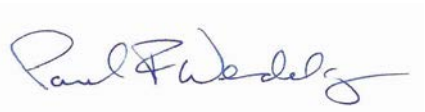
K2 Wind Power Project

NOISE ASSESSMENT REPORT

Revision 5

For

K2 WIND ONTARIO



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1 INTRODUCTION

1.1 Purpose

This Noise Assessment Report describes the results of a noise impact assessment for K2 Wind Ontario's proposed K2 Wind Power Project (K2WPP).

1.2 Revision 0

Revision 0 is the original Noise Assessment Report.

1.3 Revision 1

Revision 1 documented the following changes.

The prospective project turbine type changed from the Vestas V90-1.8MW to power and noise derated variants of the Siemens SWT-2.3-101 turbine.

The number of project turbines was reduced from 152 to 141. The 11 deleted turbines were T203, T222, T241, T244, T250, T255, T268, T278, T293, T316, and T331. No turbine re-numbering occurred at the time of Revision 1.

Removal of turbines precipitated status changes to a number of receptors, vacant lot surrogate receptors (VLSRs), and participants. These were reflected in Revision 1.

An additional transformer was added to the project near T251.

1.4 Revision 2

Revision 2 documented the following changes.

The project name was changed from Kingsbridge II Wind Power Project to K2 Wind Power Project.

The number of project turbines changed from 141 to 140. There was no renumbering of turbines. In some instances, there were small shifts in turbine locations.

Two turbine variants, the Siemens SWT-2.300-101 and the SWT-1.824-101 were included in the Siemens turbine mix. There were then six variants of the SWT-2.3-101 turbine in the project.

Turbines T224, T234, T242, T243, T351, T352, and T353 were deleted.

Turbines T360, T362, T373, T374 T379, and T380 2343 added.

Additional information on tonality and tonal audibility of the Siemens turbines was included.

Project substation and transformer locations were changed slightly. However, they remain on the same properties.

Based on advice from the Ontario Ministry of Environment, the broadband and octave band source sound power levels for the Kingsbridge Wind Power Project V80 turbines were changed.

The status of a variety of receptors, VLSRs, and participants was changed and/or updated.

A number of minor corrections and changes were incorporated.

1.5 Revision 3

Revision 3 included the following changes.

Eight turbines have been derated in order to meet a project total nameplate capacity of 270 MW.

Turbines T271, T265, T276 and T227 have been derated from Siemens SWT-1.903-101 to Siemens SWT-1.824-101.

Turbines T300 and T230 have been derated from Siemens SWT-2.221-101 to Siemens SWT-1.824-101.

Turbine T336 has been derated from Siemens SWT-2.030-101 to Siemens SWT-1.824-101.

Turbine T374 has been derated from Siemens SWT-2.126-101 to Siemens SWT-1.824-101

Figure 1-1 Wind project location map.

1.6 Revision 4

Revision 4 included the following changes.

On request from the Ontario MoE, the project turbine octave band source sound power levels have been extended and

updated to cover the full range of wind speeds from 6 to 10 ms^{-1}. Previously, octave bands were provided only for 6 and 8 ms^{-1} wind speeds. Documentation detailing these data are included in this revision. A guarantee letter with respect the turbine rated power and maximum broadband source sound power level is also included.

Included in the documentation mentioned above is a statement with respect to the turbine's tonal audibility.

Sensitivity tests to determine the MoE-defined "predictable worst case" for the project turbines have been carried out. It has been determined that this occurs for the (unadjusted) "Manufacturer's emission levels" for the 7 ms^{-1} (measured at 10 m a.g.l.) octave band source sound power levels. These have been used for all noise modelling reported in this Revision.

Sensitivity tests to determine the MoE "predictable worst case" for the Kingsbridge Wind Power Project turbines have been carried out. It has been determined that this occurs for the (unadjusted) "Manufacturer's emission levels" for the 8 ms^{-1} (measured at 10 m a.g.l.) octave band source sound power levels. Despite the logical inconsistency with the project turbine "predictable worst case" wind speed, these have been used for all noise modelling reported in this Revision.

Based on advice provided by the MoE, the base broadband source sound power level used for project power transformers in this assessment has been raised from 79 dBA (84 dBA total with 5 dBA tonal penalty included) to 87 dBA (92 dBA total with tonal penalty).

UTM coordinates for the Kingsbridge Wind Power Project substation transformer and the Suncor Ripley Wind Project 1 transformers have been included. As in previous revisions, they have not been used as noise sources for the analysis described in this Revision.

An overall figure to scale (A0 paper size hard copy format) showing an aerial photo background of the study area along with noise sources, points of reception (and sound levels) and the 40 dBA noise isopleth has been provided to MoE.

A clarification of the status of the Port Albert Wind Farm has been included. It is noted that the single Vestas V47 turbine comprising that project has been incorporated into the Kingsbridge Wind Power Project and has been included in this and all previous Revisions.

Changes to locations of a number of receptors and VLSRs based on feedback from members of the project community have been included. Also changes in status of a number of receptors, VLSR's and participants based on the same source have been included.

A number of minor corrections and editorial changes were also incorporated.

1.7 Revision 5

The present revision (Revision 5) includes the following changes.

Corrections to typographical errors in Table 5-3 of Revision 4 have been made.

The set of octave band source sound power levels for the project turbines corresponding to the MoE-defined "predictable worst case" (which occurs for the 10 m a.g.l. wind speed of 7 ms^{-1}) for resultant sound pressure levels at receptors has been replicated for all wind speeds (6 to 10 ms^{-1}) in the "Adjusted emission levels" portions of Tables 5-1 to 5-6. This does not change the results of the analysis reported in Revision 4, as the analysis summarized in that report was based on the 7 ms^{-1} "predictable worst case" octave bands.

1.8 Brief Project Description

The K2 Wind Ontario Project (K2WPP) is an expansion of the existing Kingsbridge Wind Power Project (Phase I, KWPP). K2WPP is located on the eastern shore of Lake Huron in the Regional Municipality of Ashfield-Colborne-Wawanosh (ACW) in Huron County. The proposed project features 140 power and noise derated Siemens SWT-2.3-101 turbines located north and south of the town of Kingsbridge and approximately between the towns of Sheppardton and Amberley.

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

1.9 Reporting Details

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

A noise impact assessment was carried out for this project under Section 55.(3) of O. Reg 359/09 (Government of Ontario, 2009b) and amendments (O.Reg. 521/10, Government of Ontario, 2010; O.Reg. 231/11, Government of Ontario, 2011; O.Reg. 195/12, Government of Ontario, 2012). The assessment methodology and calculations conform to the ISO 9613-2 International Standard (ISO, 1996). Results of the analysis have been interpreted using Ministry of Environment Guidelines (MoE, 2008). This latter document generally provides guidelines and clarifications for the application of MoE regulations document NPC-232 (MoE, 1995) to wind farm projects.

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

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

1.10 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.

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	36.0	38.0	42.0	44.0

Note that noise contributions from project switching, transformer, and substations must be included.

2 PROJECT LAYOUT

2.1 Project Site

Figure 2-1 shows the K2 Wind Power Project. Typical topographic map features along with project details are shown on the map.

The topography in the western portion of this region is the obviously flat surface of Lake Huron. Along the shoreline, a slight bluff (about 25 m in elevation) separates the lake from the gradually eastwards rising land area. Except for the northeastern portion of the area, 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. Within the northeastern portion of the project, the topography rises slightly and becomes somewhat more hilly. On a smaller scale, the project topography is cut by a number of creeks and small rivers flowing from the east into Lake Huron. The project turbines lie at altitudes ranging from about 200 to 300 m above sea level. Lake Huron lies approximately 176 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. There are no large towns nor cities within the project area. Obviously, the western portion, *i.e.* Lake Huron, is extremely smooth in terms of surface aerodynamic roughness.

The primary activity in this area is agriculture. The major transportation corridor is Highway 21, running north and south on the western boundary of the project.

The K2WPP 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).

2.2 Project Details

Figure 2-1 shows the properties that have been optioned for lease to the project proponent (K2 Wind Ontario) along with prospective turbine, transformer, 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', transformers are designated with 'Tr',receptors with 'R', VLSRs with 'V', and participants with 'P'.

As specified by O.Reg 359/09, the K2 Wind Power Project is a Class 4 Wind Project.

The K2WPP will consist of 140 Siemens power and noise derated SWT-2.3-101 turbines. Specifically, these are 4x Siemens SWT-2.300-101, 2x Siemens SWT-2.221-101, 5x Siemens SWT-2.126-101, 14x Siemens SWT-2.030-101, 95x Siemens SWT-1.903-101 and 20x Siemens SWT-1.824-101 turbines for a project capacity of 270.0 MW. The project turbines are numbered T200 to T380 in Figure 2-1. The project stretches for a north/south distance of about 22 km parallel to the shore of Lake Huron. Turbines are located from about 1.8 km to 12.9 km from the shoreline. A listing of all K2WPP turbine locations can be found in Section 12 (Appendix A).

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.

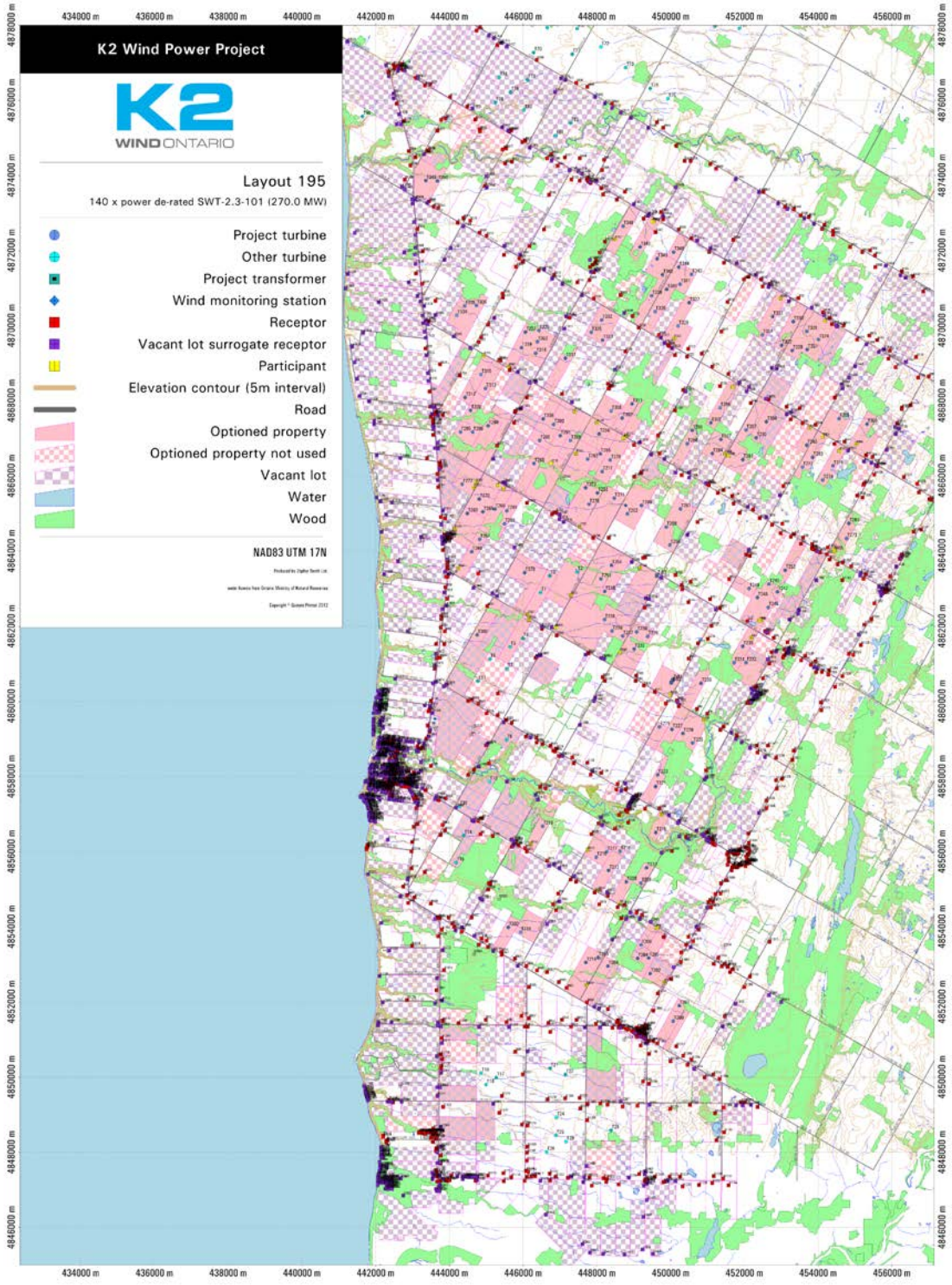

Figure 2-1 Project site details map.

2.3 Municipal Zoning

Typically, the project area is zoned as Agricultural.

2.4 Adjacent Projects

2.4.1 Kingsbridge Wind Power Project (Phase 1)

Figure 2-1 also shows the locations of existing turbines in the Capital Power Corporation (Phase 1) Kingsbridge Wind Power Project (KWPP). These turbines are located mainly to the south of the K2WPP but are also interspersed with the K2WPP turbines at the southern end of the latter project. The KWPP project is comprised of 22x Vestas V80 turbines (39.6 MW) and 1x Vestas V47 turbine (660 kW) for a total project capacity of 40.3 MW. The KWPP turbines are numbered T1 to T30 in Figure 2-1.

Note that the single Vestas V47 turbine in the KWPP previously comprised the Port Albert Wind Farm. This project (the single turbine) has been acquired by Capital Power Corporation and is presently operated as a component of the KWPP.

Details of these turbines are provided further below. All turbines in the KWPP project (including the previously designated Port Albert Wind Farm V47 turbine) within 5 km of any receptor of the K2WPP have been included in the noise assessment for the present project.

2.4.2 Suncor Ripley Wind Project 1

Figure 2-1 also shows the locations of turbines in the Suncor Ripley Wind Project 1 (SRWP1). These turbines are located roughly to the north of the K2WPP turbines. The SRWP1 project is comprised of 38x Enercon E82 2.05 MW turbines for a project capacity of approximately 77.9 MW. These SRWP1 turbines are numbered T45 to T82 in Figure 2-1.

Details of these turbines are provided further below. All turbines in the SRWP1 project within 5 km of any receptor of the K2WPP have been included in the noise assessment for the present project.

2.4.3 Privately Owned Turbine

Figure 2-1 also shows a single Enercon E33 330 kW turbine (T90) installed by a private landowner. The turbine is located to the west of the K2WPP turbines.

Details of this turbine are provided further below. This turbine has been included in the noise assessment for the present project.

2.5 Substations

2.5.1 K2 Wind Power Project

The K2WPP will include two substations comprising a total of three transformers. Two of the transformers (Tr91, Tr92) will be collocated at a single substation on a project property situated north of the intersection of Glens Hill Road and Tower Line. The third transformer (Tr93) will be located at a substation on a project property situated south of the intersection of Belgrave Road and Lanesville Line. The locations of these substations (Tr91, Tr92, Tr93) are shown in Figure 2-1.

Noise from the three transformers has been included in all the reported noise calculations.

2.5.2 Kingsbridge Wind Power Project

There is a single transformer substation associated with the KWPP project (Goderich Substation). It is located about 16.5 km to the southwest of the K2WPP transformer substation on the outskirts of the town of Goderich, and is about 12 km from any K2WPP turbine.

There is a small transformer (approximately 27.5 kV / 400 V) located at the KWPP north switch-yard (446,431E; 4,862,033N).

Neither noise from the Goderich Substation nor from the small switch-yard transformer has been included in the reported noise calculations.

2.5.3 Suncor Ripley Wind Project 1

According to Environmental Assessment documents published by Suncor, there is one transformer substation located within the SRWP1 project area. It is located approximately 4.8 km north-northeast of the northernmost K2WPP turbine. The two transformers (RN1, RN2) in this substation are located as follows.

RN1	461,713E	4,902,344N
RN2	461,734E	4,902,333N

Approximately ten SRWP1 turbines lie between this northernmost K2WPP turbine and the substation.

Noise from this transformer substation has not been included in the reported noise calculations.

3 DESCRIPTION OF RECEPTORS

3.1 Definition

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

3.2 Determination

Receptors and participants were identified through mapping, aerial photographs, and on-site surveys of the area. 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 K2WPP wind turbine or transformer 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 purposes 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, 482 receptors, 303 VLSRs, and 50 participants (total 835) have been identified within 2 km of any K2WPP turbine; 248 vacant lots have also been identified within 2 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 1.5 km of any turbine or substation in the K2WPP 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. It is important to note that MoE has provided a modified version of Section 6.3.2 (MoE, 2012; see Section 13) which has been used for the calculations presented in this report. For reference, it is as follows.

"6.3.2 Wind Farm Includes Transformer Substation

a) Dwellings up to Two Storey High

i. either of the following:

- 4.5 m above grade at the centre of the dwelling, or

- at the centre of the highest storey of the dwelling; or

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

The location from i. or ii. above, that results in the higher noise impact, must be selected.

b) Three Storey or Higher Dwelling

(unchanged)" [from MoE (2008)]

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

For areas where there is such a high density of receptors that it would be impractical (and tedious for the reader) to include them all, a comprehensive selection of sample receptors (HDSRs, High Density Sample Receptors) were designated. These specific receptors were sampled so as to represent the cluster of all receptors in such a way that the sample receptors would be those subject to the maximum sound pressure levels from the surrounding turbines. Typically,

receptors at all corners, along all boundaries, and in the centre of the high density cluster were chosen with (generally) a maximum separation of 200 m between sample receptors where possible. All sample receptors were assigned a height of 4.5 m to ensure that any 2-storey residences within the cluster were represented.

