GUNNS HILL WIND PROJECT

NOISE ASSESSMENT REPORT

Revision 6

For

Prowind CANADA

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2014 October 8

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1 INTRODUCTION

1.1 Purpose

This noise assessment report describes the results of a noise impact assessment for the Gunns Hill Wind Project (GHWP). This project is owned by Gunn's Hill Windfarm Inc. and managed by Prowind Canada Inc.

1.2 Revision 0

Revision 0 was the original Noise Assessment Report.

1.3 Revision 1

Revision 1 included the following changes.

The project turbine model was changed to the Siemens SWT-3.0-113 (Max Power 2,500 kW). All turbine locations remained the same.

Receptor, participant, and VLSR data were updated where required.

An explanation for the absence of a VLSR on the vacant lot described as Lot 17 Con 5 East was included.

1.4 Revision 2

Revision 2 of the noise assessment report corrected the previously published and incorrect location of turbine T5. It included all impacts of relocating this turbine to its proper site. Note that the erroneous turbine location was limited to previous versions of this noise assessment report. The location published in other project documents is correct.

1.5 Revision 3

Revision 3 of this noise assessment report documented the change in project turbine model from the Siemens SWT-3.0-113 (Max Power 2,500 kW) to the REpower/Senvion MM92 (1880kW;102 dBA). All turbine locations remained the same.

Documentation confirming the turbine manufacturer's name change from REpower to Senvion was provided in Section 13 .

Minor editorial corrections and improvements were included.

1.6 Revision 4

Revision 4 included the following changes.

Changes in octave band source sound power levels for the project turbine — the Senvion MM92 /60Hz/CCV, Maximum Power 1.88 MW — were documented.

A reassessment of the noise impact using the updated source sound power levels was carried out and reported.

Updated and additional documentation from Senvion Canada Inc. was included in Section 13 .

A topographic concavity analysis was carried out and reported in Section 6.4.1

All turbine locations remained the same.

Minor editorial corrections and improvements were included.

1.7 Revision 5

Revision (5) included the following changes.

Based on comments from the Ontario Ministry of Environment and Climate Change (MoECC), Senvion Canada provided an earlier and more conservative version of the turbine octave band source sound power levels (Section 13) for the project turbine.

A reassessment of the noise impact using the revised source sound power levels was carried out and reported.

All turbine locations remained the same.

Minor editorial corrections and improvements were included.

Figure 1-1 Wind project location map.

1.8 Revision 6

The present Revision (6) of this noise assessment report includes the following changes.

Receptor R408 has been added to the same property as R54 for the purpose of the temporary building permit that was obtained for this lot.

Participant vacant lot surrogate receptor (Q409) has been added to the leased project property holding infrastructure between Turbines T1 and T2. (See Section 3.4 below)

A reassessment of the noise impact using these additional RPV's was carried out and is reported herein.

Note that all turbine locations remain the same.

Minor editorial corrections and improvements are included.

1.9 Brief Project Description

The Gunns Hill Wind Project is located southeast of the city of Woodstock in the township of Norwich in Oxford County.

The project described herein features 10 Senvion MM92/60Hz/CCV(MP1880kW) turbines with a nominal project capacity of 18.0 MW. These will be located south of Oxford Centre and north of Burgessville approximately between the communities of Curries and Vandecar.

Error: Reference source not found shows the location of the project within the province of Ontario.

1.10 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 and Climate Change Guidelines (MoECC, 2008). This latter document generally provides guidelines and clarifications for the application of MoECC regulations document NPC-232 (MoECC, 1995) to wind farm projects. Note that the MoECC NPC documents (*e.g.*, NPC205, NPC32, LU-131, *etc.*) have recently been replaced by NPC-300 (MoECC, 2013)

The MoECC (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 (if such exist) 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 MoECC (2008) prescribed limits at all qualified receptors.

1.11 Sound Level Limits for Wind Farms

MoECC (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	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	38.0	42.0	44.0

2 PROJECT LAYOUT

2.1 Project Site

Figure 2-1 shows the Gunns Hill Wind 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 with a few river valleys and small hills providing minor topographic relief. The contour lines (5 m contour interval) of Figure 2-1 confirm this. The project turbines lie at altitudes ranging from 295 to 331 m above sea level.

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 city of Woodstock is approximately 5.5 km to the northwest of the project turbines.

The primary activity in this area is agriculture.

The major transportation corridors are Highways 403 and 401, running east and west on the northern boundary of the project.

The GHWP site features a population density typical of southern Ontario rural communities. There is a relatively sparse population within the vicinity of the project. The city of Woodstock is located within a few km.

2.2 Project Details

Figure 2-1 shows the properties that have been optioned for lease to the project proponent (Gunn's Hill Windfarm Inc.) along with prospective turbine, point of reception (receptor), vacant lot surrogate receptor (VLSR), participating point of reception (participant), participant vacant lot surrogate receptors (PVLSR) and vacant lot locations. Turbine numbers are designated with the prefix 'T', receptors with 'R', VLSRs with 'V', PVLSRs with 'Q'and participants with 'P'.

As specified by O.Reg 359/09, the Gunns Hill Wind Project is a Class 4 Wind Project.

The GHWP will consist of 10 Senvion MM92/60Hz/CCV(MP1880kW) turbines for a project capacity of 18 MW. The project turbines are numbered T1 to T10 in Figure 2-1. The project stretches for an east-west distance of about 5.5 km parallel to the Highway 401 and 403 corridors and 3 km in the north-south direction. A listing of all GHWP turbine locations can be found in Section 12 .

The Ontario NPC designation for the project properties would generally be Class 3 — Rural except for areas near Highways 401 and 403. Away from these two highways, typical background sound levels for these areas would be generated by residential, agricultural, and small commercial activities, ambient sound from wind, and vehicle noise from regional roads. 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

Zephyr North has been informed by Prowind Canada Inc. that there are no existing or planned wind projects within 5 km of the Gunns Hill Wind Project.

2.5 Substations

2.5.1 Gunns Hill Wind Project

Prowind Canada Inc. reports that the project turbines will be connected into the electrical distribution grid at a switching station (shown in Figure 2-1 near turbine T1). For information, this station will contain a grounding transformer operating at 27.6 kV. Due to its low voltage (O.Reg. 359/09 – Government of Ontario, 2009b), and the fact that it will only carry significant current during a fault in one of the collector phases, it has not been considered in this noise assessment report.

