Port Ryerse Wind Power Project

NOISE ASSESSMENT REPORT

Revision 6

For

BORALEX

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By

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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 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 Revision 5

For Revision 5, the following items were addressed.

Using (new) 2013 air-photos, the project list of receptors and VLSRs located within 2,000 m of a turbine were updated. This included the addition of new receptors, and the deletion of VLSRs (due to the presence of updated receptors).

The category of High Density Surrogate Receptor (HDSR) was removed from the receptor list. All known receptors, VLSRs, and participants within 2,000 m of a project turbine were included in the assessment.

Note that Ontario MoE requested a demonstration the topographic flatness/concavity/convexity for the "worst case sample". All turbine/receptor pairs were addressed in a separate email.

Minor corrections and editorial changes were included.

1.8 Revision 6

In the present Revision (6), the following items have been addressed.

Section 14 (Appendix C) has been created to include two turbine Test Report Summaries — one for the Siemens SWT-3.2-113 turbine, and one for the Siemens SWT-2.3-113 turbine. Also included is a letter to the Ontario Ministry of Environment from Siemens Canada Limited.

1.9 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. These turbines will be customized to a nameplate capacity of 2.500 MW, and will be

referred to as SWT-3.0-113 (Max Power 2,500kW) turbines. The project will feature a total maximum nameplate capacity of 10 MW. Other basic components of the wind farm will 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.

1.10 Reporting Details

Figure 1-1 Project location map.

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. Note that the MoE NPC documents (*e.g.*, NPC205, NPC32, LU-131, *etc.*) have recently been replaced by NPC-300 (MoE, 2013)

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.

1.11 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.