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

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

3.5 Concordance Table

As requested by MoE, a "concordance table" that rationalizes the identification of receptors and VLSRs between the K2WPP and the adjacent KWPP has been included here. Table 3-1 lists receptors and VLSRs which are located mutually within 1.5 km of any wind turbine in the K2WPP and the KWPP. (Note that there were no mutual receptors for any of the other neighbouring wind projects.)

The next paragraphs describe the concordance table's columns.

The first pair of columns in the table lists the UTM coordinates (NAD83, UTM17N) of the receptor or VLSR as determined for the K2WPP. The second pair of columns lists the coordinates as provided by Capital Power for the KWPP. Note that for receptors, these pairs of columns are generally only slightly different. The differences can be attributed to the choice of the exact location of the dwelling in question and the precision of the GIS data including base mapping and air or satellite photography. However, in the case of VLSRs, the locations can be significantly different since the VLSR need only be located on the vacant property in question, although it must be surrounded by at least 1 ha of available land, zoned to permit residential or similar uses, conform with local building codes, and be consistent with the typical building pattern in the area. In some instances, it is possible for the two project designers to reasonably choose two VLSRs which are hundreds of metres apart but still located on the same vacant lot property. Note that there are some receptors and VLSRs in each of the projects that do not appear to have matches in the other project. These have been indicated by "n/a" in the table.

The fifth column in the table lists the distance between the two locations (K2WPP–designated or KWPP–designated) determined for the receptor or VLSR.

The next pair of columns lists the receptor or VLSR identifier — first as used for the K2WPP, and second as used for the KWPP. Naturally, these would not be expected to be the same. As noted above, there are some receptors/VLSRs that are found in one project and not in the other. Again, this is indicated by "n/a".

The next pair of columns lists the distances from the receptor or VLSR to the nearest noise source (turbine or transformer) — first for the K2WPP, and second for the KWPP. While it might seem logical that these distances should be identical

for receptors, again the precision of the receptor location as discussed above can lead to different results where the receptor is almost equidistant from two different noise sources. In the case of VLSRs, the differences can be significant since, as noted previously, VLSRs for each of the projects can be located in quite different places on the same vacant lot.

The next pair of columns identifies the nearest noise source as determined in the previous columns — first as specified for the K2WPP and second as specified for the KWPP. Again, it would seem logical that these identities should be the same, but due to the finite precision in the GIS systems used by the two project designers, and, further, due to the fact that VLSRs can have significantly different locations on the same vacant lot, the nearest noise sources can be different.

The next three columns list the receptor/VLSR sound pressure levels — the first for the case where only K2WPP noise sources are included, the second where only KWPP noise sources are included, and the third where noise sources from both projects are included. Note that the sound pressure levels are listed for the K2WPP receptor/VLSR locations. They have not been determined for the KWPP receptor/VLSR locations. In most cases, these should be quite similar but there could be significant differences where there is a substantial separation between K2WPP/KWPP receptor/VLSR pairs. This would more likely occur in the case of the VLSRs. Note that the "Total Level" has been determined from a full analysis including both the K2WPP and the KWPP noise sources at K2WPP receptors/VLSRs.

Table 3-1 K2WPP—KWPP receptor and VLSR concordance table.

UTM coordinates K2WPP		UTM coordinates KWPP			Noise receptor ID		Distance to nearest source (m)		Nearest source ID		Level of farm (dBA)		Level (dBA)
Easting (m)	Northing (m)	Easting (m)	Northing (m)	Differ-ence (m)	K2WPP	KWPP	K2WPP	KWPP	K2WPP	KWPP	K2WPP	KWPP	Total
446,979	4,864,853	n/a	n/a	n/a	V1614	n/a	895	n/a	T275	n/a	37.4	n/a	n/a
447,093	4,864,777	n/a	n/a	n/a	V1615	n/a	835	n/a	T275	n/a	37.4	n/a	n/a
447,541	4,864,665	n/a	n/a	n/a	P751	n/a	632	n/a	T275	n/a	37.2	n/a	n/a
447,902	4,864,356	447,882	4,864,33	30	R750	H73	880	960	T254	T2	38.0	32.9	39.1
448,323	4,864,358	n/a	n/a	n/a	R749	n/a	737	n/a	T254	n/a	38.7	n/a	n/a
445,766	4,864,103	n/a	n/a	n/a	V2433	n/a	684	n/a	T260	n/a	38.6	n/a	n/a
447,290	4,862,827	n/a	n/a	n/a	P677	n/a	927	n/a	T251	n/a	36.9	n/a	n/a
445,162	4,862,879	n/a	n/a	n/a	V1613	n/a	1035	n/a	T379	n/a	34.5	n/a	n/a
445,290	4,862,808	n/a	n/a	n/a	V1616	n/a	973	n/a	T379	n/a	34.4	n/a	n/a
446,127	4,862,323	n/a	n/a	n/a	P651	n/a	1112	n/a	T379	n/a	33.2	n/a	n/a
446,163	4,862,181	n/a	n/a	n/a	P650	n/a	1256	n/a	T379	n/a	31.3	n/a	n/a
446,771	4,861,971	n/a	n/a	n/a	V1617	n/a	1450	n/a	T238	n/a	33.6	n/a	n/a
446,909	4,861,761	n/a	n/a	n/a	R682	n/a	1363	n/a	T238	n/a	32.3	n/a	n/a

UTM coordinates K2WPP		UTM coordinates KWPP			Noise receptor ID		Distance to nearest source (m)		Nearest source ID		Level of farm (dBA)		Level (dBA)
Easting (m)	Northing (m)	Easting (m)	Northing (m)	Differ-ence (m)	K2WPP	KWPP	K2WPP	KWPP	K2WPP	KWPP	K2WPP	KWPP	Total
445,023	4,862,536	n/a	n/a	n/a	R639	n/a	810	n/a	T380	n/a	34.9	n/a	n/a
446,887	4,861,966	446,907	4,861,97	24	P678	H85	1336	963	T238	T6	34.1	36.3	38.9
443,870	4,861,872	n/a	n/a	n/a	R782	n/a	890	n/a	T380	n/a	31.9	n/a	n/a
443,859	4,861,531	n/a	n/a	n/a	R783	n/a	927	n/a	T380	n/a	31.3	n/a	n/a
443,643	4,861,268	n/a	n/a	n/a	V1672	n/a	1220	n/a	T380	n/a	28.8	n/a	n/a
443,745	4,861,165	n/a	n/a	n/a	R784	n/a	1178	n/a	T380	n/a	29.1	n/a	n/a
443,659	4,861,156	n/a	n/a	n/a	R785	n/a	1256	n/a	T380	n/a	28.5	n/a	n/a
443,605	4,860,960	n/a	n/a	n/a	V1673	n/a	1407	n/a	T380	n/a	27.4	n/a	n/a
443,597	4,860,872	n/a	n/a	n/a	R171	n/a	1466	n/a	T380	n/a	25.6	n/a	n/a
446,461	4,857,727	n/a	n/a	n/a	R983	n/a	1048	n/a	T219	n/a	31.9	n/a	n/a
446,337	4,857,511	n/a	n/a	n/a	V2009	n/a	851	n/a	T219	n/a	34.7	n/a	n/a
446,398	4,857,386	n/a	n/a	n/a	V2012	n/a	717	n/a	T219	n/a	36.3	n/a	n/a
445,682	4,856,327	n/a	n/a	n/a	V2478	n/a	916	n/a	T219	n/a	34.1	n/a	n/a
445,173	4,856,417	445,176	4,856,44	28	R605	H127	1379	668	T219	T13	30.5	37.9	37.5
445,763	4,856,285	n/a	n/a	n/a	V2013	n/a	861	n/a	T219	n/a	34.7	n/a	n/a
445,799	4,856,291	n/a	n/a	n/a	R981	n/a	826	n/a	T219	n/a	34.2	n/a	n/a
445,784	4,856,243	n/a	n/a	n/a	R610	n/a	862	n/a	T219	n/a	33.8	n/a	n/a
445,740	4,856,176	n/a	n/a	n/a	V2496	n/a	935	n/a	T219	n/a	34.1	n/a	n/a
445,696	4,856,135	n/a	n/a	n/a	R609	n/a	994	n/a	T219	n/a	32.6	n/a	n/a
445,063	4,855,157	n/a	n/a	n/a	R607	n/a	1282	n/a	T207	n/a	32.4	n/a	n/a
445,110	4,855,144	n/a	n/a	n/a	R606	n/a	1251	n/a	T207	n/a	32.6	n/a	n/a
445,055	4,854,998	n/a	n/a	n/a	R608	n/a	1143	n/a	T207	n/a	33.2	n/a	n/a
444,832	4,854,761	n/a	n/a	n/a	V2058	n/a	1084	n/a	T207	n/a	33.4	n/a	n/a
444,894	4,854,722	n/a	n/a	n/a	V2057	n/a	1013	n/a	T207	n/a	34.0	n/a	n/a

4 DESCRIPTION OF SOURCES

4.1 K2 Wind Power Project Turbines

The turbines proposed for the K2WPP are manufactured by Siemens Wind Systems A/S (www.siemens.com) of Germany. Siemens Wind Power A/S is a relative newcomer to the ranks of wind turbine manufacturers. However, it entered the market by purchasing the long-standing and experienced Bonus turbine manufacturing company. The proposed models are the SWT-2.300-101 SWT-2.221-101, SWT-2.126-101, SWT-2.030-101, SWT-1.903-101 and the SWT-1.824-101.

These turbines are the power and noise derated versions of the full power (and full noise) Siemens SWT-2.3-101 turbine. It is important to note that the designation SWT-2.3-101 is a generic name used to identify all variants of these turbines. However, each of the turbines, SWT-2.300-101, SWT-2.221-101, *etc*., is a distinct model with with its own nameplate designation, rated power, and broadband and octave band source sound power characteristics. Section 13 contains a letter from Siemens Energy Inc. confirming this.

4.1.1 Siemens SWT-2.300-101

The following table summarizes this turbine's characteristics.

	Siemens SWT-2.300-101
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	2,300 kW
Rotor diameter; swept area	101.0 m; 8,000 m2
Operational rotation rate	6.0 to 16.0 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms-1
Cut-out wind speed	25 ms-1

	Siemens SWT-2.300-101
Rated wind speed	12-13 ms-1
Gearbox	yes; 3 stage planetary/helical
Generator; speed	asynchronous with squirrel-cage rotor, without slip rings; variable speed
Turbine transformer	internal (within tower)
Braking system	aerodynamic primary brake by full-span feathering of individual blades; mechanical disk brake on high-speed shaft which has two hydraulic calipers
Yaw system	active electric externally geared slewring; passive friction brake

4.1.2 Siemens SWT-2.221-101

The following table summarizes this turbine's characteristics.

	Siemens SWT-2.221-101
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	2,221 kW
Rotor diameter; swept area	101.0 m; 8,000 m^2
Operational rotation rate	6.0 to 16.0 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	12-13 ms^{-1}
Gearbox	yes; 3 stage planetary/helical
Generator; speed	asynchronous with squirrel-cage rotor, without slip rings; variable speed
Turbine transformer	internal (within tower)
Braking system	aerodynamic primary brake by full-span feathering of individual blades; mechanical disk brake on high-speed shaft which has two hydraulic calipers
Yaw system	active electric externally geared slewring; passive friction brake

4.1.3 Siemens SWT-2.126-101

The following table summarizes this turbine's characteristics.

	Siemens SWT-2.126-101
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	2,126 kW
Rotor diameter; swept area	101.0 m; 8,000 m^2
Operational rotation rate	6.0 to 16.0 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	12-13 ms^{-1}
Gearbox	yes; 3 stage planetary/helical
Generator; speed	asynchronous with squirrel-cage rotor, without slip rings; variable speed
Turbine transformer	internal (within tower)
Braking system	aerodynamic primary brake by full-span feathering of individual blades; mechanical disk brake on high-speed shaft which has two hydraulic calipers
Yaw system	active electric externally geared slewring; passive friction brake

4.1.4 Siemens SWT-2.030-101

The following table summarizes this turbine's characteristics.

	Siemens SWT-2.030-101
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	2,030 kW
Rotor diameter; swept area	101.0 m; 8,000 m^2
Operational rotation rate	6.0 to 16.0 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	12-13 ms^{-1}
Gearbox	yes; 3 stage planetary/helical
Generator; speed	asynchronous with squirrel-cage rotor, without slip rings; variable speed
Turbine transformer	internal (within tower)
Braking system	aerodynamic primary brake by full-span

	Siemens SWT-2.030-101
	feathering of individual blades; mechanical disk brake on high-speed shaft which has two hydraulic calipers
Yaw system	active electric externally geared slewring; passive friction brake

4.1.5 Siemens SWT-1.903-101

The following table summarizes this turbine's characteristics.

	Siemens SWT-1.903-101
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	1,903 kW
Rotor diameter; swept area	101.0 m; 8,000 m2
Operational rotation rate	6.0 to 16.0 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms-1
Cut-out wind speed	25 ms-1
Rated wind speed	12-13 ms-1
Gearbox	yes; 3 stage planetary/helical
Generator; speed	asynchronous with squirrel-cage rotor, without slip rings; variable speed
Turbine transformer	internal (within tower)
Braking system	aerodynamic primary brake by full-span feathering of individual blades; mechanical disk brake on high-speed shaft which has two hydraulic calipers
Yaw system	active electric externally geared slewring; passive friction brake

4.1.6 Siemens SWT-1.824-101

The following table summarizes this turbine's characteristics.

	Siemens SWT-1.824-101
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	1,824 kW
Rotor diameter; swept area	101.0 m; 8,000 m^2

	Siemens SWT-1.824-101
Operational rotation rate	6.0 to 16.0 rpm; variable speed
Hub height; tower type	99.5 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	12-13 ms^{-1}
Gearbox	yes; 3 stage planetary/helical
Generator; speed	asynchronous with squirrel-cage rotor, without slip rings; variable speed
Turbine transformer	internal (within tower)
Braking system	aerodynamic primary brake by full-span feathering of individual blades; mechanical disk brake on high-speed shaft which has two hydraulic calipers
Yaw system	active electric externally geared slewring; passive friction brake

4.2 Kingsbridge Wind Power Project Turbines

In addition to the K2WPP Siemens SWT-2.3-101 turbines, there are 22x Vestas V80 and 1x Vestas V47 turbines in the Capital Power Corporation KWPP project.

Information on the rating and noise characteristics of these turbines has been supplied by Capital Power Corporation to Zephyr North.

All of the KWPP turbines have been included in the present assessment.

4.2.1 Vestas V80

The following table describes this turbine's major characteristics.

	Vestas V80
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	1,800 kW
Rotor diameter; swept area	80.0 m; 5,027 m^2
Operational rotation rate	6.0 to 16.8 rpm; variable speed
Hub height; tower type	78 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	15 ms^{-1}
Gearbox	yes; planet/ parallel axles
Generator; speed	asynchronous with OptiSlip

	Vestas V80
Turbine transformer	unknown
Braking system	full blade pitch by three separate hydraulic pitch cylinders
Yaw system	active electrical gear motors; passive friction brake

4.2.2 Vestas V47

The following table describes this turbine's major characteristics.

	Vestas V47
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	660 kW
Rotor diameter; swept area	47.0 m; 1,735 m^2
Operational rotation rate	28.5 rpm; variable speed
Hub height; tower type	65.0 m; steel tubular tower
Power regulation	pitch regulation with variable speed
Cut-in wind speed	4 ms^{-1}
Cut-out wind speed	25 ms^{-1}
Rated wind speed	15 ms^{-1}
Gearbox	yes; planetary with parallel axles
Generator; speed	asynchronous with Optislip
Turbine transformer	unknown
Braking system	pitch/Optislip, feathered brake
Yaw system	unknown

4.3 Suncor Ripley Wind Project 1 Turbines

There are 38x Enercon E82 turbines in the SRWP1 project. Enercon, like Siemens and Vestas, is a well-experienced top-tier turbine manufacturer.

Information on the rating and noise characteristics of this turbine has been supplied by K2 Wind Ontario to Zephyr North.

All of the SRWP1 turbines have been included in the present assessment.

4.3.1 Enercon E82

The following table describes this turbine's major characteristics.

	Enercon E82
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	2,050 kW (2,000 kW nominal)
Rotor diameter; swept area	82.0 m; 5,281 m^2
Operational rotation rate	6 to 19.5 rpm; variable speed
Hub height; tower type	78 m; steel tubular tower
Power regulation	Pitch regulation with variable speed
Cut-in wind speed	2.5 ms^{-1}
Cut-out wind speed	28-34 ms^{-1}
Rated wind speed	12 ms^{-1}
Gearbox	No; direct drive
Generator; speed	Ring generator; speed synchronous with rotor; power electronics converts variable frequency to grid frequency
Turbine transformer	unknown
Braking system	3 independent blade pitch systems with emergency supply
Yaw system	6 electric motors; active

4.4 Privately Owned Turbine

There is one privately owned Enercon E33 turbine in the vicinity of the K2WPP.

Information on the rating and noise characteristics of this turbine has been supplied by K2 Wind Ontario to Zephyr North.