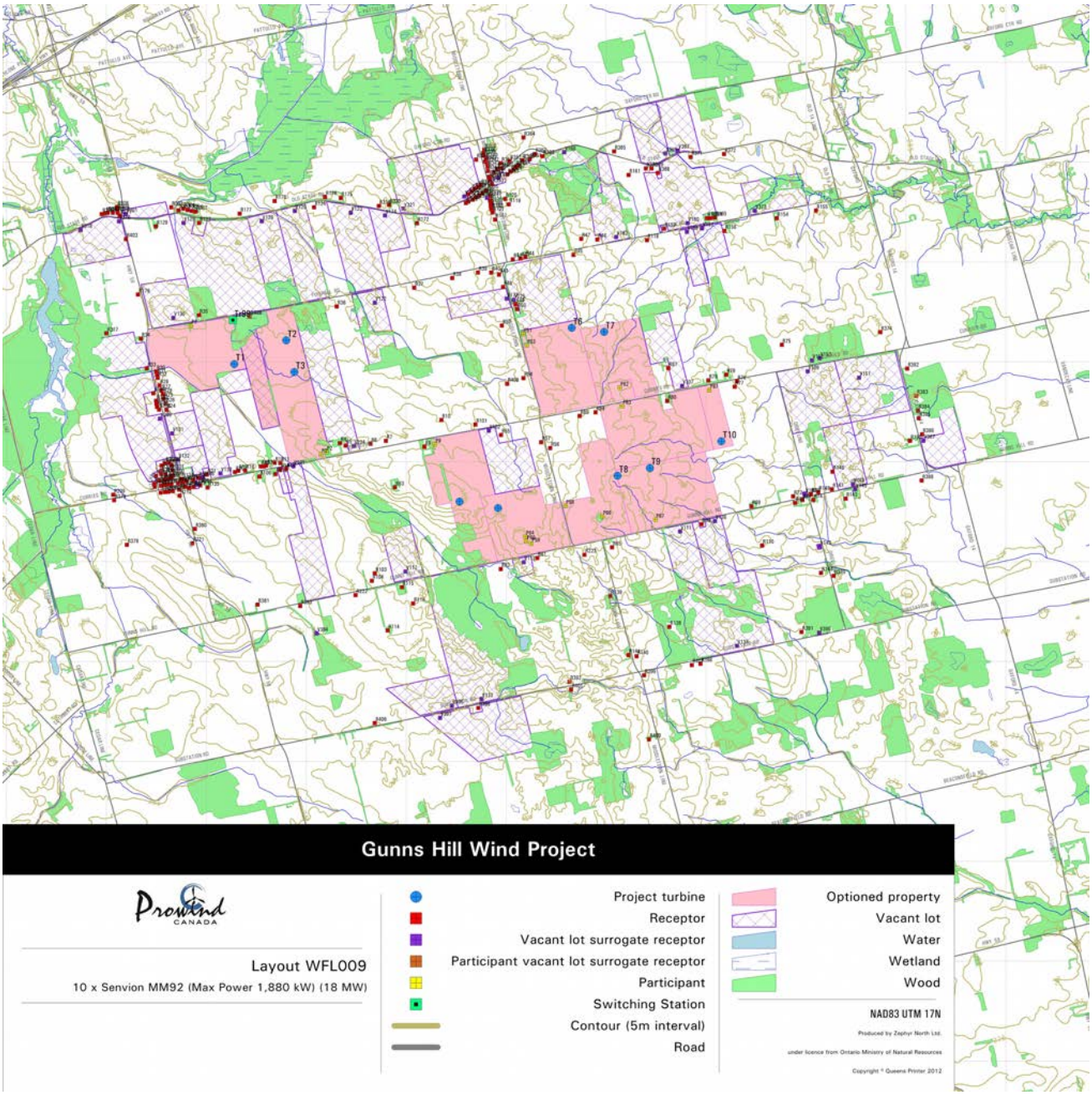

Figure 2-1 Project site details map.

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 MoECC NPC-232 (MoECC, 1995b) and Noise Guidelines (MoECC, 2008) publications, and in Ontario O.Reg. 359/09 and proposed amendments (Government of Ontario; 2009b, 2010, 2011, 2012). As noted previously, Ontario MoECC NPC-232 has been replaced by the recently published MoECC NPC-300 (2013).

3.2 Determination

Receptor and participant data (location, type, dwelling height, *etc.*) were supplied to Zephyr North by Prowind Canada Inc. These were used in this noise assessment report without audit.

Receptors and participants were identified through mapping, aerial photographs, and on-site surveys of the area by Prowind Canada 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 the project area. Their locations are also shown in Figure 2-1. All receptors within 1.5 km of any GHWP 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, Table 3-1 summarizes the estimated number of receptors, VLSRs, participants, PVLSRs, and vacant lots identified for the project. It should be noted that for the case of large lots (say, greater than 500 m in one linear direction), some of these estimates could be inaccurate due to lack of knowledge of dwellings and/or lots outside of the 2,000 m survey area.

Table 3-1 Summary of numbers of receptors, VLSRs, participants and vacant lots.

	Within 1.5 km of any project turbine	Within 2.0 km of any project turbine
Number of receptors	144	232
Number of VLSRs	32	48
Number of participants	15	15
Number of PVLSRs	1	1
Total	192	296
Number of vacant lots	39	53

Note that for Table 3-1, for the 1,500 or 2,000 m distance around the project turbines, vacant lots are included if *any portion* of the vacant lot lies within the distance. VLSR receptors are included *only* if they lie within the distance. Therefore, it is possible (and, indeed, likely) that more vacant lots will be reported than VLSRs, since some of the VLSRs may lie outside of the specified distance while some portion the associated vacant lot lies within the distance.

3.3 Vacant Lots

The MoECC (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 1.5 km of any turbine or substation in the GHWP 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 Lot 17 Con 5 East

This section explains why the vacant lot identified directly below has been assigned a participant vacant lot surrogate receptor (PVLSR).

Lot 17 Con 5 East PIN: 730028 Roll: 3202-040-040-017-00

This lot is located roughly between turbines T1 and T2 as shown in Figure 2-1.

Prowind Canada Inc. has informed Zephyr North that this property is now a part of the project and will host electrical cable. Therefore, this makes the property participating. A participant vacant lot surrogate receptor (Q409) has been added to this property as shown in Figure 2-1.

3.5 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 MoECC (2008) where there is no qualifying transformer/substation within the project, and as stipulated in Section 6.3.2 where there is a qualifying transformer/substation. For this project, Section 6.3.1 has been used.

Typically, the heights of dwellings designated as 1-, 2-, and 3-storeys are set to be 1.5, 4.5, and 7.5 m respectively. For the present project, all dwellings were conservatively designated as 2 storeys. (Prowind Canada Inc. has indicated that there are no 3-story nor higher dwellings in the project area.)

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, VLSRs and participants listed in Section 12 include only 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 Gunns Hill Wind Project Turbine

The turbines proposed for the GHWP are manufactured by Senvion SE (www.senvion.com) of Hamburg, Germany. As noted previously, until quite recently Senvion SE carried the name REpower Systems SE.

The proposed project turbine model is the Senvion MM92/60Hz/CCV(MP1880kW).

4.1.1 Senvion MM92/60Hz/CCV(MP1880kW)

The following table summarizes this turbine's characteristics.

	Senvion MM92/60Hz/CCV(MP1880kW)
Type, number of blades, rotor orientation	Horizontal-axis, 3-bladed, upwind wind turbine
Rated power	1,880 kW
Rotor diameter; swept area	92.5 m; 6,720 m^2
Operational rotation rate	7.8 to 15.0 rpm; variable speed
Hub height; tower type	100.0 m; steel tubular tower
Power regulation	Electrical blade angle adjustment-pitch and speed control
Cut-in wind speed	3.0 ms-1
Cut-out wind speed	24.0 ms-1
Rated wind speed	12.5 ms-1
Gearbox	Yes, combined planetary/spur-wheel gearbox
Generator; speed	Double fed asynchronous generator with converter; 900-1800 rpm
Turbine transformer	Adjacent to tower
Braking system	Holding brake system implemented with hydraulic pressure accumulator; dimensioned disc brake; soft brake function

	Senvion MM92/60Hz/CCV(MP1880kW)
Yaw system	Four-point bearing; electrical geared drives, hydraulic yaw brakes

4.2 Transformer Substations

4.2.1 Gunns Hill Wind Project

As noted above in Section 2.5 , there is only a switching station 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) with appropriate amendments. The MoECC (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 Gunns Hill Wind Power Project Turbines

5.2.1 Senvion MM92/60Hz/CCV(MP1880kW)

Senvion MM92/60Hz/CCV(MP1880kW) turbine source sound power level broadband data for 10 m a.g.l. wind speeds of 3 to 6.5 ms^{-1} to cut-out (24 ms^{-1}) and octave band data for 10 m a.g.l. wind speeds of 6, 7, 8, 9, and 10 ms^{-1} were provided in Senvion Canada documentation supplied by Prowind Canada Inc. This documentation is shown in Section 13 .