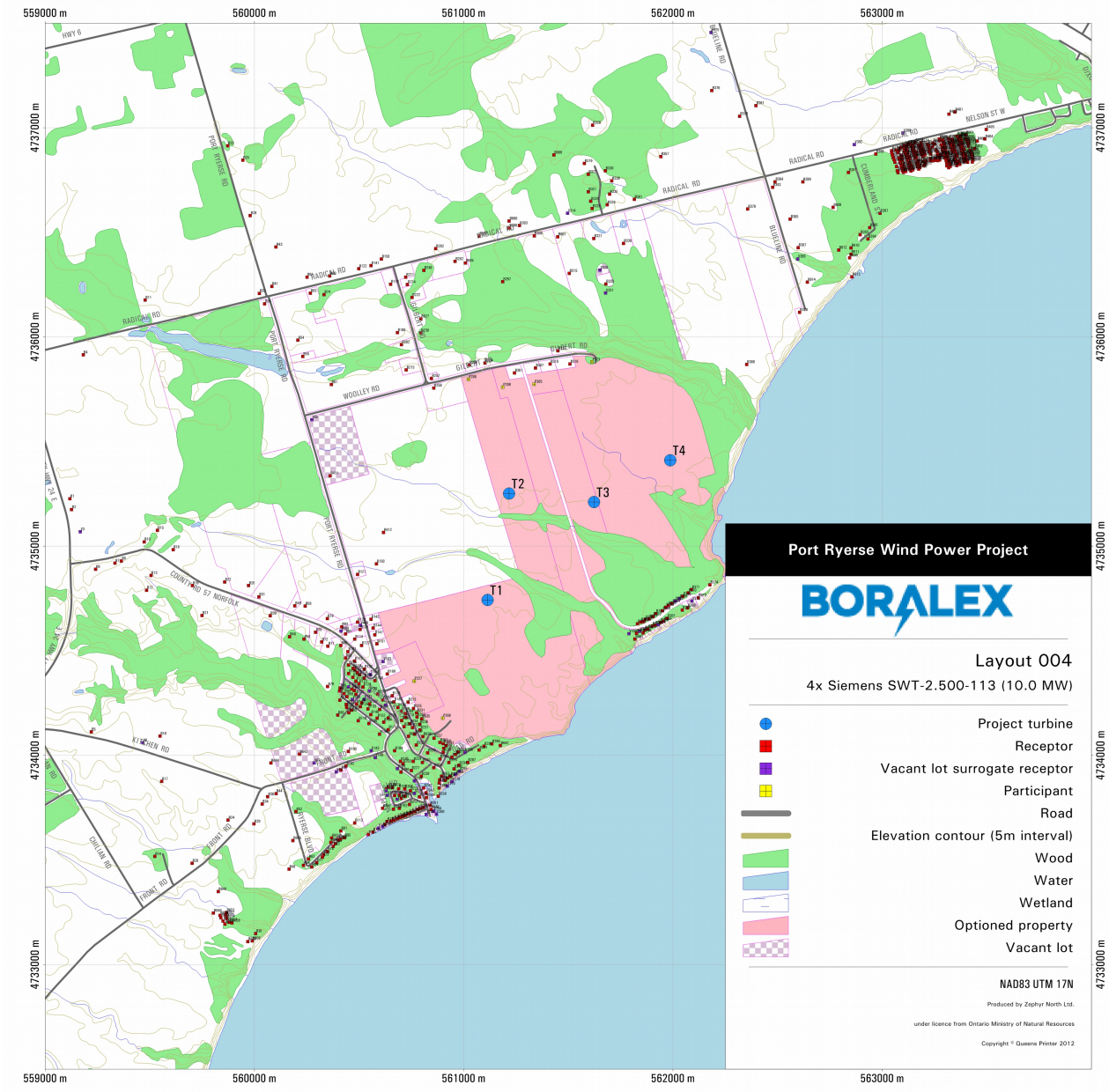

Figure 2-1 Project site map.

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). As noted previously, Ontario MoE NPC-232 has been replaced by the recently published MoE NPC-300 (2013).

3.2 Determination

Receptors and participants were identified through mapping, aerial photographs, and on-site surveys of the area by Boralex 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, 484 receptors, 44 VLSRs, and 6 participants (total 534) have been identified within 2.0 km of any PRWPP turbine; 44 vacant lots have also been identified within 2.0 km of any project turbine; 293 receptors, 40 VLSRs, and 6 participants (total 339) have been identified within 1.5 km of any PRWPP turbine; 40 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 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 .

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 transformer(s), 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.

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. The proposed project turbine model 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
Braking system	aerodynamic primary brake by full-span pitching with hydraulic activation; 3 caliper hydraulic brake at generator rear end

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

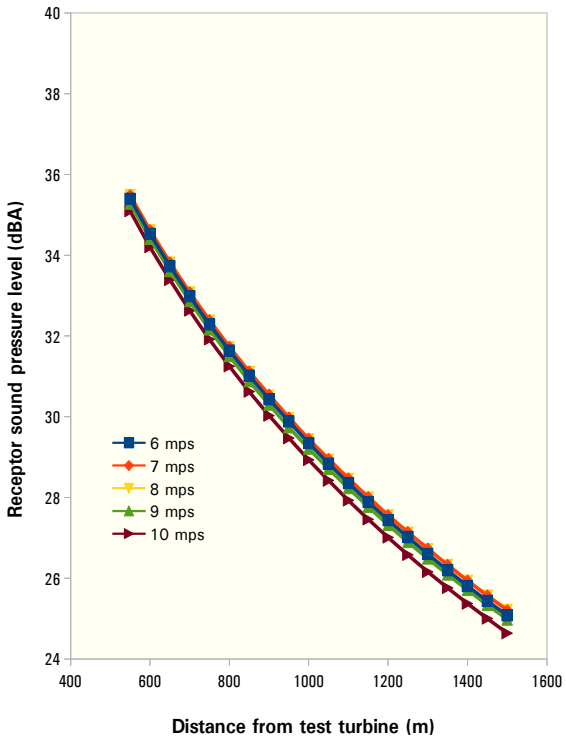

Figure 5-1 SWT-3.0-113 (MP 2500 kW) wind speed sensitivity test.