This turbine has been included in the present assessment.

4.4.1 Enercon E33

The following table describes this turbine's major characteristics.

	Enercon E33
Type, number of blades, rotor orientation	horizontal-axis, 3-bladed, upwind wind turbine
Rated power	330 kW
Rotor diameter; swept area	33.4 m; 876 m^2
Operational rotation rate	18-45rpm; variable speed
Hub height; tower type	50 m; steel tubular tower
Power regulation	Individual full span pitch control; variable speed single blade pitch system, one independent pitch system per rotor blade with allocated emergency supply

	Enercon E33
Cut-in wind speed	3.5 ms^{-1}
Cut-out wind speed	28-34ms^{-1}
Rated wind speed	14 ms^{-1}
Gearbox	No; direct drive
Generator; speed	ring generator; speed synchronous with rotor; power electronics converts variable frequency to grid frequency
Turbine transformer	unknown
Braking system	3 independent pitch control systems with emergency power supply, rotor brake, rotor lock
Yaw system	active via adjustment gears load-dependent damping

4.5 Transformer Stations

4.5.1 K2 Wind Power Project

At the present stage of this project, K2 Wind Ontario states that only limited information is available for the three transformers to be located at the two substations. A full description of the substations and transformer will be provided as soon as details are finalized.

4.5.2 Kingsbridge Wind Power Project

As noted above, the substation associated with the KWPP is a significant distance from the K2WPP. It has not been included as a noise source in the present assessment. Nor has a small switch-yard transformer been included.

4.5.3 Suncor Ripley Wind Project 1

As noted above, the substation associated with the SRWP1 is a significant distance from the K2WPP with several intervening wind turbines. It has not been included as a noise source in the present assessment.

4.5.4 Privately Owned Turbine

There is no substation associated with the privately owned turbine.

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 K2 Wind Power Project Turbines

5.2.1 Siemens SWT-2.300-101

Siemens SWT-2.300-101 turbine broadband source sound power level data for 10 m (a.g.l) wind speeds of 3 to 11 to cut-out (ms^{-1}) and octave band source sound power level data for 10 m a.g.l. wind speeds of 6 to 10 ms^{-1} were provided in Siemens A/S documentation (Siemens, 2012a) supplied by K2 Wind Ontario. This document is included in Section 13 and is referenced to IEC 61400-11. This turbine's maximum broadband source sound power level is 106 dBA while its rated power is 2.300 MW.

With respect to tonality, the Siemens (2012a) document referenced above states, "The sound level test reports for the Siemens Wind Turbine Generators have

shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002."

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see Section 5.6 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} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 7 ms^{-1} wind speed. As a consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

The broadband and octave band source sound power levels referenced to 10 m a.g.l. wind speeds for this turbine with a hub height of 99.5 m are shown in Table 5-1.

Table 5-1 Siemens SWT-2.300-101 — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-2.300-101										
Rating: 2,300 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.36										
	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	112.9	112.4	111.2	110.0	109.4	112.4	112.4	112.4	112.4	112.4
125	106.9	107.8	107.6	105.6	105.4	107.8	107.8	107.8	107.8	107.8
250	104.1	105.1	104.7	102.9	102.5	105.1	105.1	105.1	105.1	105.1
500	101.1	101.8	101.6	101.3	100.8	101.8	101.8	101.8	101.8	101.8
1000	100.9	101.6	101.7	101.9	101.8	101.6	101.6	101.6	101.6	101.6
2000	97.1	98.4	98.6	99.1	99.5	98.4	98.4	98.4	98.4	98.4
4000	91.8	93.2	93.4	94.0	94.3	93.2	93.2	93.2	93.2	93.2
8000	80.0	81.5	81.9	82.5	83.1	81.5	81.5	81.5	81.5	81.5
A-weighted	**105.1**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**	**106.0**

5.2.2 Siemens SWT-2.221-101

Siemens SWT-2.221-101 turbine broadband source sound power level data for 10 m (a.g.l) wind speeds of 3 to 11 to cut-out (ms^{-1}) and octave band source sound power level data for 10 m a.g.l. wind speeds of 6 to 10 ms^{-1} were provided in Siemens A/S documentation (Siemens, 2012b) supplied by K2 Wind Ontario. This document is included in Section 13 and is referenced to IEC 61400-11. This turbine's maximum broadband source sound power level is 105 dBA while its rated power is 2.221 MW.

With respect to tonality, the Siemens (2012b) document referenced above states, "The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002."

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see Section 5.6 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} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 7 ms^{-1} wind speed. As a consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

The broadband and octave band source sound power levels referenced to 10 m a.g.l. wind speeds for this turbine with a hub height of 99.5 m are shown in Table 5-2.

Table 5-2 Siemens SWT-2.221-101 — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-2.221-101										
Rating: 2,221 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.36										
	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	112.5	112.2	111.0	111.1	110.7	112.2	112.2	112.2	112.2	112.2
125	106.4	107.7	107.2	106.6	105.7	107.7	107.7	107.7	107.7	107.7
250	105.1	106.1	105.0	104.3	103.5	106.1	106.1	106.1	106.1	106.1
500	100.9	101.5	100.4	100.2	99.8	101.5	101.5	101.5	101.5	101.5
1000	99.2	99.9	100.1	100.0	100.2	99.9	99.9	99.9	99.9	99.9
2000	95.3	96.0	97.7	97.8	98.2	96.0	96.0	96.0	96.0	96.0
4000	91.2	92.5	92.6	94.4	94.5	92.5	92.5	92.5	92.5	92.5
8000	78.2	79.0	81.9	81.8	81.6	79.0	79.0	79.0	79.0	79.0
A-weighted	**104.2**	**105.0**	**105.0**	**105.0**	**105.0**	**105.0**	**105.0**	**105.0**	**105.0**	**105.0**

5.2.3 Siemens SWT-2.126-101

Siemens SWT-2.126-101 turbine broadband source sound power level data for 10 m (a.g.l) wind speeds of 3 to 11 to cut-out (ms^{-1}) and octave band source sound power level data for 10 m a.g.l. wind speeds of 6 to 10 ms^{-1} were provided in Siemens A/S documentation (Siemens, 2012c) supplied by K2 Wind Ontario. This document is

included in Section 13 and is referenced to IEC 61400-11. This turbine's maximum broadband source sound power level is 104 dBA while its rated power is 2.126 MW.

With respect to tonality, the Siemens (2012c) document referenced above states, "The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002."

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see Section 5.6 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} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 7 ms^{-1} wind speed. As a consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

The broadband and octave band source sound power levels referenced to 10 m a.g.l. wind speeds for this turbine with a hub height of 99.5 m are shown in Table 5-3.

Table 5-3 Siemens SWT-2.126-101 — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-2.126-101										
Rating: 2,126 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.36										
	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	112.2	111.8	110.8	110.8	110.4	111.8	111.8	111.8	111.8	111.8
125	105.9	107.1	106.8	106.2	105.3	107.1	107.1	107.1	107.1	107.1
250	105.0	105.8	103.3	102.6	101.7	105.8	105.8	105.8	105.8	105.8
500	100.3	100.8	99.5	99.2	98.8	100.8	100.8	100.8	100.8	100.8
1000	97.7	98.3	99.3	99.2	99.3	98.3	98.3	98.3	98.3	98.3
2000	93.9	94.5	96.6	96.7	97.2	94.5	94.5	94.5	94.5	94.5
4000	90.6	91.8	91.5	93.3	93.4	91.8	91.8	91.8	91.8	91.8
8000	78.1	78.8	80.4	80.3	80.1	78.8	78.8	78.8	78.8	78.8
A-weighted	**103.3**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**	**104.0**

5.2.4 Siemens SWT-2.030-101

Siemens SWT-2.030-101 turbine broadband source sound power level data for 10 m (a.g.l) wind speeds of 3 to 11 to cut-out (ms^{-1}) and octave band source sound power

level data for 10 m a.g.l. wind speeds of 6 to 10 ms^{-1} were provided in Siemens A/S documentation (Siemens, 2012d) supplied by K2 Wind Ontario. This document is included in Section 13 and is referenced to IEC 61400-11. This turbine's maximum broadband source sound power level is 103 dBA while its rated power is 2.030 MW.

With respect to tonality, the Siemens (2012d) document referenced above states, "The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002."

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see Section 5.6 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} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 7 ms^{-1} wind speed. As a consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

The broadband and octave band source sound power levels referenced to 10 m a.g.l. wind speeds for this turbine with a hub height of 99.5 m are shown in Table 5-4.

Table 5-4 Siemens SWT-2.030-101 — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-2.030-101										
Rating: 2,030 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.36										
	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	112.0	111.6	110.6	110.7	110.4	111.6	111.6	111.6	111.6	111.6
125	105.6	106.3	106.5	106.4	105.9	106.3	106.3	106.3	106.3	106.3
250	104.6	104.3	103.5	103.3	102.6	104.3	104.3	104.3	104.3	104.3
500	99.7	99.2	98.2	98.0	97.6	99.2	99.2	99.2	99.2	99.2
1000	96.2	97.3	97.8	97.6	97.8	97.3	97.3	97.3	97.3	97.3
2000	92.4	94.7	95.7	95.8	96.2	94.7	94.7	94.7	94.7	94.7
4000	89.9	90.6	90.6	91.5	91.6	90.6	90.6	90.6	90.6	90.6
8000	77.8	79.6	80.3	80.5	80.4	79.6	79.6	79.6	79.6	79.6
A-weighted	**102.4**	**103.0**	**103.0**	**103.0**	**103.0**	**103.0**	**103.0**	**103.0**	**103.0**	**103.0**

5.2.5 Siemens SWT-1.903-101

Siemens SWT-1.903-101 turbine broadband source sound power level data for 10 m (a.g.l) wind speeds of 3 to 11 to cut-out (ms^{-1}) and octave band source sound power level data for 10 m a.g.l. wind speeds of 6 to 10 ms^{-1} were provided in Siemens A/S documentation (Siemens, 2012e) supplied by K2 Wind Ontario. This document is included in Section 13 and is referenced to IEC 61400-11. This turbine's maximum broadband source sound power level is 102 dBA while its rated power is 1.903 MW.

With respect to tonality, the Siemens (2012e) document referenced above states, "The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002."

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see Section 5.6 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} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 7 ms^{-1} wind speed. As a consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

Table 5-5 Siemens SWT-1.903-101 — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-1.903-101										
Rating: 1,903 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.36										
	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	111.7	111.3	110.4	110.5	110.2	111.3	111.3	111.3	111.3	111.3
125	105.1	105.9	106.1	106.0	105.6	105.9	105.9	105.9	105.9	105.9
250	104.2	103.9	103.0	102.8	102.2	103.9	103.9	103.9	103.9	103.9
500	98.4	98.0	97.0	96.8	96.4	98.0	98.0	98.0	98.0	98.0
1000	94.5	95.9	96.4	96.3	96.4	95.9	95.9	95.9	95.9	95.9
2000	91.4	93.6	94.6	94.7	95.2	93.6	93.6	93.6	93.6	93.6
4000	89.1	89.7	89.6	90.5	90.7	89.7	89.7	89.7	89.7	89.7
8000	77.6	79.1	79.7	79.9	79.9	79.1	79.1	79.1	79.1	79.1
A-weighted	**101.4**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**	**102.0**

The broadband and octave band source sound power levels referenced to 10 m a.g.l. wind speeds for this turbine with a hub height of 99.5 m are shown in Table 5-5.

5.2.6 Siemens SWT-1.824-101

Siemens SWT-1.824-101 turbine broadband source sound power level data for 10 m (a.g.l) wind speeds of 3 to 11 to cut-out (ms^{-1}) and octave band source sound power level data for 10 m a.g.l. wind speeds of 6 to 10 ms^{-1} were provided in Siemens A/S documentation (Siemens, 2012f) supplied by K2 Wind Ontario. This document is included in Section 13 and is referenced to IEC 61400-11. This turbine's maximum broadband source sound power level is 101 dBA while its rated power is 1.824 MW.

With respect to tonality, the Siemens (2012f) document referenced above states, "The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002."

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see Section 5.6 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} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 7 ms^{-1} wind speed. As a

Table 5-6 Siemens SWT-1.824-101 — Wind turbine acoustic emissions summary.

Make and Model: Siemens SWT-1.824-101										
Rating: 1,824 kW										
Hub height (m): 99.5										
Wind profile adjustment: summer night-time power-law wind shear coefficient = 0.36										
	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	111.5	111.1	110.2	110.2	110.0	111.1	111.1	111.1	111.1	111.1
125	104.7	105.6	105.7	105.6	105.2	105.6	105.6	105.6	105.6	105.6
250	103.8	103.5	102.6	102.4	101.8	103.5	103.5	103.5	103.5	103.5
500	97.0	96.7	95.8	95.6	95.2	96.7	96.7	96.7	96.7	96.7
1000	92.8	94.4	95.0	94.9	95.1	94.4	94.4	94.4	94.4	94.4
2000	90.3	92.5	93.5	93.7	94.1	92.5	92.5	92.5	92.5	92.5
4000	88.2	88.7	88.6	89.4	89.7	88.7	88.7	88.7	88.7	88.7
8000	77.3	78.6	79.1	79.3	79.2	78.6	78.6	78.6	78.6	78.6
A-weighted	**100.4**	**101.0**	**101.0**	**101.0**	**101.0**	**101.0**	**101.0**	**101.0**	**101.0**	**101.0**

consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

The broadband and octave band source sound power levels referenced to 10 m a.g.l. wind speeds for this turbine with a hub height of 99.5 m are shown in Table 5-6.

5.3 KWPP Wind Turbines

5.3.1 Vestas V80

Vestas V80 turbine broadband and octave band source sound power level data for the KWPP turbines for 10 m a.g.l. wind speeds of 4 to 9 ms^{-1} were received from Vestas Wind Systems A/S via Capital Power Corporation as an email document. This latter document is included for reference in Section 13 (Appendix B). For purposes of determining adjusted emission levels, the 10 ms^{-1} octave bands were assumed to be identical to the 9 ms^{-1} octave bands.

No statement with regard to tonality for this turbine was provided by Vestas Wind Systems A/S.

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (see below for derivation) to synthesize/interpolate/extrapolate source octave sound power levels for 10 m a.g.l.

Table 5-7 Vestas V80 — Wind turbine acoustic emissions summary.

Make and Model: Vestas V80										
Rating: 1,800 kW										
Hub height (m): 78 m										
Wind profile adjustment: summer night-time power-law wind shear coefficient: 0.36										
	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	111.5	112.0	112.2	113.1	n/a	113.1	113.1	113.1	113.1	113.1
125	108.0	109.0	109.1	109.4	n/a	109.4	109.4	109.4	109.4	109.4
250	104.9	106.0	106.3	105.6	n/a	105.6	105.6	105.6	105.6	105.6
500	101.7	102.3	102.3	102.5	n/a	102.5	102.5	102.5	102.5	102.5
1000	97.3	97.6	97.9	98.6	n/a	98.6	98.6	98.6	98.6	98.6
2000	92.8	93.9	94.6	94.3	n/a	94.3	94.3	94.3	94.3	94.3
4000	84.5	86.6	87.3	86.6	n/a	86.6	86.6	86.6	86.6	86.6
8000	76.7	78.8	87.4	81.5	n/a	81.5	81.5	81.5	81.5	81.5
A-weighted	**103.3**	**104.1**	**104.4**	**104.4**	**n/a**	**104.4**	**104.4**	**104.4**	**104.4**	**104.4**

wind speeds of 6, 7, 8, 9, and 10 ms^{-1} for use in the ISO 9613-2 estimates of receptor noise levels.

Note that sensitivity analysis of both the "Adjusted emission levels" and the "Manufacturer's emission levels" showed that the Ontario MoE "predictable worst case" resultant receptor sound pressure levels occurred for the octave band set corresponding to the "Manufacturer's emission levels" 8 ms^{-1} wind speed. As a consequence of this, this specific set of octave band source sound power levels was used in all noise assessment analysis.

The 10 m a.g.l. broadband and octave band source sound power levels for the Vestas V80 turbine are shown in Table 5-7.

5.3.2 Vestas V47

Vestas V47 turbine broadband source sound power level data for 10 m a.g.l. wind speeds of 6 to 11 ms^{-1} were received from Capital Power Corporation in the original noise assessment report (AEL, 2005) for the KWPP. Octave band sound power levels were reported only for a wind speed of 8 ms^{-1}. In addition, it has been determined that these octave-band data were identified erroneously as unweighted (dBLin) sound power levels, whereas the values listed in the report were almost certainly A-weighted (dBA). After correction, the 8 ms^{-1} data were adjusted to reflect the A-weighted broadband source sound power levels for the remaining wind speeds.

Table 5-8 Vestas V47 — Wind turbine acoustic emissions summary.