In the documentation found in Section 13 , for the broadband source sound power levels Senvion Canada states, "The guaranteed sound power levels have been determined in accordance with IEC 61400-11:2002 + A1: 2006, and are presented

for a corresponding wind speed at a reference height of 10 m (above ground level) and based on a roughness length of 0.05 m."

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}.

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 Senvion MM92/60Hz/CCV (MP1880kW) 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.

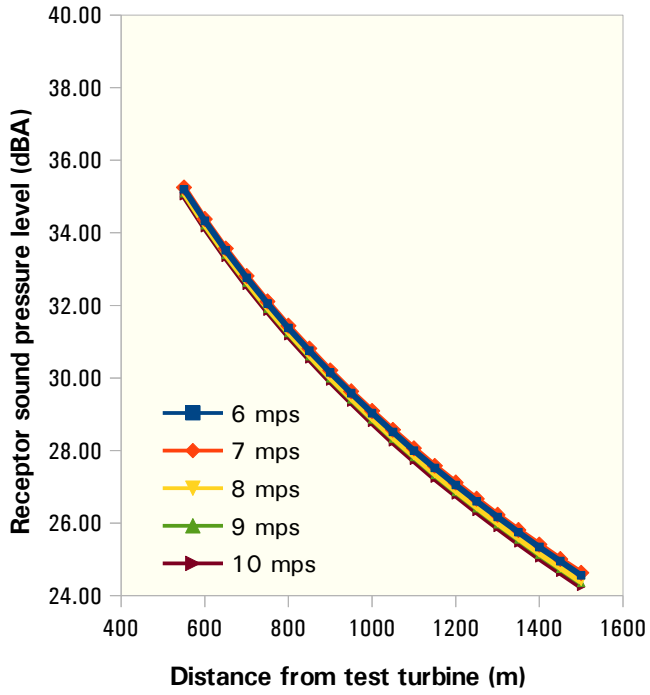

Figure 5-1 Senvion MM92/60Hz/CCV(MP880kW) wind speed sensitivity test.

In the documentation shown in Section 13 , Senvion states that, "Senvion warrants that there is no tonal audibility greater than 0 dB as determined in accordance with IEC 61400-11:2002 + A1: 2006." No tonal penalty has been applied to this turbine model.

The 10 m broadband and octave band source sound power levels for the Senvion MM92/60Hz/CCV(MP1880kW) turbine for a hub height of 100 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 MoECC-defined "predictable worst case".

Table 5-1 Senvion MM92/60Hz/CCV(MP1880kW) – Wind turbine acoustic emissions summary.

Make and Model: Senvion MM92/60Hz/CCV(MP1880kW)										
Rating: 1,880 kW										
Hub height (m): 100.0										
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	110.0	110.2	110.4	110.4	110.8	110.2	110.2	110.2	110.2	110.2
125	106.2	106.6	106.5	106.3	106.4	106.6	106.6	106.6	106.6	106.6
250	103.7	103.7	102.9	102.9	102.6	103.7	103.7	103.7	103.7	103.7
500	100.3	100.4	100.1	100.0	99.8	100.4	100.4	100.4	100.4	100.4
1000	96.3	96.2	96.6	96.7	96.7	96.2	96.2	96.2	96.2	96.2
2000	90.4	90.4	91.1	91.3	91.8	90.4	90.4	90.4	90.4	90.4
4000	84.8	85.5	87.0	86.4	87.7	85.5	85.5	85.5	85.5	85.5
8000	73.6	74.1	74.9	77.2	76.4	74.1	74.1	74.1	74.1	74.1
A-weighted	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**

5.3 Site-Specific Vertical Wind Shear Exponent

Prowind Canada Inc. 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 comparable to the highest measured values that Zephyr North has previously reviewed or calculated from measured wind speeds for Ontario.

It should be noted that due to the 7 ms^{-1} "predictable worst case" described in Section 5.2.1 above, the summer night-time vertical wind shear adjustments have not been used in the determination of the results of this noise assessment.

5.4 Gunns Hill Wind Power Project Transformer Substations

As noted above, there are no power transformers associated with this project — only a switching station.

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 levels, 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)

Normally, analysis would be carried out for turbine and transformer (where existent) 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} after adjustment for summer night-time vertical wind shear. However, for the present case, since it has been determined that the MoECC "predictable worst case" occurs for a set of octave band source sound power levels corresponding to a particular 10 m a.g.l. wind speed (7 ms^{-1}) in the "Manufacturer's emission levels" as shown in Section 5.2.1 , the analysis has been carried out with the "predictable worst case" octave band source sound power levels regardless of the wind speed to which they correspond. This is the case for all turbines considered.

b)

ISO 9613-2 parameters, as prescribed in the MoECC (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 MoECC (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 MoECC Oct 2008 document	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 in compliance with the MoECC (2008) Guidelines publication maxima requirements.

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 GHWP 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 Special conditions

6.4.1 Topographic concavity

Section 4.3.9 of *The Good Practice Guide* of the Institute of Acoustics (IOA, 2013) recommends that the topography between a turbine and a receptor be defined as (significantly) concave if the following criterion is fulfilled.

$$h_m \geq 1.5 \frac{|h_s - h_r|}{2}$$

The variables in the criterion above are defined in Figure 3 and Section 7.3.2 (Alternative method of calculation for A-weighted sound pressure level) of the ISO 9613-2 Standard (ISO, 1996) as follows.

h_m is the mean height of the propagation path above the ground, in metres,

h_s is the height of the source (turbine) above the ground, in metres,

h_r is the height of the receiver (receptor) above the ground, in metres.

Should the criterion be met (*i.e.*, should the propagation path be defined as significantly concave), *The Good Practice Guide* recommends that 3 dB "...should be added to the calculated overall A-weighted noise level...".

Zephyr North carried out analyses of the propagation paths between all project turbines and receptors (including VLSRs) within 1,500 m of each other. The highest value of h_m encountered was 65.9 m — between turbine T4 (base elevation 332 m, hub height 100.0 m) and V117 (base elevation 326 m, height 4.5 m). The concavity criterion (right hand of the equation above) for this turbine/receptor pair is 71.6 m (the same as for all turbine/receptor pairs). By this criterion, the "worst case" topography between any turbine–receptor pair is not significantly concave.

For illustration, Figure 6-1 shows the (vertically exaggerated) topography between turbine T4 (left of graph) and V117 (right of graph). The horizontal separation is 891 m.

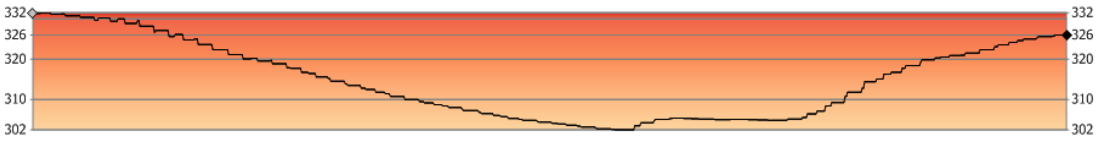

Figure 6-1 Topography profile from turbine to receptor.

6.5 Results

Calculated resultant sound pressure levels at receptors, VLSRs and participants are reported in Tables 7-1, 7-2, and 7-3 found below in Section 7 . These are based on the turbine layout designated WFL009, and listed in Section 12 .

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

Table 6-1 Highest estimated sound pressure levels at receptors.