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	663
R362	38.5	4.5	T3	P	609
V365	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
R301	38.5	4.5	T2	P	577
R370	38.5	4.5	T3	P	625
R307	38.5	4.5	T2	P	613
R310	38.4	4.5	T2	P	649
V339	38.4	4.5	T3	P	651
V344	38.2	4.5	T3	P	655
R150	38.1	4.5	T1	P	558
R374	38.0	4.5	T4	P	626
R661	38.0	4.5	T3	P	683
V410	38.0	4.5	T3	P	661
V372	37.9	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
R368	37.6	1.5	T3	P	619
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	1413	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	1259	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	1453	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	1411	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	1371	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	1348	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
R71	Residence	4.5	1498	T1	28.5	28.5	28.5	28.5	28.5	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	1460	T1	28.8	28.8	28.8	28.8	28.8	40.0	43.0	45.0	49.0	51.0
R74	Residence	4.5	1298	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	1448	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	1425	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	869	T1	33.4	33.4	33.4	33.4	33.4	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

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
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
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	984	T1	32.2	32.2	32.2	32.2	32.2	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	1043	T1	31.7	31.7	31.7	31.7	31.7	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	752	T1	34.7	34.7	34.7	34.7	34.7	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	743	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	721	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	845	T1	33.6	33.6	33.6	33.6	33.6	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	1258	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

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
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
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	1237	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	734	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	766	T1	34.4	34.4	34.4	34.4	34.4	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
R167	Residence	4.5	1180	T1	30.7	30.7	30.7	30.7	30.7	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
R173	Residence	4.5	1163	T1	30.8	30.8	30.8	30.8	30.8	40.0	43.0	45.0	49.0	51.0
R175	Residence	4.5	737	T1	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R176	Residence	4.5	1149	T2	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
R177	Residence	4.5	1153	T1	30.9	30.9	30.9	30.9	30.9	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	1097	T1	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
R181	Residence	4.5	1143	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	1130	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	669	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	1122	T1	31.1	31.1	31.1	31.1	31.1	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	1110	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	877	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

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
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	1102	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
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	1091	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	1080	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	1070	T1	31.5	31.5	31.5	31.5	31.5	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	1049	T1	31.7	31.7	31.7	31.7	31.7	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	875	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	1040	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R246	Residence	4.5	1142	T2	32.2	32.2	32.2	32.2	32.2	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	663	T2	36.5	36.5	36.5	36.5	36.5	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	709	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R258	Residence	4.5	619	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	719	T1	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R262	Residence	4.5	1222	T2	31.7	31.7	31.7	31.7	31.7	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

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
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
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	1139	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	643	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	719	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	1238	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	699	T1	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R294	Residence	4.5	635	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	688	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	577	T2	38.5	38.5	38.5	38.5	38.5	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	649	T2	38.4	38.4	38.4	38.4	38.4	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	663	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	1258	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

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
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
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	667	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	619	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	675	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	625	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	672	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	586	T4	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R383	Residence	4.5	1393	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	1422	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
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
R411	Residence	1.5	859	T2	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R412	Residence	1.5	593	T1	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
R605	Residence	4.5	1121	T2	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
R606	Residence	4.5	1302	T2	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
R607	Residence	4.5	1195	T4	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R609	Residence	4.5	1437	T4	29.1	29.1	29.1	29.1	29.1	40.0	43.0	45.0	49.0	51.0
R610	Residence	4.5	1334	T4	29.7	29.7	29.7	29.7	29.7	40.0	43.0	45.0	49.0	51.0
R611	Residence	4.5	1309	T4	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R612	Residence	4.5	1287	T4	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R613	Residence	4.5	1234	T4	30.4	30.4	30.4	30.4	30.4	40.0	43.0	45.0	49.0	51.0
R614	Residence	4.5	1074	T4	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R627	Residence	4.5	936	T2	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R629	Residence	4.5	717	T1	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R630	Residence	4.5	775	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R631	Residence	4.5	831	T1	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R632	Residence	4.5	840	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R633	Residence	4.5	777	T1	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R634	Residence	4.5	699	T1	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R635	Residence	4.5	649	T1	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R636	Residence	4.5	722	T1	34.8	34.8	34.8	34.8	34.8	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
R637	Residence	4.5	729	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R638	Residence	4.5	754	T1	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R639	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
R640	Residence	4.5	1037	T1	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R641	Residence	4.5	725	T1	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R642	Residence	4.5	699	T1	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R643	Residence	4.5	1163	T1	30.8	30.8	30.8	30.8	30.8	40.0	43.0	45.0	49.0	51.0
R644	Residence	4.5	1297	T1	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R645	Residence	4.5	1479	T1	28.7	28.7	28.7	28.7	28.7	40.0	43.0	45.0	49.0	51.0
R646	Residence	4.5	1352	T1	29.5	29.5	29.5	29.5	29.5	40.0	43.0	45.0	49.0	51.0
R647	Residence	4.5	1379	T1	29.3	29.3	29.3	29.3	29.3	40.0	43.0	45.0	49.0	51.0
R661	Residence	4.5	683	T3	38.0	38.0	38.0	38.0	38.0	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
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
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
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
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	578	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.