Make and Model: Vestas V47										
Rating: 660 kW										
Hub height (m): 65.0										
Wind profile adjustment: summer night-time power-law wind shear coefficient: unknown										
	Octave band sound power level (dB)									
	Manufacturer's emission levels (n/a)					**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	n/a	n/a	n/a	n/a	n/a	102.8	103.7	104.4	104.9	105.1
125	n/a	n/a	n/a	n/a	n/a	100.6	101.5	102.2	102.7	102.9
250	n/a	n/a	n/a	n/a	n/a	96.8	97.7	98.4	98.9	99.1
500	n/a	n/a	n/a	n/a	n/a	96.8	97.7	98.4	98.9	99.1
1000	n/a	n/a	n/a	n/a	n/a	95.4	96.3	97.0	97.5	97.7
2000	n/a	n/a	n/a	n/a	n/a	90.1	91.0	91.7	92.2	92.4
4000	n/a	n/a	n/a	n/a	n/a	85.3	86.2	86.9	87.4	87.6
8000	n/a	n/a	n/a	n/a	n/a	68.7	69.6	70.3	70.8	71.0
A-weighted	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**99.3**	**100.2**	**100.9**	**101.4**	**101.6**

These values (after correction) are repeated above in Table 5-8 without modification except to convert (correctly) from A-weighted octave source sound power levels to unweighted levels.

Due to the uncertainty in the original "Manufacturer's emission levels", for modelling purposes the octave band source sound power levels for 10 ms^{-1} (maximum source sound power level) were used for all wind speeds. This is consistent with "predictable worst case" assessment.

No statement with regard to tonality for this turbine was provided in AEL (2005).

5.4 Suncor Ripley Wind Project 1 Turbines

5.4.1 Enercon E82

Enercon E82 turbine broadband source sound power level data for 10 m a.g.l. wind speeds of 4 to 8 ms^{-1} were received from K2 Wind Ontario in the form of the Noise Assessment Report (HFP, 2005) as part of the Environmental Assessment (EA) Report submitted for the SRWP1. Octave-band sound power levels were received for wind speeds of 6 to 8 ms^{-1}. The 8 ms^{-1} octave band data were used to synthesize octave-band data for 9 and 10ms^{-1}. These tabulated and synthesized broadband and octave-band data are repeated here in Table 5-9 without modification except to

Table 5-9 Enercon E82 — Wind turbine acoustic emissions summary.

Make and Model: Enercon E82										
Rating: 2,050 kW										
Hub height (m): 78										
Wind profile adjustment: summer night-time power-law wind shear coefficient: unknown										
	Octave band sound power level (dB)									
	Manufacturer's emission levels (n/a)					**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	n/a	n/a	n/a	n/a	n/a	112.7	112.4	113.8	113.8	113.8
125	n/a	n/a	n/a	n/a	n/a	109.4	110.6	112.2	112.2	112.2
250	n/a	n/a	n/a	n/a	n/a	106.2	107.4	108.4	108.4	108.4
500	n/a	n/a	n/a	n/a	n/a	100.7	101.3	101.8	101.8	101.8
1000	n/a	n/a	n/a	n/a	n/a	92.7	93.1	93.7	93.7	93.7
2000	n/a	n/a	n/a	n/a	n/a	85.6	86.9	88.0	88.0	88.0
4000	n/a	n/a	n/a	n/a	n/a	81.4	82.6	83.3	83.3	83.3
8000	n/a	n/a	n/a	n/a	n/a	77.7	80.4	79.4	79.4	79.4
A-weighted	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**102.2**	**103.1**	**104.0**	**104.0**	**104.0**

convert from A-weighted octave band source sound power levels for inclusion in the table.

Due to the uncertainty in the original "Manufacturer's emission levels" provided in HFP (2005), for modelling purposes the octave band source sound power levels for 10 ms^{-1} (maximum source sound power level) were used for all wind speeds. This is consistent with "predictable worst case" assessment.

The HFP (2005) Noise Assessment Report states, "Enercon provide a guaranteed tonality value of 0-1 dB and guaranteed impulsivity value of 0 dB over the whole operational range of turbines."

5.5 Privately Owned Turbine

5.5.1 Enercon E33

Enercon E33 turbine broadband and octave band source sound power level data for 10 m a.g.l. wind speeds of 5 to 9 ms^{-1} are listed in the Enercon noise specification document (Enercon, 2004) and the Carl Bro (2004) noise test report supplied to Zephyr North by Enercon Canada Inc. See Section 13 (Appendix B) for a copy of this document.

Table 5-10 Enercon E33 — Wind turbine acoustic emissions summary.

Make and Model: Enercon E 33										
Rating: 330 kW										
Hub height (m): 50										
Wind profile adjustment: summer night-time power-law wind shear coefficient: 0.36										
	Octave band sound power level (dB)									
	Manufacturer's emission levels (hub-height)					**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	98.0	104.5	106.2	107.0	n/a	106.5	107.0	107.0	107.0	107.0
125	108.2	106.4	105.7	105.6	n/a	105.6	105.6	105.6	105.6	105.6
250	95.5	98.9	100.3	100.0	n/a	100.2	100.0	100.0	100.0	100.0
500	93.0	96.3	97.5	97.2	n/a	97.4	97.2	97.2	97.2	97.2
1000	92.1	95.0	96.0	95.9	n/a	96.0	95.9	95.9	95.9	95.9
2000	89.5	91.6	92.4	92.6	n/a	92.5	92.6	92.6	92.6	92.6
4000	84.3	85.6	87.0	87.3	n/a	87.1	87.3	87.3	87.3	87.3
8000	80.1	81.2	83.0	83.7	n/a	83.2	83.7	83.7	83.7	83.7
A-weighted	**98.0**	**100.0**	**100.9**	**100.8**	**n/a**	**100.8**	**100.8**	**100.8**	**100.8**	**100.8**

Enercon documentation states, "A tonal penalty of 5 dB according to (ETSU97) has to be taken into account (valid in the near vicinity of the turbine according to IEC 61 400 -11 ed. 2)." As a consequence, a tonal penalty of 5 dB has been assessed to this turbine. For this report, this has not been limited to "the near vicinity of the turbine", but has been applied everywhere.

The broadband and octave band noise information was used with the site-specific power law wind shear exponent of 0.36 (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} for use in the ISO 9613-2 estimates of receptor noise levels.

The 10 m broadband and octave band source sound power levels for the Enercon E33 at 50 m hub height are shown in Table 5-10. Note that the "Manufacturer's emission levels" for 10 ms^{-1} sound power levels (which were not provided) have been set equal to the 9 ms^{-1} sound power levels for analysis.

5.6 Site-Specific Vertical Wind Shear Exponent

The site-specific vertical wind shear exponent was calculated from two project *in situ* wind monitoring stations, HMKBN 80 m WM and HMKBS 80 m WM (shown in Figure 2-1) installed on the K2WPP site. Both of these wind monitoring stations have wind measurements at nominal levels of 40, 60 and 80 m.

The vertical wind shear exponent was calculated by Zephyr North from a least squares fit of a power law profile to period-averaged data at the three available levels of wind speed. The averaged data were filtered to include only summer months (April through September inclusive) and the diurnal hours between 23:00 and 07:00 the following day. That is, the power law wind shear exponent for the 'average summer night time wind speed profile' is reported here — specifically, 0.34 for the HMKBN 80 m WM station, and 0.36 for the HMKBS 80 m WM station. Note that two full summers of data were used for each station.

To be conservative, a value of 0.36 was used for the vertical wind shear exponent for the purposes of this report.

5.7 K2 Wind Power Project Transformer Substation

5.7.1 Noise Emission Rating

Because it is not fiscally prudent to purchase or even to order a large power transformer such as those required for this project before receiving confirmation that the project will be permitted, only limited information is available for the transformer noise for the two K2WPP substations.

While the specific transformer models have not yet been determined for the project, it has been specified that the broadband source sound power level for each the three transformers should not exceed 87.0 dBA. This is the limit specified in the CAN/CSA-C88-M90 Standard (Canadian Standards Association, 2009) for power

transformers of the approximate capacity (135 MVA) and high-side voltage (500 kV) required for this application.

For the purposes of this report, octave band source sound power levels characteristic of a typical power transformer were adjusted to reflect the maximum 87.0 dBA broadband level. These are listed in Table 5-11 along with a 5 dB tone penalty assessed to all frequencies. The net octave band source sound power levels are also shown, as is the resulting broadband source sound power levels before (87.0 dBA) and after (92.0 dBA) assessment of the penalties.

Note that the tonal penalties have been applied for all calculations in this report.

No attenuation due to acoustic barriers has been included in the present calculations.

K2 Wind Ontario has undertaken to provide full transformer and substation details as soon as they become available.

Table 5-11 Project transformer station acoustic emissions summary.

Make and Model: To be specified			
Operating voltage: To be specified			
Rating: To be specified			
Core tank size: To be specified			
Source height (m): 4.5 (to be finalized)			
Source location: outside			
Sound characteristics: steady, tonal			
Noise control measures: uncontrolled			
Frequency (Hz)	**Source sound power level (dBLin)**	**Tonal penalty (dB)**	**Net source sound power level (dBLin)**
63	77.7	5.0	82.7
125	84.7	5.0	89.7
250	80.7	5.0	85.7
500	89.7	5.0	94.7
1000	74.7	5.0	79.7
2000	54.7	5.0	59.7
4000	42.7	5.0	47.7
8000	39.7	5.0	44.7
Broadband (dBA)	87.0		92.0

6 IMPACT ASSESSMENT

6.1 Methodology

Cumulative turbine and transformer sound levels were estimated at each of the receptors using the methodology of the ISO 9613-2 Standard (ISO, 1996). Wind turbine and transformer 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)

Normally, analysis would be carried out for turbine and transformer 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 MoE "predictable worst case" occurs for a set of octave band source sound power levels corresponding to a particular 10 m a.gl. wind speed in the "Manufacturer's emission levels" (see Sections 5.2 and 5.3 in particular), 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 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 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 as required by the MoE (2008) publication.

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 K2WPP 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 25 highest sound pressure levels determined in the analysis for receptors and VLSRs.

Table 6-1 Highest noise levels at receptors.

Receptor ID	SPL (dBA)	Height (m)	Nearest Turbine	Project / Other	Distance (m)
R1002	40.0	4.5	T271	P	790
V2431	39.9	4.5	T265	P	731
V2422	39.9	4.5	T266	P	753
R662	39.9	4.5	T347	P	579
R43	39.9	7.5	T246	P	671
R733	39.9	4.5	T279	P	758
R509	39.9	4.5	T315	P	646
V1519	39.9	4.5	T319	P	648
V1557	39.8	4.5	T256	P	552
V1517	39.8	4.5	T326	P	694
R902	39.8	4.5	T276	P	582
R701	39.8	4.5	T299	P	580
R308	39.8	4.5	T319	P	677
V2433	39.7	4.5	T260	P	684
V2032	39.7	4.5	T212	P	583
V2429	39.7	4.5	T322	P	637
R754	39.7	4.5	T315	P	574
V2048	39.7	4.5	T355	P	611
R700	39.6	4.5	T299	P	709
R712	39.6	4.5	T308	P	597
R2449	39.6	4.5	T265	P	591
V2236	39.6	4.5	T330	P	557
R326	39.6	4.5	T329	P	580
R713	39.5	4.5	T308	P	612
V1475	39.5	4.5	T322	P	655
V2445	39.5	4.5	T334	P	571
WindFarm layout file: Z:\WindFarmR4\KSSO5-\WFNoise\KSSO5-Trbn-WFL195.csv					