Receptor ID	SPrL (dBA)	Height (m)	Nearest Turbine	Project / Other	Distance (m)
R84	38.6	4.5	T8	P	673
R80	38.4	4.5	T10	P	675
R85	38.1	4.5	T8	P	709
R56	37.7	4.5	T8	P	729
R57	37.3	4.5	T5	P	788
V107	37.3	4.5	T10	P	680
R36	37.0	4.5	T2	P	609
R55	37.0	4.5	T5	P	733
R81	37.0	4.5	T7	P	737
V112	36.9	4.5	T5	P	601
R50	36.9	4.5	T6	P	578
R62	36.8	4.5	T5	P	612
R77	36.7	4.5	T10	P	562
R79	36.7	4.5	T10	P	623
V102	36.7	4.5	T4	P	768
R54	36.7	4.5	T6	P	697
R61	36.6	4.5	T5	P	636
R35	36.5	4.5	T1	P	604
V111	36.5	4.5	T9	P	705
R49	36.4	4.5	T6	P	611
R8	36.4	4.5	T4	P	651
R65	36.2	4.5	T8	P	719
R101	36.1	4.5	T4	P	786
R68	36.1	4.5	T9	P	765
V225	36.0	4.5	T6	P	645
R76	36.0	4.5	T10	P	620
WindFarm layout file: GnH11-Trbn-WFL009.csv					

7 NOISE LEVEL SUMMARY TABLE

Table 7-1 Receptor noise level summary table.

Point of Reception ID	Description	Height (m)	Distance to Nearest Noise Source (m)	Nearest Noise Source	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
R4	Residence	4.5	844	T3	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R5	Residence	4.5	897	T3	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R6	Residence	4.5	1048	T3	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R7	Residence	4.5	955	T4	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R8	Residence	4.5	651	T4	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R10	Residence	4.5	836	T4	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R11	Residence	4.5	922	T3	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R12	Residence	4.5	930	T3	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R13	Residence	4.5	978	T3	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R14	Residence	4.5	986	T3	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R15	Residence	4.5	975	T3	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R16	Residence	4.5	1002	T3	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R17	Residence	4.5	992	T3	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R18	Residence	4.5	1073	T1	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R19	Residence	4.5	1070	T1	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R20	Residence	4.5	1082	T1	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R21	Residence	4.5	1141	T1	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R22	Residence	4.5	1196	T1	31.0	31.0	31.0	31.0	31.0	40.0	43.0	45.0	49.0	51.0
R23	Residence	4.5	1194	T1	30.5	30.5	30.5	30.5	30.5	40.0	43.0	45.0	49.0	51.0
R24	Residence	4.5	818	T1	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R25	Residence	4.5	786	T1	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R26	Residence	4.5	794	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R27	Residence	4.5	776	T1	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R28	Residence	4.5	779	T1	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R29	Residence	4.5	775	T1	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R30	Residence	4.5	786	T1	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R31	Residence	4.5	781	T1	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Noise Source (m)	Nearest Noise Source	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
R32	Residence	4.5	778	T1	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R33	Residence	4.5	877	T1	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
R34	Residence	4.5	968	T1	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R35	Residence	4.5	604	T1	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R36	Residence	4.5	609	T2	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R37	Residence	4.5	1387	T2	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R38	Residence	4.5	1296	T6	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R39	Residence	4.5	1090	T6	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R40	Residence	4.5	979	T6	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R41	Residence	4.5	864	T6	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R42	Residence	4.5	904	T6	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R43	Residence	4.5	902	T6	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R44	Residence	4.5	847	T6	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R45	Residence	4.5	731	T6	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R46	Residence	4.5	922	T6	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R47	Residence	4.5	897	T6	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R48	Residence	4.5	799	T6	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R49	Residence	4.5	611	T6	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R50	Residence	4.5	578	T6	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R52	Residence	4.5	697	T6	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R54	Residence	4.5	697	T6	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R55	Residence	4.5	733	T5	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R56	Residence	4.5	729	T8	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R57	Residence	4.5	788	T5	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R61	Residence	4.5	636	T5	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R62	Residence	4.5	612	T5	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
R63	Residence	4.5	661	T4	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
R65	Residence	4.5	719	T8	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
R68	Residence	4.5	765	T9	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R69	Residence	4.5	717	T10	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R70	Residence	4.5	1040	T10	31.1	31.1	31.1	31.1	31.1	40.0	43.0	45.0	49.0	51.0
R71	Residence	4.5	1002	T10	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R72	Residence	4.5	906	T10	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R73	Residence	4.5	962	T10	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R74	Residence	4.5	1093	T10	30.7	30.7	30.7	30.7	30.7	40.0	43.0	45.0	49.0	51.0
R75	Residence	4.5	1138	T10	31.0	31.0	31.0	31.0	31.0	40.0	43.0	45.0	49.0	51.0
R76	Residence	4.5	620	T10	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R77	Residence	4.5	562	T10	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R78	Residence	4.5	670	T10	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R79	Residence	4.5	623	T10	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R80	Residence	4.5	675	T10	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R81	Residence	4.5	737	T7	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R84	Residence	4.5	673	T8	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R85	Residence	4.5	709	T8	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
R101	Residence	4.5	786	T4	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R103	Residence	4.5	1112	T4	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R104	Residence	4.5	1184	T4	31.0	31.0	31.0	31.0	31.0	40.0	43.0	45.0	49.0	51.0
R106	Residence	4.5	1104	T3	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Noise Source (m)	Nearest Noise Source	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
R110	Residence	4.5	1119	T10	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R114	Residence	4.5	1479	T4	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R115	Residence	4.5	1033	T4	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
R116	Residence	4.5	1121	T4	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R118	Residence	4.5	1014	T7	32.5	32.5	32.5	32.5	32.5	40.0	43.0	45.0	49.0	51.0
R119	Residence	4.5	1387	T6	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R120	Residence	4.5	1454	T6	29.5	29.5	29.5	29.5	29.5	40.0	43.0	45.0	49.0	51.0
R121	Residence	4.5	1401	T6	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R124	Residence	4.5	1359	T2	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R127	Residence	4.5	1455	T1	29.5	29.5	29.5	29.5	29.5	40.0	43.0	45.0	49.0	51.0
R134	Residence	4.5	1263	T1	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
R135	Residence	4.5	1266	T1	30.7	30.7	30.7	30.7	30.7	40.0	43.0	45.0	49.0	51.0
R139	Residence	4.5	1206	T8	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R143	Residence	4.5	1370	T10	28.6	28.6	28.6	28.6	28.6	40.0	43.0	45.0	49.0	51.0
R146	Residence	4.5	1154	T10	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R147	Residence	4.5	1207	T10	29.7	29.7	29.7	29.7	29.7	40.0	43.0	45.0	49.0	51.0
R148	Residence	4.5	1095	T10	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
R159	Residence	4.5	1196	T7	31.0	31.0	31.0	31.0	31.0	40.0	43.0	45.0	49.0	51.0
R167	Residence	4.5	1330	T6	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
R168	Residence	4.5	1432	T6	29.7	29.7	29.7	29.7	29.7	40.0	43.0	45.0	49.0	51.0
R169	Residence	4.5	1458	T6	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
R170	Residence	4.5	1488	T6	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
R176	Residence	4.5	1487	T2	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R177	Residence	4.5	1351	T2	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R178	Residence	4.5	1401	T2	29.5	29.5	29.5	29.5	29.5	40.0	43.0	45.0	49.0	51.0
R179	Residence	4.5	1188	T1	30.2	30.2	30.2	30.2	30.2	40.0	43.0	45.0	49.0	51.0
R181	Residence	4.5	885	T1	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
R182	Residence	4.5	875	T1	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R183	Residence	4.5	865	T1	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R184	Residence	4.5	861	T1	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R185	Residence	4.5	880	T1	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R187	Residence	4.5	1292	T1	30.1	30.1	30.1	30.1	30.1	40.0	43.0	45.0	49.0	51.0
R188	Residence	4.5	1364	T1	29.3	29.3	29.3	29.3	29.3	40.0	43.0	45.0	49.0	51.0
R189	Residence	4.5	1319	T1	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R190	Residence	4.5	1358	T1	29.5	29.5	29.5	29.5	29.5	40.0	43.0	45.0	49.0	51.0
R191	Residence	4.5	1377	T1	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
R192	Residence	4.5	1399	T1	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R193	Residence	4.5	1422	T1	29.0	29.0	29.0	29.0	29.0	40.0	43.0	45.0	49.0	51.0
R194	Residence	4.5	1465	T1	28.7	28.7	28.7	28.7	28.7	40.0	43.0	45.0	49.0	51.0
R195	Residence	4.5	1441	T1	28.8	28.8	28.8	28.8	28.8	40.0	43.0	45.0	49.0	51.0
R196	Residence	4.5	1387	T1	29.2	29.2	29.2	29.2	29.2	40.0	43.0	45.0	49.0	51.0
R197	Residence	4.5	1358	T1	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
R198	Residence	4.5	1332	T1	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
R199	Residence	4.5	1299	T1	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R200	Residence	4.5	1274	T1	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R201	Residence	4.5	1231	T1	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
R202	Residence	4.5	1301	T1	29.8	29.8	29.8	29.8	29.8	40.0	43.0	45.0	49.0	51.0
R203	Residence	4.5	1322	T1	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Noise Source (m)	Nearest Noise Source	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
R204	Residence	4.5	1289	T1	29.8	29.8	29.8	29.8	29.8	40.0	43.0	45.0	49.0	51.0
R205	Residence	4.5	1249	T1	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R206	Residence	4.5	1211	T1	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
R207	Residence	4.5	1185	T1	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
R210	Residence	4.5	1484	T1	28.7	28.7	28.7	28.7	28.7	40.0	43.0	45.0	49.0	51.0
R211	Residence	4.5	1457	T1	28.9	28.9	28.9	28.9	28.9	40.0	43.0	45.0	49.0	51.0
R212	Residence	4.5	1039	T3	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
R213	Residence	4.5	1426	T1	29.3	29.3	29.3	29.3	29.3	40.0	43.0	45.0	49.0	51.0
R214	Residence	4.5	1260	T1	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
R215	Residence	4.5	1297	T1	30.2	30.2	30.2	30.2	30.2	40.0	43.0	45.0	49.0	51.0
R216	Residence	4.5	1321	T1	30.0	30.0	30.0	30.0	30.0	40.0	43.0	45.0	49.0	51.0
R217	Residence	4.5	1323	T1	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
R218	Residence	4.5	1372	T1	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
R219	Residence	4.5	1410	T1	29.3	29.3	29.3	29.3	29.3	40.0	43.0	45.0	49.0	51.0
R220	Residence	4.5	1437	T1	29.0	29.0	29.0	29.0	29.0	40.0	43.0	45.0	49.0	51.0
R222	Residence	4.5	1401	T4	29.7	29.7	29.7	29.7	29.7	40.0	43.0	45.0	49.0	51.0
R223	Residence	4.5	857	T8	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R317	Residence	4.5	1317	T1	29.0	29.0	29.0	29.0	29.0	40.0	43.0	45.0	49.0	51.0
R376	Residence	4.5	1233	T1	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
R377	Residence	4.5	1267	T1	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
R408	Residence	4.5	855	T6	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0

