residence	4.5	3	560822	4733798
R250	Residence	4.5	3	560828	4734012
R251	Residence	4.5	3	560839	4733760
R252	Residence	4.5	3	560851	4735804
R256	Residence	4.5	3	560857	4733941
R257	Residence	4.5	3	560858	4734076
R258	Residence	4.5	3	560861	4735754
R261	Residence	4.5	3	560879	4734058
R262	Residence	4.5	3	560880	4736416
R263	Residence	4.5	3	560883	4733868
R264	Residence	4.5	3	560883	4733844

R265	Residence	4.5	3	560885	4733883
R266	Residence	4.5	3	560886	4733983
R267	Residence	4.5	3	560894	4733900
R269	Residence	4.5	3	560902	4734056
R270	Residence	4.5	3	560902	4734015
R271	Residence	4.5	3	560905	4734034
R272	Residence	4.5	3	560911	4733880
R274	Residence	4.5	3	560923	4733891
R275	Residence	4.5	3	560929	4733966
R276	Residence	4.5	3	560936	4733899
R277	Residence	4.5	3	560944	4733992
R279	Residence	4.5	3	560954	4733935
R281	Residence	4.5	3	560961	4734004
R282	Residence	4.5	3	560961	4736355
R283	Residence	4.5	3	560973	4734015
R284	Residence	4.5	3	560977	4733952
R287	Residence	4.5	3	561019	4733966
R289	Residence	4.5	3	561030	4735866
R291	Residence	4.5	3	561077	4734021
R292	Residence	4.5	3	561082	4736486
R293	Residence	4.5	3	561101	4734041
R294	Residence	4.5	3	561106	4735878
R296	Residence	4.5	3	561135	4734051
R297	Residence	4.5	3	561187	4736264
R300	Residence	4.5	3	561217	4736521
R301	Residence	4.5	3	561243	4735832
R303	Residence	4.5	3	561266	4736532
R306	Residence	4.5	3	561337	4736483
R307	Residence	4.5	3	561343	4735852
R310	Residence	4.5	3	561419	4735867
R312	Residence	4.5	3	561450	4735934
R315	Residence	4.5	3	561504	4736304
R316	Residence	4.5	3	561504	4735872
R319	Residence	4.5	3	561576	4736829
R321	Residence	4.5	3	561595	4736694
R322	Residence	4.5	3	561595	4736778
R324	Residence	4.5	3	561607	4736648
R325	Residence	4.5	3	561614	4736613
R327	Residence	4.5	3	561622	4736471
R330	Residence	4.5	3	561677	4736794
R333	Residence	4.5	3	561679	4736253
R334	Residence	4.5	3	561686	4736631
R335	Residence	4.5	3	561697	4736682
R336	Residence	4.5	3	561708	4736746
R338	Residence	4.5	3	561764	4736447
R341	Residence	4.5	3	561820	4736649
R342	Residence	1.5	3	561826	4734584
R343	Residence	4.5	3	561831	4734629
R345	Residence	1.5	3	561846	4734637
R346	Residence	1.5	3	561857	4734585
R347	Residence	1.5	3	561860	4734639
R348	Residence	1.5	3	561865	4734599
R349	Residence	1.5	3	561868	4734649
R350	Residence	1.5	3	561880	4734604
R351	Residence	1.5	3	561886	4734653
R352	Residence	1.5	3	561901	4734618
R353	Residence	4.5	3	561905	4734663
R354	Residence	1.5	3	561915	4734622
R355	Residence	1.5	3	561918	4734678
R356	Residence	1.5	3	561940	4734635

R357	Residence	4.5	3	561942	4736863
R358	Residence	1.5	3	561950	4734691
R359	Residence	1.5	3	561955	4734641
R360	Residence	1.5	3	561966	4734708
R361	Residence	1.5	3	561973	4734655
R362	Residence	4.5	3	561978	4734716
R364	Residence	4.5	3	561996	4734725
R367	Residence	1.5	3	562044	4734691
R368	Residence	1.5	3	562052	4734761
R369	Residence	1.5	3	562066	4734703
R370	Residence	4.5	3	562067	4734774
R371	Residence	1.5	3	562089	4734792
R373	Residence	1.5	3	562119	4734748
R374	Residence	4.5	3	562177	4734815
R379	Residence	4.5	3	562357	4736611
R380	Residence	4.5	3	562370	4735838
R383	Residence	4.5	3	562475	4736719
R384	Residence	4.5	3	562487	4736746
R385	Residence	4.5	3	562561	4736563
R387	Residence	4.5	3	562598	4736427
R388	Residence	4.5	3	562605	4736118
R389	Residence	4.5	3	562621	4736741
R390	Residence	4.5	3	562844	4736378
R393	Residence	4.5	3	562895	4736489
R394	Residence	4.5	3	562932	4736468
R395	Residence	4.5	3	562940	4736523