7 NOISE LEVEL SUMMARY TABLE

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
R5	Receptor	4.5	1378	T218	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R9	Receptor	4.5	647	T206	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R10	Receptor	1.5	1068	T205	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
R11	Receptor	4.5	890	T200	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R12	Receptor	4.5	847	T200	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R13	Receptor	4.5	881	T200	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R14	Receptor	1.5	902	T200	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R15	Receptor	1.5	931	T200	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R16	Receptor	4.5	952	T200	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
R17	Receptor	1.5	930	T200	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R18	Receptor	4.5	955	T200	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R19	Receptor	4.5	985	T200	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R20	Receptor	1.5	1048	T200	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R21	Receptor	4.5	1025	T200	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R22	Receptor	4.5	1119	T200	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R23	Receptor	1.5	1007	T200	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R24	Receptor	4.5	1140	T200	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R25	Receptor	4.5	1467	T354	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
R27	Receptor	1.5	763	T207	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R28	Receptor	4.5	690	T207	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
R29	Receptor	4.5	921	T207	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R30	Receptor	4.5	782	T207	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R31	Receptor	1.5	1271	T207	31.7	31.7	31.7	31.7	31.7	40.0	43.0	45.0	49.0	51.0
R32	Receptor	4.5	1467	T207	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R35	Receptor	1.5	1380	T200	32.3	32.3	32.3	32.3	32.3	40.0	43.0	45.0	49.0	51.0
R36	Receptor	4.5	943	T225	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R37	Receptor	4.5	825	T225	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
R39	Receptor	4.5	830	T230	37.5	37.5	37.5	37.5	37.5	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
R40	Receptor	4.5	693	T230	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R41	Receptor	4.5	639	T227	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
R42	Receptor	4.5	714	Tr93	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R43	Receptor	7.5	671	T246	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
R47	Receptor	1.5	637	T246	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
R48	Receptor	4.5	681	T246	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R49	Receptor	4.5	825	T246	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R50	Receptor	1.5	1106	T232	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R51	Receptor	1.5	724	T273	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R52	Receptor	4.5	680	T273	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
R53	Receptor	4.5	810	T273	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R54	Receptor	1.5	903	T273	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R55	Receptor	4.5	946	T253	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
R56	Receptor	1.5	936	T253	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R57	Receptor	1.5	928	T253	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R58	Receptor	4.5	946	T273	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R59	Receptor	4.5	823	T253	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R60	Receptor	4.5	990	T253	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R61	Receptor	4.5	990	T253	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R62	Receptor	4.5	904	T253	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R63	Receptor	4.5	986	T253	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R64	Receptor	1.5	585	T329	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R65	Receptor	4.5	976	T304	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R66	Receptor	4.5	596	T240	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R85	Receptor	4.5	1413	T215	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R108	Receptor	4.5	788	T217	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R109	Receptor	4.5	793	T216	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R113	Receptor	4.5	930	T221	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R120	Receptor	4.5	566	T221	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R122	Receptor	4.5	1067	T221	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R123	Receptor	4.5	818	T221	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R124	Receptor	4.5	1032	T221	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R171	Receptor	1.5	1216	T11	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R178	Receptor	4.5	1139	T380	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R189	Receptor	1.5	1065	T380	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
R190	Receptor	4.5	1099	T380	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R197	Receptor	1.5	1263	T380	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R200	Receptor	4.5	1189	T360	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R270	Receptor	4.5	743	T295	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R282	Receptor	4.5	657	T304	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R291	Receptor	4.5	676	T304	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
R297	Receptor	4.5	976	T312	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R308	Receptor	4.5	677	T319	39.8	39.8	39.8	39.8	39.8	40.0	43.0	45.0	49.0	51.0
R311	Receptor	1.5	1113	T312	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R314	Receptor	1.5	629	T315	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R317	Receptor	4.5	782	T329	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R320	Receptor	1.5	1232	T334	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R322	Receptor	1.5	574	T329	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R323	Receptor	1.5	870	T315	36.9	36.9	36.9	36.9	36.9	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
R324	Receptor	4.5	857	T336	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R326	Receptor	4.5	580	T329	39.6	39.6	39.6	39.6	39.6	40.0	43.0	45.0	49.0	51.0
R329	Receptor	4.5	600	T336	39.3	39.3	39.3	39.3	39.3	40.0	43.0	45.0	49.0	51.0
R330	Receptor	4.5	774	T334	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R339	Receptor	4.5	609	T332	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R344	Receptor	4.5	1250	T334	32.7	32.7	32.7	32.7	32.7	40.0	43.0	45.0	49.0	51.0
R345	Receptor	1.5	1201	T332	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R354	Receptor	4.5	1489	T336	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R373	Receptor	4.5	1304	T349	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
R378	Receptor	4.5	1379	T350	32.3	32.3	32.3	32.3	32.3	40.0	43.0	45.0	49.0	51.0
R381	Receptor	4.5	1213	T350	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
R391	Receptor	4.5	838	T332	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R509	Receptor	4.5	646	T315	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
R515	Receptor	4.5	694	T334	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R516	Receptor	4.5	748	T336	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R518	Receptor	4.5	777	T336	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R520	Receptor	1.5	1285	T332	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R523	Receptor	1.5	1313	T348	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R529	Receptor	4.5	941	T348	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R538	Receptor	7.5	1233	T350	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
R540	Receptor	4.5	711	T350	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R541	Receptor	1.5	684	T350	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R543	Receptor	4.5	565	T349	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R548	Receptor	4.5	1170	T348	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
R549	Receptor	1.5	1301	T350	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R561	Receptor	1.5	686	T349	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R564	Receptor	1.5	917	T349	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R565	Receptor	4.5	805	T349	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R605	Receptor	4.5	785	T14	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R606	Receptor	4.5	1090	T15	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R607	Receptor	4.5	1044	T15	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R608	Receptor	4.5	1130	T15	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R609	Receptor	1.5	994	T219	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R610	Receptor	1.5	862	T219	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R611	Receptor	4.5	822	T219	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R612	Receptor	1.5	755	T219	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R613	Receptor	4.5	799	T219	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R615	Receptor	1.5	925	T219	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R616	Receptor	4.5	851	T215	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
R619	Receptor	4.5	632	T217	38.9	38.9	38.9	38.9	38.9	40.0	43.0	45.0	49.0	51.0
R621	Receptor	4.5	968	T216	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R639	Receptor	7.5	810	T380	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R640	Receptor	4.5	617	T360	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R654	Receptor	4.5	1003	T348	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R655	Receptor	7.5	722	T348	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R656	Receptor	4.5	920	T348	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R657	Receptor	4.5	589	T348	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
R660	Receptor	4.5	914	T346	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R661	Receptor	4.5	1096	T347	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R662	Receptor	4.5	579	T347	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
R663	Receptor	4.5	608	T346	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R664	Receptor	7.5	764	T343	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
R665	Receptor	4.5	929	T343	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R666	Receptor	4.5	1239	T333	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
R667	Receptor	1.5	1034	T333	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R668	Receptor	4.5	845	T333	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R669	Receptor	4.5	1256	T333	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R670	Receptor	4.5	1038	T337	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
R671	Receptor	4.5	1116	T324	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R672	Receptor	4.5	978	T329	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R673	Receptor	4.5	1103	T310	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R675	Receptor	4.5	817	T286	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
R676	Receptor	4.5	878	T269	39.1	39.1	39.1	39.1	39.1	40.0	43.0	45.0	49.0	51.0
R679	Receptor	4.5	1163	T233	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R680	Receptor	4.5	1138	T233	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R681	Receptor	4.5	872	T229	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R682	Receptor	1.5	917	T6	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R683	Receptor	4.5	712	T233	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R684	Receptor	1.5	853	T233	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R686	Receptor	4.5	686	T239	39.4	39.4	39.4	39.4	39.4	40.0	43.0	45.0	49.0	51.0
R687	Receptor	4.5	582	T267	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R688	Receptor	1.5	836	T284	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
R691	Receptor	4.5	652	T304	39.4	39.4	39.4	39.4	39.4	40.0	43.0	45.0	49.0	51.0
R693	Receptor	1.5	1161	T348	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R694	Receptor	1.5	1243	T348	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R695	Receptor	1.5	1118	T332	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R696	Receptor	1.5	703	T325	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
R697	Receptor	4.5	724	T306	38.8	38.8	38.8	38.8	38.8	40.0	43.0	45.0	49.0	51.0
R698	Receptor	4.5	786	T306	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
R699	Receptor	4.5	786	T306	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
R700	Receptor	4.5	709	T299	39.6	39.6	39.6	39.6	39.6	40.0	43.0	45.0	49.0	51.0
R701	Receptor	4.5	580	T299	39.8	39.8	39.8	39.8	39.8	40.0	43.0	45.0	49.0	51.0
R705	Receptor	1.5	753	T360	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
R706	Receptor	4.5	715	T360	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R707	Receptor	4.5	764	T360	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
R708	Receptor	1.5	711	T360	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R709	Receptor	4.5	772	T360	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R712	Receptor	4.5	597	T308	39.6	39.6	39.6	39.6	39.6	40.0	43.0	45.0	49.0	51.0
R713	Receptor	4.5	612	T308	39.5	39.5	39.5	39.5	39.5	40.0	43.0	45.0	49.0	51.0
R716	Receptor	4.5	686	T323	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
R717	Receptor	4.5	601	T304	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
R719	Receptor	4.5	933	T310	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
R720	Receptor	4.5	584	T310	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R721	Receptor	4.5	1112	T310	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
R722	Receptor	4.5	852	T329	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R723	Receptor	4.5	664	T329	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
R724	Receptor	4.5	617	T335	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
R725	Receptor	1.5	622	T335	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R727	Receptor	4.5	834	T306	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
R733	Receptor	4.5	758	T279	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
R734	Receptor	4.5	793	T286	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
R735	Receptor	4.5	853	T286	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
R736	Receptor	4.5	829	T284	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
R737	Receptor	4.5	1054	T284	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R738	Receptor	4.5	962	T281	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R739	Receptor	4.5	1015	T281	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R740	Receptor	1.5	1195	T281	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R741	Receptor	4.5	1109	Tr93	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R742	Receptor	4.5	931	Tr93	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R743	Receptor	1.5	770	Tr93	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R744	Receptor	4.5	501	Tr93	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R747	Receptor	4.5	580	Tr93	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R748	Receptor	4.5	605	Tr93	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R749	Receptor	4.5	737	T254	39.4	39.4	39.4	39.4	39.4	40.0	43.0	45.0	49.0	51.0
R750	Receptor	4.5	880	T254	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
R752	Receptor	1.5	920	T275	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
R753	Receptor	4.5	1035	T275	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
R754	Receptor	4.5	574	T315	39.7	39.7	39.7	39.7	39.7	40.0	43.0	45.0	49.0	51.0
R755	Receptor	4.5	665	T295	38.7	38.7	38.7	38.7	38.7	40.0	43.0	45.0	49.0	51.0
R756	Receptor	1.5	858	T295	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R757	Receptor	4.5	978	T312	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R758	Receptor	4.5	834	T295	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R759	Receptor	4.5	906	T295	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R760	Receptor	1.5	813	T295	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R761	Receptor	4.5	756	T295	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R762	Receptor	4.5	1143	T295	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R763	Receptor	4.5	839	T272	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R764	Receptor	4.5	797	T272	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R765	Receptor	4.5	737	T272	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R766	Receptor	4.5	726	T272	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R767	Receptor	4.5	661	T272	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
R768	Receptor	4.5	726	T263	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
R770	Receptor	4.5	839	T263	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R771	Receptor	4.5	842	T360	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
R773	Receptor	1.5	812	T360	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R774	Receptor	4.5	820	T360	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R775	Receptor	4.5	783	T360	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R776	Receptor	1.5	713	T360	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R777	Receptor	4.5	747	T360	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R778	Receptor	4.5	792	T360	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R779	Receptor	1.5	962	T360	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R780	Receptor	4.5	932	T360	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R781	Receptor	7.5	1006	T380	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R782	Receptor	4.5	890	T380	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R783	Receptor	4.5	927	T380	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R784	Receptor	4.5	1178	T380	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R785	Receptor	4.5	1256	T380	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
R813	Receptor	1.5	574	Tr92	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R814	Receptor	4.5	512	Tr92	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R815	Receptor	4.5	750	Tr92	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R817	Receptor	4.5	714	Tr91	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R818	Receptor	1.5	1064	T230	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R819	Receptor	4.5	955	T231	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R820	Receptor	4.5	1007	T235	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
R821	Receptor	4.5	1095	T248	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R822	Receptor	4.5	946	T248	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
R823	Receptor	4.5	597	T248	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
R824	Receptor	4.5	906	T248	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R825	Receptor	4.5	868	T248	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R827	Receptor	4.5	1360	T281	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R828	Receptor	4.5	1419	T281	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R839	Receptor	1.5	1159	T200	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R840	Receptor	4.5	1093	T200	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R841	Receptor	4.5	1031	T200	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R842	Receptor	4.5	1046	T200	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R843	Receptor	4.5	1253	T200	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R844	Receptor	4.5	1292	T200	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R846	Receptor	1.5	1492	T200	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
R847	Receptor	4.5	1458	T200	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R855	Receptor	4.5	1478	T314	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R856	Receptor	1.5	685	T207	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
R857	Receptor	4.5	753	T207	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R858	Receptor	4.5	718	T314	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R859	Receptor	4.5	910	T314	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
R860	Receptor	4.5	1107	T314	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R861	Receptor	4.5	1082	T214	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R862	Receptor	4.5	895	T214	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R863	Receptor	4.5	850	T214	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R864	Receptor	4.5	1054	T214	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
R865	Receptor	4.5	1137	T354	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R867	Receptor	4.5	887	T206	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R868	Receptor	4.5	787	T208	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
R869	Receptor	4.5	805	T206	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R870	Receptor	1.5	617	T209	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R872	Receptor	4.5	713	T209	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
R873	Receptor	4.5	623	T209	39.1	39.1	39.1	39.1	39.1	40.0	43.0	45.0	49.0	51.0
R874	Receptor	4.5	934	T212	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R876	Receptor	4.5	703	T212	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R877	Receptor	4.5	1153	T314	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R878	Receptor	4.5	1126	T314	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R880	Receptor	4.5	594	T221	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
R881	Receptor	4.5	659	T221	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R882	Receptor	4.5	496	Tr92	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
R883	Receptor	4.5	1235	T253	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R884	Receptor	4.5	1257	T253	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R885	Receptor	4.5	724	T277	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R900	Receptor	4.5	593	T240	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
R902	Receptor	4.5	582	T276	39.8	39.8	39.8	39.8	39.8	40.0	43.0	45.0	49.0	51.0
R904	Receptor	4.5	635	T305	38.9	38.9	38.9	38.9	38.9	40.0	43.0	45.0	49.0	51.0
R906	Receptor	4.5	832	T301	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
R907	Receptor	4.5	883	T301	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R915	Receptor	4.5	1384	T374	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
R916	Receptor	4.5	1047	T374	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R917	Receptor	4.5	777	T374	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R918	Receptor	4.5	550	T374	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
R919	Receptor	4.5	660	T374	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
R920	Receptor	4.5	673	T328	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
R921	Receptor	4.5	644	T330	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
R922	Receptor	1.5	873	T333	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R923	Receptor	1.5	614	T346	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R924	Receptor	4.5	1444	T348	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
R964	Receptor	4.5	1456	T343	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R970	Receptor	4.5	1337	T350	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R971	Receptor	1.5	810	T349	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R975	Receptor	1.5	755	T360	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R976	Receptor	4.5	729	T308	38.8	38.8	38.8	38.8	38.8	40.0	43.0	45.0	49.0	51.0
R977	Receptor	4.5	671	T308	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
R980	Receptor	4.5	1030	T207	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R981	Receptor	1.5	826	T219	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R982	Receptor	1.5	1010	T219	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R983	Receptor	1.5	1048	T219	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
R984	Receptor	4.5	575	T305	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
R985	Receptor	4.5	1009	T218	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
R986	Receptor	4.5	945	T218	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R988	Receptor	1.5	662	T218	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
R989	Receptor	1.5	825	T218	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R990	Receptor	4.5	810	T225	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
R991	Receptor	4.5	1208	T225	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
R992	Receptor	1.5	1066	T232	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R993	Receptor	4.5	1051	T232	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R994	Receptor	1.5	1080	T232	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
R995	Receptor	1.5	714	T232	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R996	Receptor	1.5	688	T232	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
R997	Receptor	1.5	623	T232	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R998	Receptor	4.5	634	T232	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
R999	Receptor	4.5	753	T232	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R1001	Receptor	1.5	713	T298	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
R1002	Receptor	4.5	790	T271	40.0	40.0	40.0	40.0	40.0	40.0	43.0	45.0	49.0	51.0
R1004	Receptor	4.5	611	T216	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
R1020	Receptor	4.5	1067	T246	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R1021	Receptor	4.5	564	T273	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
R1024	Receptor	4.5	772	T261	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
R1025	Receptor	4.5	784	T261	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
R1026	Receptor	1.5	967	T276	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
R1027	Receptor	4.5	969	T276	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine (m)	Nearest Turbine	Calculated Sound Level at Selected Wind Speeds (dBA)					Sound Level Limit (dBA)				
					6.0	7.0	8.0	9.0	10.0	6.0	7.0	8.0	9.0	10.0
R1028	Receptor	4.5	1143	T276	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R1029	Receptor	4.5	1146	T301	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R1030	Receptor	1.5	1154	T301	32.3	32.3	32.3	32.3	32.3	40.0	43.0	45.0	49.0	51.0
R1031	Receptor	4.5	813	T301	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R1032	Receptor	1.5	1027	T301	30.5	30.5	30.5	30.5	30.5	40.0	43.0	45.0	49.0	51.0
R1033	Receptor	1.5	1043	T301	30.4	30.4	30.4	30.4	30.4	40.0	43.0	45.0	49.0	51.0
R1034	Receptor	4.5	1283	T301	30.1	30.1	30.1	30.1	30.1	40.0	43.0	45.0	49.0	51.0
R1078	Receptor	4.5	1215	T205	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R1079	Receptor	4.5	1280	T205	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
R1080	Receptor	4.5	894	T205	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R1081	Receptor	1.5	880	T205	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R1082	Receptor	4.5	588	T202	38.8	38.8	38.8	38.8	38.8	40.0	43.0	45.0	49.0	51.0
R1084	Receptor	4.5	567	T202	39.3	39.3	39.3	39.3	39.3	40.0	43.0	45.0	49.0	51.0
R1085	Receptor	4.5	604	T200	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
R1086	Receptor	4.5	725	T200	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
R1087	Receptor	4.5	985	T200	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R1088	Receptor	1.5	944	T200	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R1089	Receptor	1.5	967	T200	33.0	33.0	33.0	33.0	33.0	40.0	43.0	45.0	49.0	51.0
R1090	Receptor	1.5	893	T200	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R1092	Receptor	1.5	928	T200	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R1093	Receptor	1.5	876	T200	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
R1094	Receptor	1.5	864	T200	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R1095	Receptor	1.5	832	T200	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
R1096	Receptor	4.5	819	T200	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
R1102	Receptor	4.5	618	T263	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
R1103	Receptor	4.5	771	T295	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R1104	Receptor	4.5	787	T295	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R1105	Receptor	4.5	796	T295	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
R1106	Receptor	4.5	569	T349	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
R1107	Receptor	4.5	576	T349	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
R1113	Receptor	4.5	640	T348	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
R1114	Receptor	4.5	1406	T348	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
R1116	Receptor	4.5	1072	T200	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R1117	Receptor	4.5	918	T215	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
R1180	Receptor	7.5	1091	T200	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
R1193	Receptor	4.5	1116	T273	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
R1194	Receptor	4.5	1497	T232	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R1259	Receptor	1.5	1305	T232	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
R1260	Receptor	4.5	1019	T232	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
R1261	Receptor	1.5	1054	T232	33.2	33.2	33.2	33.2	33.2	40.0	43.0	45.0	49.0	51.0
R1262	Receptor	4.5	1125	T232	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
R1263	Receptor	4.5	1172	T232	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R1264	Receptor	4.5	1088	T273	31.6	31.6	31.6	31.6	31.6	40.0	43.0	45.0	49.0	51.0
R1265	Receptor	4.5	1168	T273	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
R1266	Receptor	4.5	752	T273	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
R1267	Receptor	4.5	646	T273	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
R1268	Receptor	1.5	729	T273	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
R1297	Receptor	4.5	1229	T200	30.8	30.8	30.8	30.8	30.8	40.0	43.0	45.0	49.0	51.0
R1298	Receptor	7.5	1139	T200	31.6	31.6	31.6	31.6	31.6	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
R1299	Receptor	4.5	1068	T200	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
R1300	Receptor	4.5	966	T200	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
R1301	Receptor	4.5	676	T200	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
R1302	Receptor	4.5	725	T200	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
R1303	Receptor	1.5	1094	T200	31.8	31.8	31.8	31.8	31.8	40.0	43.0	45.0	49.0	51.0
R1304	Receptor	4.5	911	T200	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
R1305	Receptor	1.5	762	T200	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
R1306	Receptor	4.5	856	T200	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
R1307	Receptor	4.5	1265	T201	30.6	30.6	30.6	30.6	30.6	40.0	43.0	45.0	49.0	51.0
R1316	Receptor	4.5	1451	T201	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
R1414	Receptor	4.5	859	T200	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
R1415	Receptor	1.5	846	T200	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
R2449	Receptor	4.5	591	T265	39.6	39.6	39.6	39.6	39.6	40.0	43.0	45.0	49.0	51