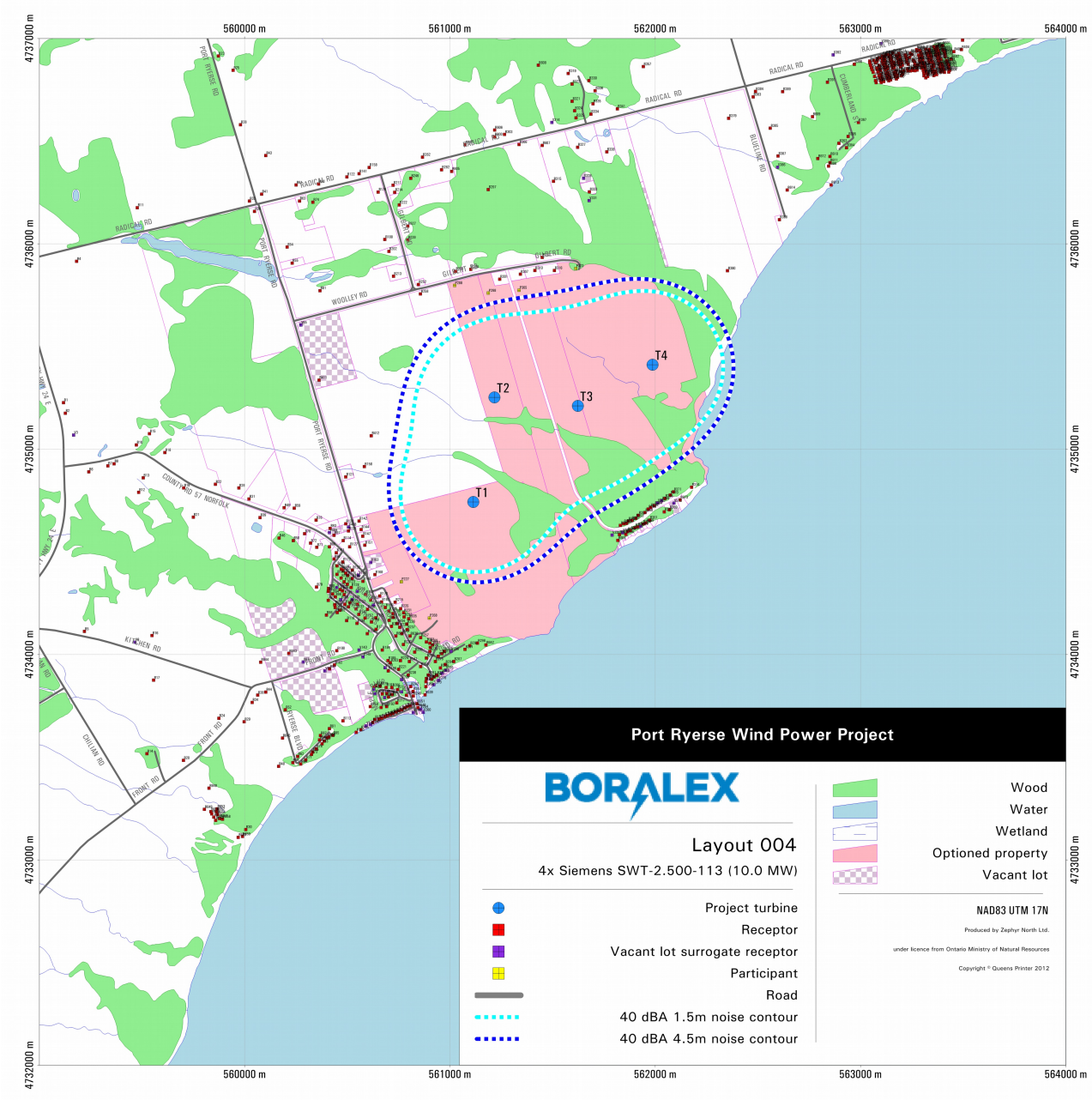

Figure 8-1 40 dBA noise isopleth map for 1.5 and 4.5 m receptor heights.