Table 7-2 VLSR noise level summary table.

Point of Reception ID	Description	Height (m)	Distance to Nearest Noise Source (m)	Nearest Noise Source	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
V102	VLSR	4.5	768	T4	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
V105	VLSR	4.5	943	T3	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
V107	VLSR	4.5	680	T10	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
V108	VLSR	4.5	991	T10	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
V109	VLSR	4.5	1111	T10	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
V111	VLSR	4.5	705	T9	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V112	VLSR	4.5	601	T5	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
V117	VLSR	4.5	885	T4	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
V122	VLSR	4.5	964	T2	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
V123	VLSR	4.5	1432	T2	29.7	29.7	29.7	29.7	29.7	40.0	43.0	45.0	49.0	51.0
V125	VLSR	4.5	1299	T2	30.2	30.2	30.2	30.2	30.2	40.0	43.0	45.0	49.0	51.0
V126	VLSR	4.5	1217	T2	30.9	30.9	30.9	30.9	30.9	40.0	43.0	45.0	49.0	51.0
V130	VLSR	4.5	766	T1	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
V131	VLSR	4.5	932	T1	32.5	32.5	32.5	32.5	32.5	40.0	43.0	45.0	49.0	51.0
V132	VLSR	4.5	1110	T1	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
V133	VLSR	4.5	1103	T1	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
V136	VLSR	4.5	802	T10	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
V142	VLSR	4.5	1443	T10	28.6	28.6	28.6	28.6	28.6	40.0	43.0	45.0	49.0	51.0
V145	VLSR	4.5	1425	T10	28.2	28.2	28.2	28.2	28.2	40.0	43.0	45.0	49.0	51.0
V149	VLSR	4.5	1386	T10	28.4	28.4	28.4	28.4	28.4	40.0	43.0	45.0	49.0	51.0
V152	VLSR	4.5	1217	T10	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
V153	VLSR	4.5	1290	T10	29.4	29.4	29.4	29.4	29.4	40.0	43.0	45.0	49.0	51.0
V157	VLSR	4.5	1427	T7	29.6	29.6	29.6	29.6	29.6	40.0	43.0	45.0	49.0	51.0
V158	VLSR	4.5	1299	T7	30.3	30.3	30.3	30.3	30.3	40.0	43.0	45.0	49.0	51.0
V160	VLSR	4.5	1372	T7	29.8	29.8	29.8	29.8	29.8	40.0	43.0	45.0	49.0	51.0
V162	VLSR	4.5	959	T7	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
V173	VLSR	4.5	715	T6	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
V186	VLSR	4.5	1177	T1	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
V208	VLSR	4.5	922	T1	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
V224	VLSR	4.5	948	T3	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V225	VLSR	4.5	645	T6	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V405	VLSR	4.5	1260	T1	30.5	30.5	30.5	30.5	30.5	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 Noise Source (m)	Nearest Noise Source	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6.0	7.0	8.0	9.0	10.0
P1	Residence	4.5	583	T1	36.6	36.6	36.6	36.6	36.6
P2	Residence	4.5	863	T3	34.5	34.5	34.5	34.5	34.5
P3	Residence	4.5	868	T3	34.4	34.4	34.4	34.4	34.4
P9	Residence	4.5	623	T4	36.8	36.8	36.8	36.8	36.8
P51	Residence	4.5	489	T6	38.3	38.3	38.3	38.3	38.3
P53	Residence	4.5	484	T6	38.5	38.5	38.5	38.5	38.5
P58	Residence	4.5	604	T8	38.5	38.5	38.5	38.5	38.5
P59	Residence	4.5	488	T5	38.5	38.5	38.5	38.5	38.5
P60	Residence	4.5	437	T5	39.3	39.3	39.3	39.3	39.3
P64	Residence	4.5	396	T5	40.0	40.0	40.0	40.0	40.0
P66	Residence	4.5	437	T8	39.8	39.8	39.8	39.8	39.8
P67	Residence	4.5	521	T9	39.2	39.2	39.2	39.2	39.2
P82	Residence	4.5	583	T7	38.9	38.9	38.9	38.9	38.9
P83	Residence	4.5	678	T9	38.9	38.9	38.9	38.9	38.9
P87	Residence	4.5	523	T10	37.8	37.8	37.8	37.8	37.8

Table 7-4 Participant VLSR noise level summary table

Point of Reception ID	Description	Height (m)	Distance to Nearest Noise Source (m)	Nearest Noise Source	Calculated Sound Level at Selected Wind Speeds (dBA)				
					6.0	7.0	8.0	9.0	10.0
Q409	Participant VLSR	4.5	435	T2	40.7	40.7	40.7	40.7	40.7

8 NOISE LEVEL ISOPLETH MAP

Figure 8-1 is a noise-level isopleth map of the sound pressure level (dBA) field 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 MoECC "predictable worst case" octave band source sound power levels have been used for the project turbine types. For information, the "predictable worst case" for GHWP project turbines has been determined to occur for a 7 ms^{-1} wind speed (measured at 10 m a.g.l.).