Vacant Lot Surrogate Receptors

Table - Vacant Lot Surrogate Receptor Locations

Project Name: Port Ryerse Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
V65	VLSR	4.5	3	560274	4735605
V67	VLSR	4.5	3	560285	4733964
V85	VLSR	4.5	3	560391	4733920
V103	VLSR	4.5	3	560449	4734327
V108	VLSR	4.5	3	560468	4734267
V131	VLSR	4.5	3	560524	4734268
V136	VLSR	4.5	3	560549	4734307
V139	VLSR	4.5	3	560554	4734387
V143	VLSR	4.5	3	560558	4734022
V149	VLSR	4.5	3	560577	4733989
V154	VLSR	4.5	3	560592	4733653
V161	VLSR	4.5	3	560614	4733659
V163	VLSR	4.5	3	560615	4734449
V165	VLSR	4.5	3	560627	4734240
V167	VLSR	4.5	3	560630	4733667
V169	VLSR	4.5	3	560635	4733809
V173	VLSR	4.5	3	560644	4733671
V177	VLSR	4.5	3	560655	4733688
V185	VLSR	4.5	3	560682	4733790
V189	VLSR	4.5	3	560684	4733936
V228	VLSR	4.5	3	560764	4733878
V229	VLSR	4.5	3	560765	4733818

V244	VLSR	4.5	3	560811	4734101
V248	VLSR	4.5	3	560821	4733718
V254	VLSR	4.5	3	560856	4733734
V260	VLSR	4.5	3	560870	4733719
V273	VLSR	4.5	3	560921	4733853
V278	VLSR	4.5	3	560944	4733874
V280	VLSR	4.5	3	560960	4733909
V285	VLSR	4.5	3	560979	4733924
V286	VLSR	4.5	3	561006	4734015
V314	VLSR	4.5	3	561497	4736591
V328	VLSR	4.5	3	561652	4736319
V331	VLSR	4.5	3	561678	4736211
V339	VLSR	4.5	3	561790	4734582
V344	VLSR	4.5	3	561841	4734593
V365	VLSR	4.5	3	562011	4734738
V366	VLSR	4.5	3	562031	4734749
V372	VLSR	4.5	3	562091	4734737
V386	VLSR	4.5	3	562596	4736373
V406	VLSR	4.5	3	561809	4734581
V407	VLSR	4.5	3	560629	4733830
V408	VLSR	4.5	3	560506	4734621
V409	VLSR	4.5	3	560414	4734594
V410	VLSR	4.5	3	561928	4734625

Participating Receptors (Participants)

Table - Participating Receptor Locations

Project Name: Port Ryerse Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17N

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
P227	Residence	4.5	3	560763	4734355
P268	Residence	4.5	3	560900	4734178
P288	Residence	4.5	3	561023	4735795
P298	Residence	4.5	3	561187	4735760
P305	Residence	4.5	3	561337	4735774
P323	Residence	4.5	3	561607	4735877

13 APPENDIX B — ADDITIONAL DOCUMENTATION

The following document is included in this Appendix.

SWT-3.0-113, Max. Power 2500 kW, Contract Acoustic Emission, Hub Height 99.5 m, Port Ryerse – Ontario - Canada

This document from Siemens A/S lists broadband source sound power levels for 4 to 12 ms^{-1} to cut-out (measured at 10 m a.g.l.) and octave band source sound power levels for 6, 7, 8, 9, and 10 ms^{-1} (10 m a.g.l.). This document also contains a statement with respect to the turbine tonal audibility.

SIEMENS

Contract Acoustic Emission, SWT-3.0-113, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-E-CA00112-947-0
HST, JES / 2013.03.20
Confidential

SWT-3.0-113, Rev. 0, Max. Power 2500 kW
Contract Acoustic Emission, Hub Height 99.5 m
Port Ryerse - Ontario - Canada

Sound Power Levels

The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 99.5 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (LWA) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	4	5	6	7	8	9	10	11	12	Up to cut-out
Max. Power 2500kW	95.3	99.7	102.4	102.5	102.5	102.5	102.5	102.5	102.5	102.5

Typical Octave Bands

Typical, not warranted octave band spectra are tabulated below referenced to 10 m height.

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	89.5	89.9	91.5	91.6	91.3
125	92.6	93.0	93.0	92.5	91.7
250	96.4	96.5	95.4	94.8	94.1
500	94.9	94.8	94.4	94.2	94.0
1000	95.0	94.9	95.0	94.9	95.2
2000	94.1	94.0	95.1	95.2	95.9
4000	91.2	91.8	91.8	93.6	93.9
8000	81.8	81.9	84.1	84.1	84.1

Table 2: Typical octave bands for 6-10 m/s, L_{WA} [dB(A) re 1 pW]

Tonality

Typical, not warranted tonal audibility for the SWT-3.0-113 wind turbine generators shall not exceed 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

A measurement uncertainty range of -1.5dB(A) and +1.5dB(A) is applicable.

END

Appendix D

Noise Assessment Report