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-3.0-113 (Max Power 2,500 kW)	561114	4734743	PRWPP
T2	Siemens SWT-3.0-113 (Max Power 2,500 kW)	561217	4735252	PRWPP
T3	Siemens SWT-3.0-113 (Max Power 2,500 kW)	561623	4735211	PRWPP
T4	Siemens SWT-3.0-113 (Max Power 2,500 kW)	561987	4735411	PRWPP

Transformer Stations

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

There is no transformer substation 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	559703	4734811
R21	Residence	4.5	3	559750	4734669
R22	Residence	4.5	3	559858	4734829
R26	Residence	4.5	3	559972	4734811
R31	Residence	4.5	3	560021	4734757
R34	Residence	4.5	3	560037	4733767
R36	Residence	4.5	3	560049	4736158
R38	Residence	4.5	3	560063	4733802
R39	Residence	4.5	3	560075	4734667
R44	Residence	4.5	3	560103	4733817
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	560267	4736209
R70	Residence	4.5	3	560292	4734588
R71	Residence	4.5	3	560298	4733487
R72	Residence	4.5	3	560321	4734542
R73	Residence	4.5	3	560325	4733514
R74	Residence	4.5	3	560333	4736203
R75	Residence	4.5	3	560331	4733525
R76	Residence	4.5	3	560348	4734654
R77	Residence	4.5	3	560351	4734522
R78	Residence	4.5	3	560349	4733541
R79	Residence	4.5	3	560350	4734329
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	560449	4734018
R101	Residence	4.5	3	560447	4734496
R102	Residence	4.5	3	560438	4733949

R104	Residence	4.5	3	560450	4734432
R105	Residence	4.5	3	560451	4734204
R106	Residence	4.5	3	560450	4734390
R107	Residence	4.5	3	560465	4734216
R109	Residence	4.5	3	560470	4734372
R110	Residence	4.5	3	560471	4734416
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	560497	4734165
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	560544	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	560566	4733634
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	560599	4734220
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	560618	4734159
R166	Residence	4.5	3	560629	4733839
R167	Residence	4.5	3	560624	4733669
R168	Residence	4.5	3	560635	4734389
R170	Residence	4.5	3	560639	4733848
R171	Residence	4.5	3	560640	4734123
R173	Residence	4.5	3	560634	4733684
R175	Residence	4.5	3	560640	4734179
R176	Residence	4.5	3	560651	4736252
R177	Residence	4.5	3	560654	4733686
R178	Residence	4.5	3	560658	4734285
R179	Residence	4.5	3	560660	4733846
R180	Residence	4.5	3	560664	4733742
R181	Residence	4.5	3	560667	4733691

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	560683	4733698
R188	Residence	4.5	3	560683	4736021
R190	Residence	4.5	3	560686	4734229
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	560694	4733703
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	560710	4733709
R202	Residence	4.5	3	560703	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	560722	4733713
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	560738	4733719
R217	Residence	4.5	3	560741	4733765
R219	Residence	4.5	3	560745	4733830
R220	Residence	4.5	3	560751	4733726
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	560766	4733731
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	560791	4733745
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	560795	4736019
R241	Residence	4.5	3	560803	4733966
R242	Residence	4.5	3	560809	4733844
R243	Residence	4.5	3	560806	4733750
R246	Residence	4.5	3	560810	4736319
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	560846	4735802
R256	Residence	4.5	3	560857	4733941
R257	Residence	4.5	3	560858	4734082
R258	Residence	4.5	3	560857	4735756