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

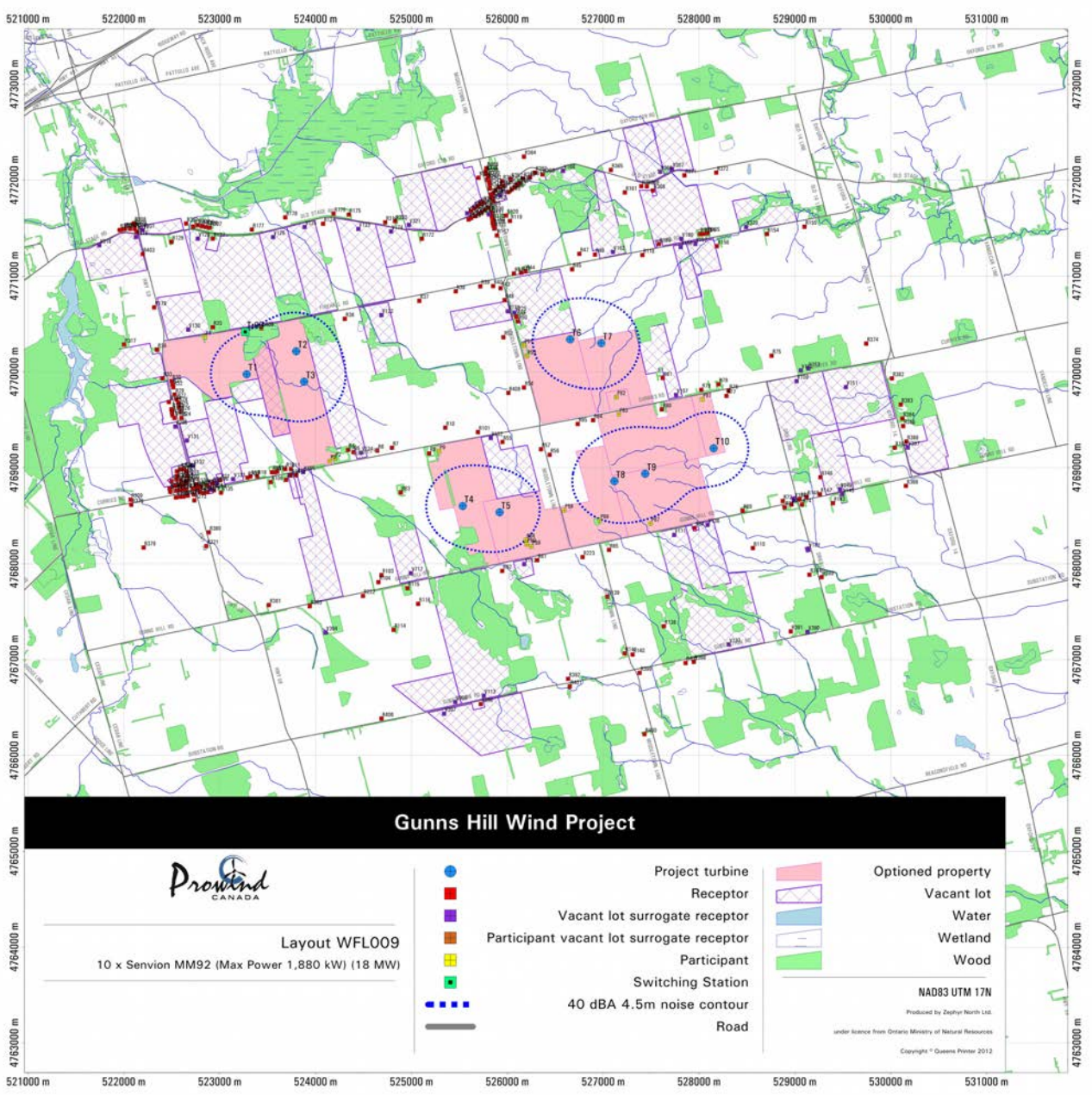

Figure 8-1 40 dBA noise isopleth map for 4.5 m a.g.l.

9 EXAMPLE CALCULATION

9.1 Method of Calculation

The calculation of cumulative receptor noise levels from turbines and transformers (where existent) 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.

9.2 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 R84 due to the single turbine T8. Receptor and turbine are separated by 673 m. Note that the

Table 9-1 Sample calculation for receptor and turbine.

Intermediate calculations for receptor R84 and turbine T8						
Octave band	**Mid-band frequency (Hz)**	**L_W (dBA)**	**A_{div} (dB)**	**A_{atm} (dB)**	**A_{gr} (dB)**	**L_{fT}(DW) (dBA)**
1	63	84.0	67.6	0.1	-3.0	19.4
2	125	90.5	67.6	0.3	1.0	21.6
3	250	95.1	67.6	0.7	-0.1	26.9
4	500	97.2	67.6	1.3	-0.7	29.1
5	1000	96.2	67.6	2.5	-0.7	26.9
6	2000	91.6	67.6	6.5	-0.8	18.3
7	4000	86.5	67.6	22.1	-0.8	-2.4
8	8000	73.0	67.6	78.8	-0.8	-72.6

resultant A-weighted sound pressure level at R84 due to turbine T8 alone is 33.2 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 R84 due to all turbines (from all projects) within 5,000 m of the receptor. The resultant A-weighted sound pressure level at R84 due to all turbines is 38.6 dBA.

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

Intermediate calculations for R84 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	3646	31.0	21.8	18.0	12.1	1.3	-26.4	-115.5	-433.9	13.9
T2	3179	31.9	23.1	19.5	14.1	4.2	-20.7	-99.0	-378.1	15.6
T3	3040	32.2	23.6	20.1	14.7	5.0	-19.0	-94.1	-361.5	16.1
T4	1628	37.8	29.6	26.9	22.8	15.7	0.1	-42.4	-190.8	23.7
T5	1368	39.3	31.2	28.7	24.8	18.2	4.2	-32.3	-158.9	25.7
T6	877	43.3	35.3	33.0	29.6	23.8	12.8	-12.4	-97.6	30.5
T7	809	44.0	36.0	33.8	30.5	24.8	14.2	-9.4	-88.9	31.3
T8	673	45.6	37.7	35.5	32.3	26.9	17.1	-3.4	-71.5	33.2
T9	779	44.3	36.4	34.1	30.8	25.2	14.8	-8.1	-85.2	31.7
T10	1292	39.8	31.7	29.2	25.5	18.9	5.4	-29.4	-149.6	26.3

10 CONCLUSIONS

This noise impact assessment for the proposed Gunns Hill Wind 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 and Climate Change 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: Gunns Hill Wind Project
Datum and Projection: NAD83 (Canada); UTM 17N

Identifier	Equipment Make and Model	X(E,m)	Y(N,m)	Remarks
T1	Senvion MM92/60Hz/CCV(MP1880kW)	523280	4769978	GHWP
T2	Senvion MM92/60Hz/CCV(MP1880kW)	523798	4770216	GHWP
T3	Senvion MM92/60Hz/CCV(MP1880kW)	523881	4769898	GHWP
T4	Senvion MM92/60Hz/CCV(MP1880kW)	525534	4768602	GHWP
T5	Senvion MM92/60Hz/CCV(MP1880kW)	525919	4768537	GHWP
T6	Senvion MM92/60Hz/CCV(MP1880kW)	526656	4770340	GHWP
T7	Senvion MM92/60Hz/CCV(MP1880kW)	526980	4770300	GHWP
T8	Senvion MM92/60Hz/CCV(MP1880kW)	527115	4768860	GHWP
T9	Senvion MM92/60Hz/CCV(MP1880kW)	527438	4768938	GHWP
T10	Senvion MM92/60Hz/CCV(MP1880kW)	528153	4769205	GHWP