Table 7-2 VLSR 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
V1436	VLSR	4.5	1403	T348	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V1437	VLSR	4.5	651	T348	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
V1438	VLSR	4.5	777	T348	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
V1440	VLSR	4.5	1006	T346	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V1441	VLSR	4.5	710	T346	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V1442	VLSR	4.5	856	T343	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
V1446	VLSR	4.5	1251	T343	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
V1447	VLSR	4.5	1200	T333	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
V1451	VLSR	4.5	841	T333	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
V1452	VLSR	4.5	623	T330	38.9	38.9	38.9	38.9	38.9	40.0	43.0	45.0	49.0	51.0
V1453	VLSR	4.5	633	T328	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
V1459	VLSR	4.5	763	T301	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
V1460	VLSR	4.5	872	T301	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
V1461	VLSR	4.5	822	T301	33.6	33.6	33.6	33.6	33.6	40.0	43.0	45.0	49.0	51.0
V1462	VLSR	4.5	871	T301	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
V1464	VLSR	4.5	1306	T374	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
V1465	VLSR	4.5	1226	T374	33.7	33.7	33.7	33.7	33.7	40.0	43.0	45.0	49.0	51.0
V1466	VLSR	4.5	1128	T305	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V1467	VLSR	4.5	807	T305	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
V1468	VLSR	4.5	918	T305	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
V1469	VLSR	4.5	708	T304	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V1470	VLSR	4.5	616	T374	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
V1471	VLSR	4.5	606	T374	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
V1472	VLSR	4.5	614	T304	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
V1473	VLSR	4.5	962	T310	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
V1475	VLSR	4.5	655	T322	39.5	39.5	39.5	39.5	39.5	40.0	43.0	45.0	49.0	51.0
V1476	VLSR	4.5	790	T333	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
V1477	VLSR	4.5	557	T329	39.3	39.3	39.3	39.3	39.3	40.0	43.0	45.0	49.0	51.0
V1479	VLSR	4.5	1319	T332	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
V1480	VLSR	4.5	1274	T348	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
V1481	VLSR	4.5	728	T348	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
V1483	VLSR	4.5	1487	T348	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V1488	VLSR	4.5	1352	T350	33.4	33.4	33.4	33.4	33.4	40.0	43.0	45.0	49.0	51.0
V1489	VLSR	4.5	1328	T350	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V1492	VLSR	4.5	598	T349	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
V1494	VLSR	4.5	663	T349	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
V1495	VLSR	4.5	622	T349	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V1496	VLSR	4.5	702	T349	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
V1497	VLSR	4.5	622	T349	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
V1498	VLSR	4.5	570	T349	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
V1502	VLSR	4.5	1184	T334	32.8	32.8	32.8	32.8	32.8	40.0	43.0	45.0	49.0	51.0
V1503	VLSR	4.5	1044	T334	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
V1505	VLSR	4.5	922	T334	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
V1506	VLSR	4.5	916	T334	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
V1507	VLSR	4.5	840	T334	35.7	35.7	35.7	35.7	35.7	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
V1509	VLSR	4.5	1399	T350	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
V1511	VLSR	4.5	1348	T338	32.6	32.6	32.6	32.6	32.6	40.0	43.0	45.0	49.0	51.0
V1512	VLSR	4.5	589	T336	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
V1513	VLSR	4.5	1431	T326	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
V1514	VLSR	4.5	1391	T326	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
V1515	VLSR	4.5	802	T325	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
V1516	VLSR	4.5	854	T332	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
V1517	VLSR	4.5	694	T326	39.8	39.8	39.8	39.8	39.8	40.0	43.0	45.0	49.0	51.0
V1518	VLSR	4.5	755	T318	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
V1519	VLSR	4.5	648	T319	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
V1520	VLSR	4.5	774	T300	39.4	39.4	39.4	39.4	39.4	40.0	43.0	45.0	49.0	51.0
V1521	VLSR	4.5	853	T323	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
V1522	VLSR	4.5	588	T329	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
V1523	VLSR	4.5	613	T329	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
V1524	VLSR	4.5	795	T307	39.3	39.3	39.3	39.3	39.3	40.0	43.0	45.0	49.0	51.0
V1525	VLSR	4.5	1021	T310	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
V1526	VLSR	4.5	741	T286	38.4	38.4	38.4	38.4	38.4	40.0	43.0	45.0	49.0	51.0
V1527	VLSR	4.5	762	T286	38.7	38.7	38.7	38.7	38.7	40.0	43.0	45.0	49.0	51.0
V1528	VLSR	4.5	847	T310	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
V1529	VLSR	4.5	803	T284	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V1530	VLSR	4.5	587	T304	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
V1531	VLSR	4.5	1263	T281	35.1	35.1	35.1	35.1	35.1	40.0	43.0	45.0	49.0	51.0
V1532	VLSR	4.5	973	T277	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V1533	VLSR	4.5	1489	T253	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V1534	VLSR	4.5	578	T276	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
V1536	VLSR	4.5	1034	T301	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
V1537	VLSR	4.5	983	T273	32.4	32.4	32.4	32.4	32.4	40.0	43.0	45.0	49.0	51.0
V1547	VLSR	4.5	1051	T273	32.0	32.0	32.0	32.0	32.0	40.0	43.0	45.0	49.0	51.0
V1549	VLSR	4.5	1234	T232	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
V1550	VLSR	4.5	806	T247	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
V1551	VLSR	4.5	764	T247	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
V1552	VLSR	4.5	877	T253	35.7	35.7	35.7	35.7	35.7	40.0	43.0	45.0	49.0	51.0
V1556	VLSR	4.5	1027	T248	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
V1557	VLSR	4.5	552	T256	39.8	39.8	39.8	39.8	39.8	40.0	43.0	45.0	49.0	51.0
V1558	VLSR	4.5	871	T267	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
V1559	VLSR	4.5	824	T286	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
V1560	VLSR	4.5	1024	T286	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
V1561	VLSR	4.5	836	T275	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
V1562	VLSR	4.5	891	T299	38.9	38.9	38.9	38.9	38.9	40.0	43.0	45.0	49.0	51.0
V1563	VLSR	4.5	663	T306	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
V1564	VLSR	4.5	802	T318	38.9	38.9	38.9	38.9	38.9	40.0	43.0	45.0	49.0	51.0
V1566	VLSR	4.5	673	T295	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
V1567	VLSR	4.5	759	T295	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
V1568	VLSR	4.5	762	T315	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
V1569	VLSR	4.5	867	T312	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
V1570	VLSR	4.5	827	T334	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
V1571	VLSR	4.5	930	T334	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
V1572	VLSR	4.5	978	T334	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
V1573	VLSR	4.5	1029	T334	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
V1575	VLSR	4.5	1348	T334	33.8	33.8	33.8	33.8	33.8	40.0	43.0	45.0	49.0	51.0
V1578	VLSR	4.5	1204	T312	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
V1579	VLSR	4.5	1090	T312	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1582	VLSR	4.5	938	T312	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V1583	VLSR	4.5	908	T295	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
V1586	VLSR	4.5	764	T295	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
V1587	VLSR	4.5	735	T295	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
V1589	VLSR	4.5	811	T295	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
V1590	VLSR	4.5	746	T295	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
V1591	VLSR	4.5	741	T272	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
V1592	VLSR	4.5	677	T272	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
V1598	VLSR	4.5	766	T263	37.7	37.7	37.7	37.7	37.7	40.0	43.0	45.0	49.0	51.0
V1599	VLSR	4.5	898	T360	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
V1601	VLSR	4.5	1399	T263	33.5	33.5	33.5	33.5	33.5	40.0	43.0	45.0	49.0	51.0
V1604	VLSR	4.5	855	T360	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
V1605	VLSR	4.5	820	T360	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
V1606	VLSR	4.5	811	T360	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
V1607	VLSR	4.5	667	T263	38.7	38.7	38.7	38.7	38.7	40.0	43.0	45.0	49.0	51.0
V1608	VLSR	4.5	739	T263	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
V1609	VLSR	4.5	816	T360	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
V1610	VLSR	4.5	789	T360	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
V1611	VLSR	4.5	776	T360	37.3	37.3	37.3	37.3	37.3	40.0	43.0	45.0	49.0	51.0
V1612	VLSR	4.5	693	T360	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V1613	VLSR	4.5	1035	T379	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
V1614	VLSR	4.5	895	T275	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
V1615	VLSR	4.5	835	T275	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
V1616	VLSR	4.5	973	T379	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
V1617	VLSR	4.5	828	T6	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
V1618	VLSR	4.5	666	Tr93	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
V1619	VLSR	4.5	656	Tr93	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
V1620	VLSR	4.5	769	T229	38.8	38.8	38.8	38.8	38.8	40.0	43.0	45.0	49.0	51.0
V1621	VLSR	4.5	130	Tr93	39.4	39.4	39.4	39.4	39.4	40.0	43.0	45.0	49.0	51.0
V1622	VLSR	4.5	1063	T248	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V1623	VLSR	4.5	546	Tr92	38.5	38.5	38.5	38.5	38.5	40.0	43.0	45.0	49.0	51.0
V1624	VLSR	4.5	596	T232	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V1625	VLSR	4.5	705	T232	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
V1626	VLSR	4.5	1084	T225	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
V1627	VLSR	4.5	869	T232	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
V1628	VLSR	4.5	759	T232	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V1629	VLSR	4.5	823	T232	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
V1630	VLSR	4.5	839	T232	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
V1631	VLSR	4.5	900	T232	34.8	34.8	34.8	34.8	34.8	40.0	43.0	45.0	49.0	51.0
V1632	VLSR	4.5	926	T232	34.7	34.7	34.7	34.7	34.7	40.0	43.0	45.0	49.0	51.0
V1633	VLSR	4.5	948	T232	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V1634	VLSR	4.5	990	T232	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1635	VLSR	4.5	1027	T232	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
V1636	VLSR	4.5	1060	T232	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V1637	VLSR	4.5	919	T232	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1638	VLSR	4.5	882	T232	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
V1639	VLSR	4.5	908	T232	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V1640	VLSR	4.5	945	T232	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1641	VLSR	4.5	975	T232	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
V1644	VLSR	4.5	1323	T225	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
V1645	VLSR	4.5	1172	T225	33.1	33.1	33.1	33.1	33.1	40.0	43.0	45.0	49.0	51.0
V1646	VLSR	4.5	991	T225	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1648	VLSR	4.5	1443	T218	31.3	31.3	31.3	31.3	31.3	40.0	43.0	45.0	49.0	51.0
V1650	VLSR	4.5	1312	T218	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
V1651	VLSR	4.5	1294	T218	31.9	31.9	31.9	31.9	31.9	40.0	43.0	45.0	49.0	51.0
V1652	VLSR	4.5	1253	T218	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
V1653	VLSR	4.5	1109	T218	32.9	32.9	32.9	32.9	32.9	40.0	43.0	45.0	49.0	51.0
V1654	VLSR	4.5	1423	T218	31.4	31.4	31.4	31.4	31.4	40.0	43.0	45.0	49.0	51.0
V1655	VLSR	4.5	1022	T225	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1656	VLSR	4.5	711	T218	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
V1657	VLSR	4.5	585	T218	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
V1662	VLSR	4.5	951	T229	37.6	37.6	37.6	37.6	37.6	40.0	43.0	45.0	49.0	51.0
V1665	VLSR	4.5	966	T360	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
V1666	VLSR	4.5	1149	T380	34.3	34.3	34.3	34.3	34.3	40.0	43.0	45.0	49.0	51.0
V1667	VLSR	4.5	905	T360	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
V1669	VLSR	4.5	1312	T360	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
V1670	VLSR	4.5	1169	T380	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V1672	VLSR	4.5	1220	T380	34.4	34.4	34.4	34.4	34.4	40.0	43.0	45.0	49.0	51.0
V1673	VLSR	4.5	1236	T11	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
V2009	VLSR	4.5	851	T219	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V2012	VLSR	4.5	717	T219	37.5	37.5	37.5	37.5	37.5	40.0	43.0	45.0	49.0	51.0
V2013	VLSR	4.5	861	T219	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
V2014	VLSR	4.5	928	T217	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
V2015	VLSR	4.5	936	T221	35.5	35.5	35.5	35.5	35.5	40.0	43.0	45.0	49.0	51.0
V2016	VLSR	4.5	1065	T219	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
V2017	VLSR	4.5	1040	T215	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
V2018	VLSR	4.5	785	T215	37.0	37.0	37.0	37.0	37.0	40.0	43.0	45.0	49.0	51.0
V2019	VLSR	4.5	935	T221	36.3	36.3	36.3	36.3	36.3	40.0	43.0	45.0	49.0	51.0
V2020	VLSR	4.5	896	T221	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
V2021	VLSR	4.5	869	T221	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
V2022	VLSR	4.5	837	T221	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V2023	VLSR	4.5	822	T221	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V2024	VLSR	4.5	798	T221	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V2025	VLSR	4.5	775	T221	36.6	36.6	36.6	36.6	36.6	40.0	43.0	45.0	49.0	51.0
V2026	VLSR	4.5	745	T221	36.7	36.7	36.7	36.7	36.7	40.0	43.0	45.0	49.0	51.0
V2027	VLSR	4.5	723	T221	36.8	36.8	36.8	36.8	36.8	40.0	43.0	45.0	49.0	51.0
V2028	VLSR	4.5	705	T221	36.9	36.9	36.9	36.9	36.9	40.0	43.0	45.0	49.0	51.0
V2029	VLSR	4.5	671	T221	37.1	37.1	37.1	37.1	37.1	40.0	43.0	45.0	49.0	51.0
V2030	VLSR	4.5	656	T221	37.2	37.2	37.2	37.2	37.2	40.0	43.0	45.0	49.0	51.0
V2031	VLSR	4.5	716	T217	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
V2032	VLSR	4.5	583	T212	39.7	39.7	39.7	39.7	39.7	40.0	43.0	45.0	49.0	51.0
V2033	VLSR	4.5	563	T218	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
V2034	VLSR	4.5	652	T218	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
V2035	VLSR	4.5	647	T218	36.1	36.1	36.1	36.1	36.1	40.0	43.0	45.0	49.0	51.0
V2036	VLSR	4.5	897	T218	34.1	34.1	34.1	34.1	34.1	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
V2037	VLSR	4.5	1387	T218	31.5	31.5	31.5	31.5	31.5	40.0	43.0	45.0	49.0	51.0
V2038	VLSR	4.5	1468	T218	31.2	31.2	31.2	31.2	31.2	40.0	43.0	45.0	49.0	51.0
V2041	VLSR	4.5	673	T206	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
V2044	VLSR	4.5	1312	T201	30.4	30.4	30.4	30.4	30.4	40.0	43.0	45.0	49.0	51.0
V2046	VLSR	4.5	824	T209	38.1	38.1	38.1	38.1	38.1	40.0	43.0	45.0	49.0	51.0
V2047	VLSR	4.5	695	T206	38.3	38.3	38.3	38.3	38.3	40.0	43.0	45.0	49.0	51.0
V2048	VLSR	4.5	611	T355	39.7	39.7	39.7	39.7	39.7	40.0	43.0	45.0	49.0	51.0
V2049	VLSR	4.5	805	T206	38.0	38.0	38.0	38.0	38.0	40.0	43.0	45.0	49.0	51.0
V2051	VLSR	4.5	1149	T354	34.9	34.9	34.9	34.9	34.9	40.0	43.0	45.0	49.0	51.0
V2052	VLSR	4.5	1331	T314	35.2	35.2	35.2	35.2	35.2	40.0	43.0	45.0	49.0	51.0
V2053	VLSR	4.5	755	T314	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V2054	VLSR	4.5	1064	T219	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
V2056	VLSR	4.5	946	T207	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
V2057	VLSR	4.5	1013	T207	35.9	35.9	35.9	35.9	35.9	40.0	43.0	45.0	49.0	51.0
V2058	VLSR	4.5	1084	T207	35.6	35.6	35.6	35.6	35.6	40.0	43.0	45.0	49.0	51.0
V2059	VLSR	4.5	1245	T207	33.3	33.3	33.3	33.3	33.3	40.0	43.0	45.0	49.0	51.0
V2234	VLSR	4.5	749	T207	37.8	37.8	37.8	37.8	37.8	40.0	43.0	45.0	49.0	51.0
V2236	VLSR	4.5	557	T330	39.6	39.6	39.6	39.6	39.6	40.0	43.0	45.0	49.0	51.0
V2237	VLSR	4.5	895	T314	36.5	36.5	36.5	36.5	36.5	40.0	43.0	45.0	49.0	51.0
V2238	VLSR	4.5	761	T229	39.0	39.0	39.0	39.0	39.0	40.0	43.0	45.0	49.0	51.0
V2240	VLSR	4.5	560	T254	39.2	39.2	39.2	39.2	39.2	40.0	43.0	45.0	49.0	51.0
V2357	VLSR	4.5	1430	T207	32.2	32.2	32.2	32.2	32.2	40.0	43.0	45.0	49.0	51.0
V2389	VLSR	4.5	1443	T200	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
V2391	VLSR	4.5	1079	T200	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V2392	VLSR	4.5	985	T200	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
V2393	VLSR	4.5	910	T200	34.2	34.2	34.2	34.2	34.2	40.0	43.0	45.0	49.0	51.0
V2394	VLSR	4.5	940	T200	33.9	33.9	33.9	33.9	33.9	40.0	43.0	45.0	49.0	51.0
V2395	VLSR	4.5	909	T200	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
V2396	VLSR	4.5	927	T200	34.6	34.6	34.6	34.6	34.6	40.0	43.0	45.0	49.0	51.0
V2414	VLSR	4.5	1391	T200	29.9	29.9	29.9	29.9	29.9	40.0	43.0	45.0	49.0	51.0
V2422	VLSR	4.5	753	T266	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
V2424	VLSR	4.5	1162	T232	34.5	34.5	34.5	34.5	34.5	40.0	43.0	45.0	49.0	51.0
V2425	VLSR	4.5	1179	T232	34.1	34.1	34.1	34.1	34.1	40.0	43.0	45.0	49.0	51.0
V2428	VLSR	4.5	856	T360	35.3	35.3	35.3	35.3	35.3	40.0	43.0	45.0	49.0	51.0
V2429	VLSR	4.5	637	T322	39.7	39.7	39.7	39.7	39.7	40.0	43.0	45.0	49.0	51.0
V2430	VLSR	4.5	638	T332	39.4	39.4	39.4	39.4	39.4	40.0	43.0	45.0	49.0	51.0
V2431	VLSR	4.5	731	T265	39.9	39.9	39.9	39.9	39.9	40.0	43.0	45.0	49.0	51.0
V2433	VLSR	4.5	684	T260	39.7	39.7	39.7	39.7	39.7	40.0	43.0	45.0	49.0	51.0
V2434	VLSR	4.5	827	T221	36.0	36.0	36.0	36.0	36.0	40.0	43.0	45.0	49.0	51.0
V2445	VLSR	4.5	571	T334	39.5	39.5	39.5	39.5	39.5	40.0	43.0	45.0	49.0	51.0
V2447	VLSR	4.5	707	T349	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
V2448	VLSR	4.5	1139	T354	35.0	35.0	35.0	35.0	35.0	40.0	43.0	45.0	49.0	51.0
V2450	VLSR	4.5	846	T276	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
V2455	VLSR	4.5	663	T202	38.2	38.2	38.2	38.2	38.2	40.0	43.0	45.0	49.0	51.0
V2476	VLSR	4.5	659	T246	38.6	38.6	38.6	38.6	38.6	40.0	43.0	45.0	49.0	51.0
V2477	VLSR	4.5	664	T246	37.9	37.9	37.9	37.9	37.9	40.0	43.0	45.0	49.0	51.0
V2478	VLSR	4.5	916	T219	36.4	36.4	36.4	36.4	36.4	40.0	43.0	45.0	49.0	51.0
V2479	VLSR	4.5	865	T273	35.8	35.8	35.8	35.8	35.8	40.0	43.0	45.0	49.0	51.0
V2485	VLSR	4.5	574	T334	38.9	38.9	38.9	38.9	38.9	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
V2487	VLSR	4.5	858	T310	37.4	37.4	37.4	37.4	37.4	40.0	43.0	45.0	49.0	51.0
V2488	VLSR	4.5	1333	T332	35.4	35.4	35.4	35.4	35.4	40.0	43.0	45.0	49.0	51.0
V2496	VLSR	4.5	935	T219	36.2	36.2	36.2	36.2	36.2	40.0	43.0	45.0	49.0	51.0
V2504	VLSR	4.5	1148	T349	32.1	32.1	32.1	32.1	32.1	40.0	43.0	45.0	49.0	51.0
V2505	VLSR	4.5	1480	T349	30.7	30.7	30.7	30.7	30.7	40.0	43.0	45.0	49.0	51.0
V2537	VLSR	4.5	1165	T205	34.0	34.0	34.0	34.0	34.0	40.0	43.0	45.0	49.0	51.0
V2548	VLSR	4.5	1117	T301	34.0	34.0	34.0	34.0	34.0	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
P7	Receptor	4.5	614	T206	38.4	38.4	38.4	38.4	38.4
P8	Receptor	1.5	631	T206	37.1	37.1	37.1	37.1	37.1
P38	Receptor	4.5	678	T226	38.7	38.7	38.7	38.7	38.7
P44	Receptor	4.5	330	T235	41.7	41.7	41.7	41.7	41.7
P45	Receptor	4.5	404	T246	40.9	40.9	40.9	40.9	40.9
P46	Receptor	1.5	423	T246	39.8	39.8	39.8	39.8	39.8
P67	Receptor	4.5	465	T240	39.6	39.6	39.6	39.6	39.6
P316	Receptor	4.5	514	T315	39.5	39.5	39.5	39.5	39.5
P325	Receptor	1.5	345	T329	40.4	40.4	40.4	40.4	40.4
P331	Receptor	4.5	519	T374	39.6	39.6	39.6	39.6	39.6
P340	Receptor	4.5	528	T333	39.2	39.2	39.2	39.2	39.2
P367	Receptor	4.5	416	T348	41.0	41.0	41.0	41.0	41.0
P507	Receptor	4.5	606	T319	40.0	40.0	40.0	40.0	40.0
P614	Receptor	4.5	582	T219	38.9	38.9	38.9	38.9	38.9
P618	Receptor	4.5	296	T215	42.7	42.7	42.7	42.7	42.7
P641	Receptor	4.5	564	T360	37.5	37.5	37.5	37.5	37.5
P650	Receptor	1.5	528	T6	40.2	40.2	40.2	40.2	40.2
P651	Receptor	4.5	656	T6	41.1	41.1	41.1	41.1	41.1
P652	Receptor	1.5	599	T265	39.7	39.7	39.7	39.7	39.7
P653	Receptor	4.5	628	T270	40.8	40.8	40.8	40.8	40.8
P658	Receptor	1.5	766	T347	36.8	36.8	36.8	36.8	36.8
P659	Receptor	4.5	775	T347	38.0	38.0	38.0	38.0	38.0
P677	Receptor	4.5	648	T2	41.5	41.5	41.5	41.5	41.5
P678	Receptor	4.5	936	T6	38.9	38.9	38.9	38.9	38.9
P685	Receptor	4.5	384	T233	43.0	43.0	43.0	43.0	43.0
P689	Receptor	1.5	343	T284	43.0	43.0	43.0	43.0	43.0
P690	Receptor	4.5	411	T281	43.2	43.2	43.2	43.2	43.2
P702	Receptor	4.5	376	T272	42.6	42.6	42.6	42.6	42.6
P703	Receptor	1.5	327	T272	43.1	43.1	43.1	43.1	43.1
P704	Receptor	4.5	529	T263	40.6	40.6	40.6	40.6	40.6
P710	Receptor	4.5	465	T280	41.6	41.6	41.6	41.6	41.6
P711	Receptor	4.5	355	T282	44.5	44.5	44.5	44.5	44.5
P718	Receptor	4.5	651	T310	38.2	38.2	38.2	38.2	38.2
P729	Receptor	4.5	672	T300	40.4	40.4	40.4	40.4	40.4
P730	Receptor	4.5	306	T294	43.7	43.7	43.7	43.7	43.7
P731	Receptor	4.5	536	T307	41.7	41.7	41.7	41.7	41.7
P732	Receptor	4.5	482	T307	41.7	41.7	41.7	41.7	41.7
P746	Receptor	4.5	501	Tr93	38.3	38.3	38.3	38.3	38.3
P751	Receptor	1.5	632	T275	38.0	38.0	38.0	38.0	38.0
P816	Receptor	4.5	318	Tr92	37.5	37.5	37.5	37.5	37.5
P866	Receptor	1.5	600	T214	37.1	37.1	37.1	37.1	37.1
P871	Receptor	1.5	606	T209	37.6	37.6	37.6	37.6	37.6
P875	Receptor	4.5	603	T212	38.9	38.9	38.9	38.9	38.9
P886	Receptor	4.5	498	T218	38.6	38.6	38.6	38.6	38.6