R261	Residence	4.5	3	560886	4734061
R262	Residence	4.5	3	560866	4736422
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	560959	4736361
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	561027	4735866
R291	Residence	4.5	3	561074	4734025
R292	Residence	4.5	3	561074	4736482
R293	Residence	4.5	3	561097	4734044
R294	Residence	4.5	3	561101	4735876
R296	Residence	4.5	3	561134	4734055
R297	Residence	4.5	3	561187	4736264
R300	Residence	4.5	3	561217	4736521
R301	Residence	4.5	3	561243	4735828
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	561414	4735870
R312	Residence	4.5	3	561450	4735934
R315	Residence	4.5	3	561504	4736304
R316	Residence	4.5	3	561508	4735870
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	561815	4736657
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	4734694
R368	Residence	1.5	3	562047	4734760
R369	Residence	1.5	3	562069	4734705
R370	Residence	4.5	3	562073	4734777
R371	Residence	1.5	3	562089	4734792
R373	Residence	1.5	3	562121	4734753
R374	Residence	4.5	3	562177	4734815
R379	Residence	4.5	3	562357	4736611
R380	Residence	4.5	3	562352	4735869
R383	Residence	4.5	3	562477	4736715
R384	Residence	4.5	3	562488	4736742
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
R411	Residence	1.5	3	560362	4735336
R412	Residence	1.5	3	560617	4735066
R605	Residence	4.5	3	561008	4736353
R606	Residence	4.5	3	561217	4736554
R607	Residence	4.5	3	561450	4736479
R609	Residence	4.5	3	562766	4736619
R610	Residence	4.5	3	562852	4736426
R611	Residence	4.5	3	562851	4736395
R612	Residence	4.5	3	562792	4736415
R613	Residence	4.5	3	562856	4736287
R614	Residence	4.5	3	562643	4736262
R627	Residence	4.5	3	560795	4736087
R629	Residence	4.5	3	560479	4734409
R630	Residence	4.5	3	560466	4734317
R631	Residence	4.5	3	560407	4734307
R632	Residence	4.5	3	560439	4734243
R633	Residence	4.5	3	560512	4734251
R634	Residence	4.5	3	560742	4734151
R635	Residence	4.5	3	560800	4734175
R636	Residence	4.5	3	560806	4734090
R637	Residence	4.5	3	560766	4734102
R638	Residence	4.5	3	560737	4734090
R639	Residence	4.5	3	560878	4733804
R640	Residence	4.5	3	560844	4733742
R641	Residence	4.5	3	560916	4734046
R642	Residence	4.5	3	561176	4734047
R643	Residence	4.5	3	560215	4734005
R644	Residence	4.5	3	560078	4733963
R645	Residence	4.5	3	560184	4733593
R646	Residence	4.5	3	560402	4733594

R647	Residence	4.5	3	560365	4733585
R661	Residence	4.5	3	561818	4734556

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
V169	VLSR	4.5	3	560635	4733809
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
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
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	4735797
P298	Residence	4.5	3	561187	4735760
P305	Residence	4.5	3	561337	4735774
P323	Residence	4.5	3	561613	4735881

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.

14 APPENDIX C — ADDITIONAL DOCUMENTATION

The following documents are included in this Appendix.

Siemens Canada Limited Letter to Ontario Ministry of Environment re. broadband source sound power Level for the Port Ryerse wind turbine model

This letter from Siemens Canada Limited guarantees the maximum broadband sound power level.

Test Report Summary Wind Turbine noise measurement, IEC 61400 ed. 2.1 Siemens SWT 3.2-113, Power curve revision 0

This document from Grontmij Acoustica is an acoustic Test Report Summary for the Siemens model SWT-3.2-113 wind turbine.

Test Report Summary Acoustic Noise, Wind Turbine Siemens SWT 2.3-113. Power curve revision 1

This document from Grontmij Acoustica is an acoustic Test Report Summary for the Siemens model SWT 2.3-113 wind turbine.

SIEMENS

July 14, 2014

To: Ontario Ministry of Environment

Re: Port Ryerse Wind Project

Dear Sir/Madam,

With respect to the Port Ryerse Wind Project, Siemens Canada Limited ("Siemens") will provide its SWT D3 Direct Drive wind turbine generators, with a maximum power output of 2,500 kW each. In accordance with the Turbine Supply Agreement between Siemens and Boralex, Siemens will guarantee the maximum broadband sound power levels for those Units at the maximum rated power level shown in the table below.