Switching Station

Tr99	Switching Station	523265	4770417	GHWP

Points of Reception (Receptors)

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

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
R4	Residence	4.5	3	524337	4769188
R5	Residence	4.5	3	524393	4769162
R6	Residence	4.5	3	524643	4769179
R7	Residence	4.5	3	524797	4769210
R8	Residence	4.5	3	525183	4769150
R10	Residence	4.5	3	525351	4769418
R11	Residence	4.5	3	523740	4768987
R12	Residence	4.5	3	523683	4768989
R13	Residence	4.5	3	523600	4768961
R14	Residence	4.5	3	523740	4768922
R15	Residence	4.5	3	523798	4768927
R16	Residence	4.5	3	523544	4768954
R17	Residence	4.5	3	523575	4768954
R18	Residence	4.5	3	523390	4768911
R19	Residence	4.5	3	523320	4768909
R20	Residence	4.5	3	523287	4768896
R21	Residence	4.5	3	523005	4768871
R22	Residence	4.5	3	522921	4768837
R23	Residence	4.5	3	522651	4768963
R24	Residence	4.5	3	522601	4769521
R25	Residence	4.5	3	522575	4769631
R26	Residence	4.5	3	522592	4769582
R27	Residence	4.5	3	522550	4769714
R28	Residence	4.5	3	522531	4769764
R29	Residence	4.5	3	522566	4769676
R30	Residence	4.5	3	522497	4769904
R31	Residence	4.5	3	522506	4769870
R32	Residence	4.5	3	522514	4769840
R33	Residence	4.5	3	522404	4769934
R34	Residence	4.5	3	522346	4770232
R35	Residence	4.5	3	522926	4770468
R36	Residence	4.5	3	524304	4770555
R37	Residence	4.5	3	525081	4770742
R38	Residence	4.5	3	525461	4770841
R39	Residence	4.5	3	525717	4770894
R40	Residence	4.5	3	525850	4770895
R41	Residence	4.5	3	526143	4771035
R42	Residence	4.5	3	526067	4771026
R43	Residence	4.5	3	525929	4770874
R44	Residence	4.5	3	526191	4771048
R45	Residence	4.5	3	526674	4771071
R46	Residence	4.5	3	526913	4771225
R47	Residence	4.5	3	526751	4771232
R48	Residence	4.5	3	525970	4770749
R49	Residence	4.5	3	526093	4770577
R50	Residence	4.5	3	526109	4770528
R52	Residence	4.5	3	525959	4770363
R54	Residence	4.5	3	526173	4769838
R55	Residence	4.5	3	525949	4769269
R56	Residence	4.5	3	526441	4769137
R57	Residence	4.5	3	526351	4769196

R61	Residence	4.5	3	526311	4768036
R62	Residence	4.5	3	525947	4767926
R63	Residence	4.5	3	524888	4768744
R65	Residence	4.5	3	527060	4768143
R68	Residence	4.5	3	527955	4768374
R69	Residence	4.5	3	528454	4768554
R70	Residence	4.5	3	529049	4768677
R71	Residence	4.5	3	528964	4768617
R72	Residence	4.5	3	528872	4768653
R73	Residence	4.5	3	528891	4768588
R74	Residence	4.5	3	529074	4768617
R75	Residence	4.5	3	528757	4770170
R76	Residence	4.5	3	528308	4769805
R77	Residence	4.5	3	528286	4769751
R78	Residence	4.5	3	528202	4769873
R79	Residence	4.5	3	528023	4769814
R80	Residence	4.5	3	527612	4769608
R81	Residence	4.5	3	527621	4769937
R84	Residence	4.5	3	526894	4769496
R85	Residence	4.5	3	526735	4769459
R101	Residence	4.5	3	525692	4769372
R103	Residence	4.5	3	524687	4767882
R104	Residence	4.5	3	524656	4767808
R106	Residence	4.5	3	523531	4768851
R110	Residence	4.5	3	528560	4768163
R114	Residence	4.5	3	524814	4767310
R115	Residence	4.5	3	524957	4767745
R116	Residence	4.5	3	525070	4767581
R118	Residence	4.5	3	527409	4771219
R119	Residence	4.5	3	526027	4771576
R120	Residence	4.5	3	525988	4771632
R121	Residence	4.5	3	525863	4771495
R124	Residence	4.5	3	524078	4771546
R127	Residence	4.5	3	522928	4771390
R134	Residence	4.5	3	522756	4768829
R135	Residence	4.5	3	523012	4768741
R139	Residence	4.5	3	527042	4767656
R143	Residence	4.5	3	529397	4768632
R146	Residence	4.5	3	529266	4768902
R147	Residence	4.5	3	529260	4768725
R148	Residence	4.5	3	529123	4768698
R159	Residence	4.5	3	527581	4771334
R167	Residence	4.5	3	525889	4771426
R168	Residence	4.5	3	525854	4771526
R169	Residence	4.5	3	525847	4771553
R170	Residence	4.5	3	525844	4771587
R176	Residence	4.5	3	524187	4771651
R177	Residence	4.5	3	523335	4771485
R178	Residence	4.5	3	523683	4771612
R179	Residence	4.5	3	522316	4770673
R181	Residence	4.5	3	522506	4769549
R182	Residence	4.5	3	522501	4769580
R183	Residence	4.5	3	522497	4769611
R184	Residence	4.5	3	522470	4769686
R185	Residence	4.5	3	522527	4769522
R187	Residence	4.5	3	522765	4768793
R188	Residence	4.5	3	522498	4768861
R189	Residence	4.5	3	522716	4768786
R190	Residence	4.5	3	522651	4768774
R191	Residence	4.5	3	522612	4768774

R192	Residence	4.5	3	522579	4768767
R193	Residence	4.5	3	522545	4768761
R194	Residence	4.5	3	522483	4768749
R195	Residence	4.5	3	522477	4768782
R196	Residence	4.5	3	522531	4768811
R197	Residence	4.5	3	522576	4768817
R198	Residence	4.5	3	522614	4768825
R199	Residence	4.5	3	522651	4768841
R200	Residence	4.5	3	522661	4768865
R201	Residence	4.5	3	522660	4768915
R202	Residence	4.5	3	522593	4768873
R203	Residence	4.5	3	522547	4768878
R204	Residence	4.5	3	522553	4768914
R205	Residence	4.5	3	522552	4768963
R206	Residence	4.5	3	522586	4768985
R207	Residence	4.5	3	522628	4768989
R210	Residence	4.5	3	522543	4768690
R211	Residence	4.5	3	522585	4768698
R212	Residence	4.5	3	523692	4768876
R213	Residence	4.5	3	522734	4768661
R214	Residence	4.5	3	522940	4768765
R215	Residence	4.5	3	522872	4768747
R216	Residence	4.5	3	522827	4768737
R217	Residence	4.5	3	522790	4768749
R218	Residence	4.5	3	522728	4768722
R219	Residence	4.5	3	522666	4768709
R220	Residence	4.5	3	522623	4768700
R222	Residence	4.5	3	524493	4767665
R223	Residence	4.5	3	526784	4768070
R317	Residence	4.5	3	522000	4770286
R376	Residence	4.5	3	522869	4768816
R377	Residence	4.5	3	522801	4768805
R408	Residence	4.5	3	526009	4769781

Vacant Lot Surrogate Receptors

Table - Vacant Lot Surrogate Receptor Locations

Project Name: Gunns Hill Wind Project
Datum and Projection: NAD83 (Canada); UTM 17