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
P901	Receptor	4.5	488	T240	40.4	40.4	40.4	40.4	40.4
P903	Receptor	4.5	432	T276	40.1	40.1	40.1	40.1	40.1
P905	Receptor	1.5	606	T301	37.0	37.0	37.0	37.0	37.0
P1022	Receptor	4.5	460	T273	38.3	38.3	38.3	38.3	38.3
P1023	Receptor	4.5	447	T273	38.6	38.6	38.6	38.6	38.6
P1083	Receptor	1.5	448	T202	39.1	39.1	39.1	39.1	39.1

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 have been used for each of the turbine types. However, these do not occur at the same wind speed for all turbines types. While logically inconsistent, this ensures that the most conservative version of the MoE "predictable worst case" is modelled. For information, the "predictable worst case" for K2WPP project turbines has been determined to occur for a 7 ms^{-1} wind speed (measured at 10 m a.g.l.). For the nearby KWPP turbines, it has been determined to occur for an 8 ms^{-1} wind speed.

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

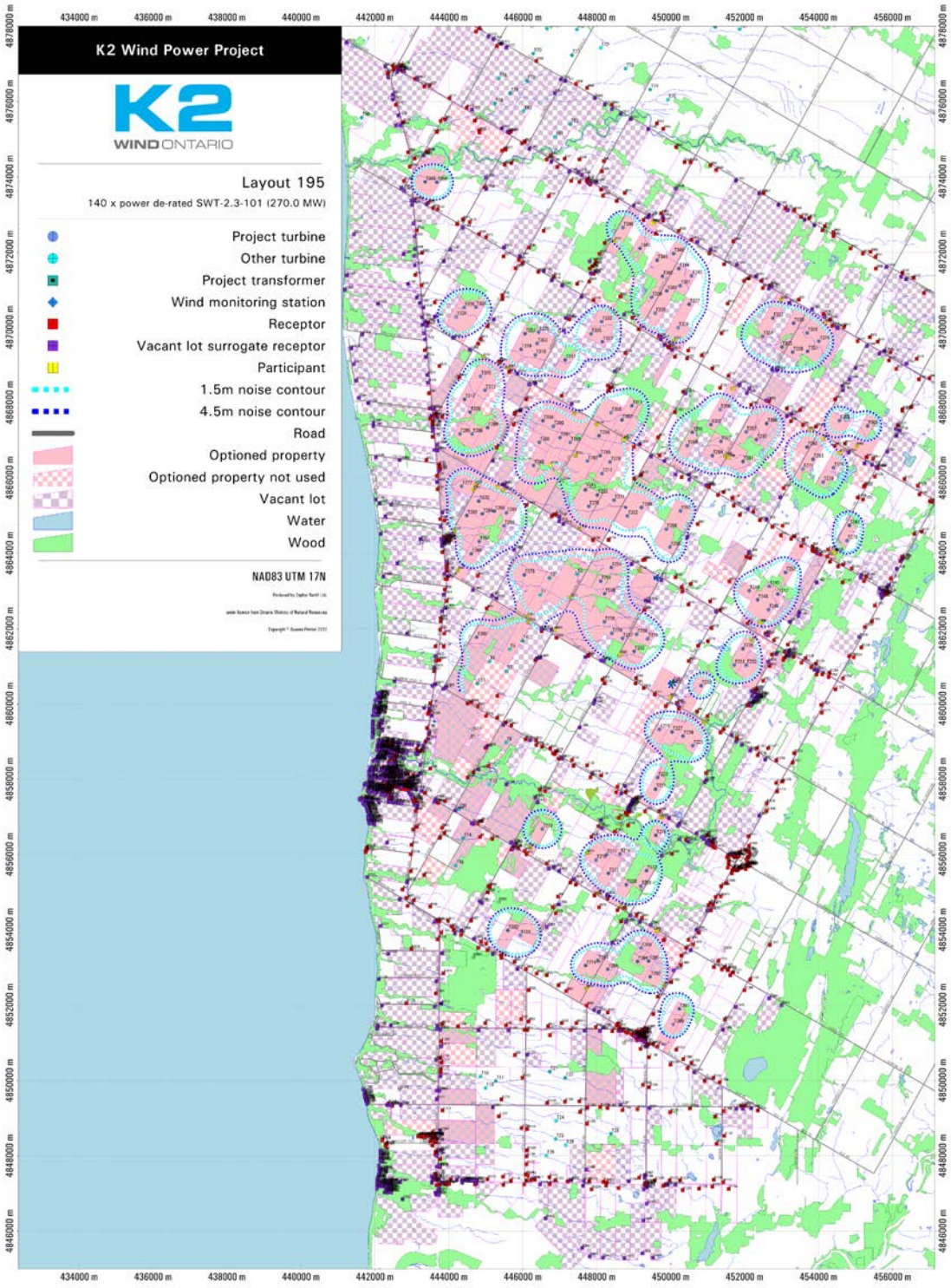

Figure 8-1 40 dBA noise isopleth map for 1.5 and 4.5 m a.g.l.

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

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

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 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 R1002 due to the single turbine T271. Receptor and turbine are separated by 790 m. Note

Table 9-1 Sample calculation for receptor and turbine.

Intermediate calculations for receptor R1002 and turbine T271						
Octave band	**Mid-band frequency (Hz)**	**L_W (dBA)**	**A_{div} (dB)**	**A_{atm} (dB)**	**A_{gr} (dB)**	**L_{fT}(DW) (dBA)**
1	63	84.9	69.0	0.1	-3.0	18.8
2	125	89.5	69.0	0.3	1.1	19.1
3	250	94.9	69.0	0.8	-0.1	25.1
4	500	93.5	69.0	1.5	-0.7	23.7
5	1000	94.4	69.0	2.9	-0.7	23.2
6	2000	93.7	69.0	7.7	-0.8	17.7
7	4000	89.7	69.0	26.1	-0.8	-4.7
8	8000	77.5	69.0	93.2	-0.8	-83.9

that the resultant A-weighted sound pressure level at R1002 due to turbine T271 alone is 29.9 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 R1002 due to all turbines (from all projects) within 5,000 m of the receptor. The resultant A-weighted sound pressure level at R1002 due to all turbines is 40.0 dBA.

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

Intermediate calculations for receptor R1002 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	3997	32.9	23.5	19.5	12.6	1.0	-26.2	-125.9	-462.4	15.1
T2	2970	34.9	26.4	23.0	17.0	7.3	-13.8	-89.7	-339.8	18.8
T3	3492	33.9	24.8	21.2	14.7	4.0	-20.2	-108.2	-402.3	16.8
Tr93	2707	0.5	-3.5	-5.5	3.2	-16.7	-52.9	-127.5	-358.4	0.3
T210	3157	33.3	22.9	20.2	13.0	5.4	-16.2	-93.2	-370.2	15.7
T211	883	44.0	34.2	32.7	25.8	21.9	14.7	-9.7	-94.6	28.8
T229	4155	31.6	20.2	17.0	8.8	-0.6	-28.1	-128.2	-489.2	12.4
T233	4583	30.6	18.9	15.3	6.0	-4.3	-34.1	-143.9	-540.5	10.7
T236	4268	31.1	19.6	16.2	7.2	-2.6	-30.5	-133.0	-503.1	11.5
T237	4253	31.1	19.6	16.3	7.3	-2.5	-30.3	-132.5	-501.3	11.6
T238	3890	32.6	22.3	19.6	12.2	3.6	-23.7	-117.1	-458.2	14.9
T239	4134	31.3	19.9	16.6	7.7	-1.8	-28.9	-128.4	-487.1	11.9
T240	4751	30.1	18.2	14.5	4.1	-6.8	-37.2	-150.8	-561.0	9.7
T245	4637	30.5	18.7	15.2	5.8	-4.6	-34.8	-145.8	-546.9	10.5
T247	4945	30.5	19.3	16.2	7.5	-3.9	-37.4	-154.3	-583.8	11.4
T248	4305	30.8	19.2	15.7	5.8	-4.3	-32.0	-135.3	-508.0	10.9
T249	4637	30.8	19.1	15.6	7.0	-3.2	-33.7	-144.9	-546.5	11.1
T251	2864	33.7	23.1	20.5	11.9	4.4	-14.7	-84.7	-336.1	15.6
T252	1084	42.3	32.3	30.7	23.6	19.4	10.9	-18.0	-119.8	26.6
T253	4787	30.3	18.4	14.8	5.3	-5.5	-36.5	-151.0	-564.7	10.1

Intermediate calculations for receptor R1002 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	
T254	2441	35.1	24.7	22.4	14.0	7.4	-9.2	-69.4	-285.2	17.5
T256	2058	36.8	26.6	24.6	17.6	11.7	-2.9	-54.4	-238.5	20.2
T257	4515	30.7	19.0	15.5	6.3	-4.0	-33.4	-141.6	-532.5	10.8
T259	1597	39.4	29.4	27.7	21.8	17.0	4.8	-36.2	-182.0	24.0
T260	3738	32.0	20.9	17.9	9.3	0.5	-24.3	-114.5	-440.0	13.1
T262	1008	43.1	33.2	31.8	25.7	21.8	13.4	-13.9	-109.8	28.3
T263	4632	31.0	20.0	17.1	8.6	-2.2	-33.8	-143.5	-546.6	12.2
T264	4212	31.2	19.7	16.4	7.4	-2.3	-29.8	-131.1	-496.4	11.7
T265	3575	32.1	21.0	18.0	8.7	-0.1	-23.4	-109.8	-421.0	13.0
T266	3882	31.7	20.5	17.4	8.7	-0.4	-26.0	-119.6	-457.1	12.6
T267	1516	39.5	29.5	27.8	21.2	16.4	5.0	-34.0	-172.6	23.8
T269	791	45.2	35.5	34.1	28.2	24.7	17.6	-4.7	-82.5	30.8
T270	4247	31.1	19.6	16.3	7.3	-2.5	-30.3	-132.3	-500.6	11.6
T271	790	45.0	35.2	33.7	26.9	23.2	16.5	-5.7	-82.8	29.9
T272	4671	30.4	18.7	15.1	5.7	-4.8	-35.2	-147.0	-551.0	10.4
T275	1434	40.0	30.0	28.4	21.9	17.2	6.3	-30.8	-162.5	24.4
T277	4567	30.6	18.9	15.4	6.1	-4.3	-34.0	-143.4	-538.7	10.7
T279	789	45.2	35.5	34.1	28.2	24.7	17.6	-4.7	-82.3	30.8
T280	2745	34.2	23.9	21.4	13.8	6.7	-12.1	-79.4	-321.3	16.8
T281	2975	33.5	23.1	20.5	12.6	5.2	-15.0	-87.7	-348.9	15.8
T282	1348	40.8	31.0	29.4	23.8	19.4	8.7	-26.6	-151.4	25.9
T283	4864	30.1	18.3	14.6	5.0	-5.9	-37.4	-153.7	-573.9	9.9
T284	2203	36.2	26.0	23.9	16.7	10.6	-4.9	-59.7	-256.0	19.4
T285	1108	42.3	32.4	30.9	24.7	20.6	11.6	-18.0	-122.2	27.2
T286	1682	38.6	28.5	26.7	20.0	14.9	2.5	-40.3	-192.8	22.6
T288	2744	34.3	23.9	21.4	13.8	6.7	-12.1	-79.4	-321.2	16.8
T289	1983	37.1	27.0	25.0	18.0	12.3	-1.9	-51.6	-229.4	20.7
T290	3463	32.5	21.6	18.8	10.4	2.1	-21.0	-104.9	-407.2	14.0
T291	2286	35.9	25.6	23.5	16.2	10.0	-6.0	-62.8	-266.0	19.0
T292	2546	35.2	25.0	22.7	16.0	9.5	-8.4	-71.3	-296.8	18.4
T294	1486	39.7	29.7	28.0	21.5	16.7	5.4	-32.8	-168.8	24.0
T295	4862	30.2	18.3	14.6	5.0	-5.9	-37.3	-153.6	-573.6	9.9
T296	4539	30.6	19.0	15.5	6.2	-4.1	-33.6	-142.4	-535.3	10.8
T297	3273	32.8	22.1	19.4	11.3	3.3	-18.7	-98.2	-384.6	14.6
T298	1993	37.1	26.9	25.0	18.0	12.3	-2.0	-52.0	-230.6	20.6
T299	4190	31.2	19.8	16.5	7.5	-2.2	-29.6	-130.3	-493.9	11.7
T300	2592	34.6	24.1	21.7	13.2	6.3	-11.2	-74.9	-303.4	16.8
T302	2526	35.0	24.7	22.4	14.9	8.2	-9.2	-71.5	-295.0	17.8