	Maximum Rated Power Level	Maximum Broadband Sound Power Level	Hub Height
SWT D3 Direct Drive Wind Turbine Generator, Maximum Power rating 2,500kW	2,500 kW	102.5 dB	99.5m

The warranted sound power level is presented with reference to the IEC 61400-11:2002 Code with amendment 1 dated 2006-05 based on a hub height of 99.5m.

Siemens has performed acoustic testing of its SWT-2.3-113 and SWT-3.2-113 model wind turbine generators in accordance with the IEC 61400-11:2002 Code with amendment 1 dated 2006-05 and confirms that the attached acoustic emission datasheet is consistent with that testing. Executive summaries for both test reports are attached hereto.

Based on the testing of the SWT-2.3-113 and SWT3.2-113 model wind turbine generators, Siemens does not expect that the tonality generated by the SWT D3 Direct Drive wind turbine generators listed above with a Maximum Power of 2,500 kW will be higher than 3 dB when tested in accordance with the IEC 61400-11:2002 Code with amendment 1 dated 2006-05.

Best regards,

Donald Marcucci
Siemens Energy, Inc.
Wind Power Americas
Enclosures (3)

cc: Adam Rosso, Boralex

TEST REPORT SUMMARY

This is a summary of the test report P6.002.14. The full test report has 27 pages in total.

Summary:

Wind Turbine noise measurement, IEC 61400 ed. 2.1
Siemens SWT 3.2-113, Power curve revision 0

Report no.: P6.002.14
Aarhus 6. February 2014
Project: 35.6342.20

Client:	Commissioned by:
Siemens Wind Power A/S Borupvej 16 DK-7330 Brande Denmark	Tomas R. Hansen Telephone: +45 9942 2605
Prepared by: Bo Søndergaard Checked by: Peter Henningsen	Signatory: Bo Søndergaard Bo Søndergaard

For the Siemens wind turbine type SWT 3.2-113, serial number 3000364, the following acoustic data has been determined according to IEC 61400-11 Edition 2.1:

Standardized wind speed [m/s]	5	6	7	8*	9*	10*
Power [kW]	1038	1799	2650	3115	3196	3200
Apparent Sound Power Level L_{WA} [dB re 1 pW]	101,6	105,8	107,5	107,0	107,2	-
Uncertainty U_c [dB]	1,2	1,0	0,9	1,0	1,1	-
Tonal Audibility ΔL_a [dB]	-	-	-	-	-4,5	-

* corresponds to more than 95% of rated power.

Third octave band spectra are included in the full report.

The measurements were carried out on 15. January 2014, at Flø wind farm Denmark.

Grontmij Acoustica Acoustics · Noise · Vibrations

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File Summary P6.002.14 SWT 3.2-113 Flø T02.doc

CVR-no. 48233511

TEST REPORT SUMMARY

This is a summary of the test report P6.024.12. The full test report has 26 pages in total.

Summary:

Acoustic Noise, Wind Turbine
Siemens SWT 2.3-113. Power curve revision 1

Report no.: P6.024.12
Aarhus 17. August 2012
Project: 35.6342.08

Client:
Siemens Wind Power A/S
Borupvej 16
DK-7330 Brande
Denmark

Commissioned by:
Tomas R. Hansen

Telephone: +45 9942 2605

Prepared by:
Bo Søndergaard

Checked by:
Peter Henningsen

Signatory:
Bo Søndergaard

For the Siemens wind turbine type SWT 2.3-113, serial number 2305083, the following acoustic data has been determined according to IEC 61400-11 Edition 2.1:

Standardized wind speed [m/s]	5	6	7	8*	9*	10*
Power [kW]	1088	1806	2248	2298	2300	2300
Apparent Sound Power Level L_{WA} [dB re 1 pW]	100,2	102,0	102,5	102,4	102,2	102,3
Uncertainty U_c [dB]	1,2	0,9	1,1	1,1	1,2	1,3
Tonal Audibility ΔL_a [dB]	-	-4,3	-10,9	-7,0	-6,9	-11,3

* correspond to more than 95% of rated power.

Third octave band spectra are included in the full report

The measurements were carried out on 17 to 18 June 2012, at Høvsøre Test Site Denmark.

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