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
V102	VLSR	4.5	3	525827	4769312
V105	VLSR	4.5	3	523870	4768955
V107	VLSR	4.5	3	527760	4769760
V108	VLSR	4.5	3	528990	4768674
V109	VLSR	4.5	3	529016	4769905
V111	VLSR	4.5	3	527739	4768301
V112	VLSR	4.5	3	526176	4767994
V117	VLSR	4.5	3	524994	4767901
V122	VLSR	4.5	3	524685	4770593
V123	VLSR	4.5	3	524444	4771494
V125	VLSR	4.5	3	523884	4771512
V126	VLSR	4.5	3	523555	4771408
V130	VLSR	4.5	3	522671	4770442
V131	VLSR	4.5	3	522657	4769285
V132	VLSR	4.5	3	522717	4769021

V133	VLSR	4.5	3	523140	4768884
V136	VLSR	4.5	3	528089	4768406
V142	VLSR	4.5	3	529138	4768150
V145	VLSR	4.5	3	529494	4768723
V149	VLSR	4.5	3	529471	4768775
V152	VLSR	4.5	3	529061	4770015
V153	VLSR	4.5	3	529138	4770038
V157	VLSR	4.5	3	527961	4771336
V158	VLSR	4.5	3	527807	4771302
V160	VLSR	4.5	3	527814	4771389
V162	VLSR	4.5	3	527101	4771251
V173	VLSR	4.5	3	526004	4770633
V186	VLSR	4.5	3	522964	4768844
V208	VLSR	4.5	3	522537	4769432
V224	VLSR	4.5	3	524474	4769158
V225	VLSR	4.5	3	526075	4770620
V405	VLSR	4.5	3	522912	4768773

Participating Receptors (Participants)

Table - Participating Receptor Locations

Project Name: Gunns Hill Wind Project
Datum and Projection: NAD83 (Canada); UTM 17N

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
P1	Residence	4.5	3	522843	4770364
P2	Residence	4.5	3	524200	4769096
P3	Residence	4.5	3	524146	4769071
P9	Residence	4.5	3	525286	4769173
P51	Residence	4.5	3	526171	4770278
P53	Residence	4.5	3	526205	4770164
P58	Residence	4.5	3	526592	4768558
P59	Residence	4.5	3	526250	4768179
P60	Residence	4.5	3	526201	4768203
P64	Residence	4.5	3	526192	4768250
P66	Residence	4.5	3	526963	4768450
P67	Residence	4.5	3	527493	4768420
P82	Residence	4.5	3	527137	4769739
P83	Residence	4.5	3	527162	4769557
P87	Residence	4.5	3	528033	4769714

Participating vacant lot surrogate receptors

Table - Participating Receptor Locations

Project Name: Gunns Hill Wind Project
Datum and Projection: NAD83 (Canada); UTM 17N

Point of Reception ID	Description	Height (m)	NPC Class	X(E,m)	Y(N,m)
Q409	Participant VLSR	4.5	3	523434	4770455

13 APPENDIX B — ADDITIONAL DOCUMENTATION

The following documents have been included in this Appendix.

Senvion Canada Inc. Letter 2014-01-20

This letter states that REpower Systems Inc is now Senvion Canada Inc.

Senvion Canada Inc. Letter 2014-07-29

This letter states provides details of **"MM92 Acoustic Emissions for the Gunns Hill project"**.

MM92/60Hz/CCV, Maximum Rated Power 1.88 MW Acoustic Emission, Hub Height 98 – 100m

This document (attached to the previous letter and also dated 2014-07-29) provides broadband and octave band data for the Gunns Hill Wind Project turbines.

SENVION

January 20, 2014

Senvion Canada Inc.
1250 René-Lévesque Blvd. West,
Suite 3610
Montreal, Quebec, H3B 4W8
Canada
info.canada@senvion.com
www.senvion.com

REpower Systems is now called Senvion.

Dear Sir or Madam,

The wait is over: REpower Systems Inc. is now Senvion Canada Inc. and from now on, we will contact you only as Senvion. In order to ensure a smooth transition for all involved, we would kindly ask you to inform your colleagues and other relevant contacts in your company, such as your accounting department, of our new name and brand appearance. Our bank details, tax and company registration number will remain unchanged.

Senvion will pick up where REpower Systems left off: as one of the leading companies in the wind energy industry which has installed more than 5,000 turbines in 15 countries and builds on 25 years of engineering experience. We are proud to continue the success story of REpower Systems under the name of Senvion.

Should you have any questions, your current contact partners will, of course, be pleased to help you at any time. Further information can now also be found at www.senvion.com

We look forward to continuing our fruitful working relationship.

Yours sincerely,

Helmut Herold
- MD, CEO North America, Senvion Canada Inc.-

SENVION

July 29, 2014

Attn: Juan Andersen

Prowind Canada Inc.
19 Bold St, Unit 2B
Hamilton, ON, L8P 1T3
Canada

RE: MM92 Acoustic Emissions for the Gunns Hill project

Dear Mr. Andersen,

This letter is to confirm that Senvion will supply the MM92/60 Hz/CCV, Maximum Rated Power 1.88 MW wind turbine for the Gunns Hill project. The maximum rated power and maximum sound power level for the specific nameplate are tabulated below.

Turbine Model Nameplate	Maximum Rated Power	Maximum Sound Power Level	Hub Height
MM92/60Hz/CCV, Maximum Power 1.88 MW	1.88 MW	102.0 dBA	98-100 m

Senvion warrants the guaranteed maximum sound power levels detailed in the attached acoustic emission sheet for 98-100 metre hub height, which were determined in accordance with IEC 61400-11:2002 + A1: 2006.

Senvion further warrants that there is no tonal audibility greater than 0 dB for this turbine model as determined in accordance with IEC 61400-11 + A1: 2006.

We remain at your disposal should you require any further details.

Sincerely,

Andrew Rabeau, P. Eng.
Project and Sales Engineer
Technical Support Americas

Senvion Canada Inc.
1250, Boulevard René-Lévesque Ouest, bureau 3610, Montréal, Québec, Canada, H3B 4W8

SENVION

MM92/60Hz/CCV, Maximum Rated Power 1.88 MW
Acoustic Emission, Hub Height 98 - 100m

Senvion guarantees the following sound power levels when measured in accordance with IEC 61400-11:2002 + A1: 2006. The guaranteed sound power levels have been determined in accordance with IEC 61400-11:2002 + A1: 2006, and are presented for a corresponding wind speed at a reference height of 10 m (above ground level) and based on a roughness length of 0.05 m.

Sound Power Levels

Wind Speed (m/s)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0 – Vout
Sound Power Level Lwa (dB(A))	89.2	90.2	94.4	98.2	100.7	101.7	102.0	102.0	102.0

Octave Band Spectra

The octave band spectra tabulated below are referenced to wind speed at 10 m height, and are for information purposes only. Senvion does not warrant these values.

Lwa in dB(A)		Wind Speed (m/s)				
		6	7	8	9	10
Frequency (Hz)	63	83.8	84.0	84.2	84.2	84.6
	125	90.1	90.5	90.4	90.2	90.3
	250	95.1	95.1	94.3	94.3	94.0
	500	97.1	97.2	96.9	96.8	96.6
	1000	96.3	96.2	96.6	96.7	96.7
	2000	91.6	91.6	92.3	92.5	93.0
	4000	85.8	86.5	88.0	87.4	88.7
	8000	72.5	73.0	73.8	76.1	75.3

Measurement Uncertainty:
The measurement uncertainty applicable on the provided sum levels is +/- 1 dB(A).

Tonal Audibility:
Senvion warrants that there is no tonal audibility greater than 0 dB as determined in accordance with IEC 61400-11:2002 + A1: 2006.

July 29, 2014

Senvion Canada Inc.
1250, Boulevard René-Lévesque Ouest, bureau 3610, Montréal, Québec, Canada, H3B 4W8

END