Intermediate calculations for receptor R1002 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	
T304	3871	31.7	20.5	17.4	8.7	-0.3	-25.9	-119.2	-455.9	12.7
T306	2910	33.5	23.0	20.4	11.6	4.1	-15.3	-86.3	-341.6	15.4
T307	1596	39.4	29.4	27.7	21.8	17.1	4.9	-36.2	-181.8	24.0
T308	1861	37.7	27.6	25.7	18.8	13.3	-0.1	-47.1	-214.6	21.4
T309	4778	30.3	18.4	14.8	5.3	-5.4	-36.4	-150.7	-563.7	10.1
T310	2958	33.6	23.1	20.6	12.7	5.3	-14.8	-87.1	-346.9	15.9
T311	1941	37.3	27.2	25.2	18.3	12.7	-1.3	-50.1	-224.3	20.9
T313	4668	30.4	18.7	15.1	5.7	-4.8	-35.1	-146.9	-550.6	10.4
T315	4967	30.0	18.0	14.3	4.6	-6.4	-38.5	-157.2	-586.1	9.7
T317	3665	32.1	21.1	18.1	9.6	0.9	-23.4	-112.0	-431.3	13.3
T318	4234	31.1	19.7	16.3	7.3	-2.4	-30.1	-131.8	-499.0	11.6
T319	4600	30.5	18.8	15.3	5.9	-4.4	-34.3	-144.5	-542.6	10.6
T323	3736	32.0	20.9	17.9	9.3	0.5	-24.2	-114.5	-439.7	13.1
T325	4017	31.5	20.2	17.0	8.2	-1.2	-27.6	-124.3	-473.2	12.2
T326	4673	30.4	18.7	15.1	5.7	-4.8	-35.2	-147.0	-551.2	10.4
T327	4850	30.2	18.3	14.6	5.0	-5.8	-37.2	-153.2	-572.3	10.0
T329	4184	31.2	19.8	16.5	7.5	-2.1	-29.5	-130.1	-493.1	11.8
T332	4265	31.1	19.6	16.2	7.2	-2.6	-30.5	-132.9	-502.7	11.5
T335	4431	30.8	19.2	15.8	6.6	-3.5	-32.4	-138.7	-522.5	11.1
T337	4865	30.1	18.3	14.6	5.0	-5.9	-37.4	-153.7	-574.0	9.9
T339	4839	30.2	18.3	14.6	5.1	-5.7	-37.1	-152.8	-570.9	10.0
T360	4840	30.0	18.0	14.2	3.8	-7.2	-38.2	-153.8	-571.6	9.5
T362	4448	30.6	18.9	15.3	5.2	-5.1	-33.7	-140.3	-524.9	10.5
T373	1352	40.3	30.3	28.6	21.2	16.5	6.5	-28.7	-152.9	24.2
T379	3920	31.5	20.1	16.9	7.3	-2.1	-27.5	-121.9	-462.2	12.0

10 CONCLUSIONS

This noise impact assessment for the proposed K2 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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Siemens Wind Power A/S, 2012f: SWT-2.3-101, Rev. 4, Max. Power 1824 kW, Contract Acoustic Emission, Hub Height 99.5m, Kingsbridge II - Ontario - Canada, Document ID: E W EN OEN DES TLS-10-0000-780-00, HST, JES / 2012.12.19, "Strictly Confidential". Document provided as file, SWT-2.3-101, Rev. 4, Kingsbridge II Acoustic Emission, -5dB, 101dB 99.5m HH R20121219.pdf

Siemens Wind Power A/S (SWP), 2011: Noise Measurement, SWP Report N02304 099-T1, 25.05.2011, Ejler Kristensen.

Wong, Cynthia (2007): Email from Cynthia Wong (Vestas), 2007/10/23.

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: K2 Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17N

Identifier	Equipment Make and Model	X(E,m)	Y(N,m)	Remarks
T1	Vestas V80	446469	4862901	KWPP
T2	Vestas V80	447463	4863451	KWPP
T3	Vestas V80	446722	4863348	KWPP
T5	Vestas V80	445644	4861460	KWPP
T6	Vestas V80	445996	4861680	KWPP
T7	Vestas V80	445563	4860874	KWPP
T8	Vestas V80	445551	4858977	KWPP
T9	Vestas V80	445101	4861128	KWPP
T11	Vestas V80	444767	4860539	KWPP
T13	Vestas V80	445083	4857868	KWPP
T14	Vestas V80	444388	4856434	KWPP
T15	Vestas V80	444181	4855715	KWPP
T17	Vestas V80	445268	4849988	KWPP
T18	Vestas V80	444992	4849802	KWPP
T19	Vestas V80	444859	4850109	KWPP
T21	Vestas V80	446729	4850239	KWPP
T22	Vestas V80	447147	4850070	KWPP
T24	Vestas V80	446900	4848930	KWPP
T25	Vestas V80	446886	4848448	KWPP

T26	Vestas V80	446633	4848009	KWPP
T28	Vestas V80	448384	4848585	KWPP
T29	Vestas V80	447160	4848284	KWPP
T30	Vestas V47	444266	4857207	KWPP
T45	Enercon E82	446861	4882501	SRWP1
T46	Enercon E82	447300	4882308	SRWP1
T47	Enercon E82	447484	4882747	SRWP1
T48	Enercon E82	447618	4882162	SRWP1
T49	Enercon E82	447897	4882382	SRWP1
T50	Enercon E82	449687	4880871	SRWP1
T51	Enercon E82	450398	4880483	SRWP1
T52	Enercon E82	450936	4880181	SRWP1
T53	Enercon E82	451656	4880077	SRWP1
T54	Enercon E82	445341	4881434	SRWP1
T55	Enercon E82	445652	4881403	SRWP1
T56	Enercon E82	446345	4880497	SRWP1
T57	Enercon E82	446806	4880459	SRWP1
T58	Enercon E82	447542	4880257	SRWP1
T59	Enercon E82	447447	4879790	SRWP1
T60	Enercon E82	447839	4879712	SRWP1
T61	Enercon E82	448162	4879573	SRWP1
T62	Enercon E82	448767	4879227	SRWP1
T63	Enercon E82	449390	4879024	SRWP1
T64	Enercon E82	449980	4878833	SRWP1
T65	Enercon E82	450723	4878592	SRWP1
T66	Enercon E82	451204	4877983	SRWP1
T67	Enercon E82	451861	4877920	SRWP1
T68	Enercon E82	446653	4877939	SRWP1
T69	Enercon E82	447460	4877911	SRWP1
T70	Enercon E82	446286	4877278	SRWP1
T71	Enercon E82	447331	4877234	SRWP1
T72	Enercon E82	448108	4877425	SRWP1
T73	Enercon E82	448781	4876874	SRWP1
T74	Enercon E82	449445	4876318	SRWP1
T75	Enercon E82	449922	4876049	SRWP1
T76	Enercon E82	445351	4876611	SRWP1
T77	Enercon E82	446115	4876547	SRWP1
T78	Enercon E82	445655	4876220	SRWP1
T79	Enercon E82	445247	4875946	SRWP1
T80	Enercon E82	446024	4875749	SRWP1
T81	Enercon E82	446876	4875066	SRWP1
T82	Enercon E82	447286	4875399	SRWP1
T90	Enercon E33	441642	4875574	Privately Owned
T200	Siemens SWT1.903-101	450069	4851493	K2WPP
T201	Siemens SWT2.030-101	450229	4851903	K2WPP
T202	Siemens SWT1.903-101	449443	4852755	K2WPP
T204	Siemens SWT1.903-101	449101	4853160	K2WPP
T205	Siemens SWT1.903-101	449406	4853172	K2WPP
T206	Siemens SWT2.030-101	449199	4853517	K2WPP
T207	Siemens SWT2.300-101	445595	4853991	K2WPP
T208	Siemens SWT1.903-101	449193	4855164	K2WPP
T209	Siemens SWT1.903-101	448796	4855199	K2WPP
T210	Siemens SWT2.030-101	448212	4862930	K2WPP
T211	Siemens SWT1.824-101	448141	4866122	K2WPP
T212	Siemens SWT1.903-101	448318	4855502	K2WPP
T213	Siemens SWT1.903-101	449347	4855577	K2WPP
T214	Siemens SWT1.903-101	447699	4853050	K2WPP
T215	Siemens SWT1.903-101	447982	4855855	K2WPP
T216	Siemens SWT1.903-101	448629	4856016	K2WPP
T217	Siemens SWT1.903-101	448267	4856000	K2WPP

T218	Siemens SWT1.903-101	449596	4856514	K2WPP
T219	Siemens SWT2.300-101	446527	4856681	K2WPP
T221	Siemens SWT1.903-101	449592	4857740	K2WPP
T223	Siemens SWT1.903-101	449643	4858049	K2WPP
T225	Siemens SWT1.903-101	450599	4858895	K2WPP
T226	Siemens SWT2.126-101	450331	4859151	K2WPP
T227	Siemens SWT1.824-101	450035	4859261	K2WPP
T228	Siemens SWT1.903-101	449697	4859327	K2WPP
T229	Siemens SWT2.030-101	448407	4861873	K2WPP
T230	Siemens SWT1.824-101	450822	4860486	K2WPP
T231	Siemens SWT2.030-101	451718	4861031	K2WPP
T232	Siemens SWT1.903-101	452040	4861032	K2WPP
T233	Siemens SWT1.903-101	449009	4861401	K2WPP
T235	Siemens SWT1.903-101	451953	4861469	K2WPP
T236	Siemens SWT1.903-101	449375	4861731	K2WPP
T237	Siemens SWT1.903-101	448697	4861743	K2WPP
T238	Siemens SWT2.221-101	448206	4862179	K2WPP
T239	Siemens SWT1.903-101	449078	4861851	K2WPP
T240	Siemens SWT1.824-101	453690	4866821	K2WPP
T245	Siemens SWT1.903-101	452350	4862765	K2WPP
T246	Siemens SWT1.824-101	452644	4862507	K2WPP
T247	Siemens SWT2.126-101	452896	4862922	K2WPP
T248	Siemens SWT1.824-101	452124	4863008	K2WPP
T249	Siemens SWT2.030-101	452664	4863125	K2WPP
T251	Siemens SWT1.824-101	448106	4863267	K2WPP
T252	Siemens SWT1.824-101	448017	4865555	K2WPP
T253	Siemens SWT1.903-101	453103	4863497	K2WPP
T254	Siemens SWT1.824-101	448390	4863624	K2WPP
T256	Siemens SWT1.903-101	449977	4864166	K2WPP
T257	Siemens SWT1.903-101	444818	4864314	K2WPP
T259	Siemens SWT2.030-101	449882	4864644	K2WPP
T260	Siemens SWT1.903-101	445492	4864730	K2WPP
T261	Siemens SWT1.903-101	454832	4864741	K2WPP
T262	Siemens SWT1.903-101	448826	4864993	K2WPP
T263	Siemens SWT2.126-101	444486	4865005	K2WPP
T264	Siemens SWT1.903-101	444907	4865047	K2WPP
T265	Siemens SWT1.824-101	445555	4865078	K2WPP
T266	Siemens SWT1.903-101	445229	4865118	K2WPP
T267	Siemens SWT1.903-101	450262	4865124	K2WPP
T269	Siemens SWT1.903-101	449207	4865217	K2WPP
T270	Siemens SWT1.903-101	444808	4865389	K2WPP
T271	Siemens SWT1.824-101	448470	4865410	K2WPP
T272	Siemens SWT1.903-101	444346	4865785	K2WPP
T273	Siemens SWT1.903-101	454770	4864340	K2WPP
T274	Siemens SWT1.903-101	454124	4865896	K2WPP
T275	Siemens SWT1.903-101	447782	4865249	K2WPP
T276	Siemens SWT1.824-101	454401	4866273	K2WPP
T277	Siemens SWT1.903-101	453573	4866245	K2WPP
T279	Siemens SWT1.903-101	448361	4866429	K2WPP
T280	Siemens SWT1.903-101	446291	4866337	K2WPP
T281	Siemens SWT1.903-101	451953	4866439	K2WPP
T282	Siemens SWT2.030-101	447748	4866449	K2WPP
T283	Siemens SWT1.903-101	453850	4866500	K2WPP
T284	Siemens SWT1.903-101	451128	4866599	K2WPP
T285	Siemens SWT1.903-101	448089	4866595	K2WPP
T286	Siemens SWT1.903-101	450448	4866861	K2WPP
T288	Siemens SWT1.903-101	446444	4866948	K2WPP
T289	Siemens SWT1.903-101	447281	4866949	K2WPP
T290	Siemens SWT1.903-101	452317	4867020	K2WPP
T291	Siemens SWT1.903-101	447004	4867074	K2WPP

T292	Siemens SWT2.030-101	451357	4866977	K2WPP
T294	Siemens SWT1.903-101	448059	4867123	K2WPP
T295	Siemens SWT1.903-101	444298	4867170	K2WPP
T296	Siemens SWT1.903-101	444632	4867170	K2WPP
T297	Siemens SWT1.903-101	452041	4867227	K2WPP
T298	Siemens SWT1.903-101	450581	4867214	K2WPP
T299	Siemens SWT1.903-101	445047	4867337	K2WPP
T300	Siemens SWT1.824-101	446825	4867373	K2WPP
T301	Siemens SWT2.030-101	455326	4867385	K2WPP
T302	Siemens SWT1.903-101	451091	4867420	K2WPP
T304	Siemens SWT1.903-101	452597	4867447	K2WPP
T305	Siemens SWT1.903-101	454565	4867531	K2WPP
T306	Siemens SWT1.824-101	446543	4867522	K2WPP
T307	Siemens SWT2.030-101	448682	4867545	K2WPP
T308	Siemens SWT1.903-101	448385	4867736	K2WPP
T309	Siemens SWT1.903-101	444574	4867752	K2WPP
T310	Siemens SWT1.903-101	451335	4867817	K2WPP
T311	Siemens SWT1.903-101	448951	4867924	K2WPP
T312	Siemens SWT1.903-101	444424	4868091	K2WPP
T313	Siemens SWT1.903-101	444979	4868333	K2WPP
T314	Siemens SWT2.300-101	445927	4853859	K2WPP
T315	Siemens SWT1.903-101	444856	4868703	K2WPP
T317	Siemens SWT1.903-101	447144	4869137	K2WPP
T318	Siemens SWT1.903-101	446342	4869269	K2WPP
T319	Siemens SWT1.903-101	445951	4869417	K2WPP
T320	Siemens SWT1.903-101	453297	4869343	K2WPP
T321	Siemens SWT1.903-101	453702	4869366	K2WPP
T322	Siemens SWT1.903-101	453004	4869482	K2WPP
T323	Siemens SWT1.903-101	448152	4869619	K2WPP
T324	Siemens SWT2.300-101	452488	4869763	K2WPP
T325	Siemens SWT1.903-101	447844	4869827	K2WPP
T326	Siemens SWT1.903-101	446426	4869875	K2WPP
T327	Siemens SWT1.903-101	446060	4869832	K2WPP
T328	Siemens SWT1.903-101	453691	4869855	K2WPP
T329	Siemens SWT1.903-101	450203	4869995	K2WPP
T330	Siemens SWT1.903-101	453321	4870110	K2WPP
T332	Siemens SWT1.903-101	448132	4870157	K2WPP
T333	Siemens SWT1.903-101	452764	4870250	K2WPP
T334	Siemens SWT2.221-101	444196	4870282	K2WPP
T335	Siemens SWT1.903-101	449579	4870379	K2WPP
T336	Siemens SWT1.824-101	444731	4870544	K2WPP
T337	Siemens SWT1.903-101	450501	4870616	K2WPP
T338	Siemens SWT2.030-101	444414	4870526	K2WPP
T339	Siemens SWT1.903-101	449482	4870800	K2WPP
T340	Siemens SWT2.030-101	449894	4870969	K2WPP
T341	Siemens SWT1.903-101	450254	4871110	K2WPP
T342	Siemens SWT1.903-101	449778	4871359	K2WPP
T343	Siemens SWT1.903-101	450567	4871372	K2WPP
T344	Siemens SWT1.903-101	450219	4871563	K2WPP
T345	Siemens SWT1.903-101	449632	4871787	K2WPP
T346	Siemens SWT1.903-101	450079	4871964	K2WPP
T347	Siemens SWT1.903-101	449169	4872096	K2WPP
T348	Siemens SWT2.126-101	448708	4872653	K2WPP
T349	Siemens SWT1.903-101	443358	4873865	K2WPP
T350	Siemens SWT2.126-101	443674	4873854	K2WPP
T354	Siemens SWT1.903-101	448296	4852955	K2WPP
T355	Siemens SWT1.903-101	448030	4853186	K2WPP
T360	Siemens SWT1.824-101	444603	4863989	K2WPP
T362	Siemens SWT1.824-101	446386	4869573	K2WPP
T373	Siemens SWT1.824-101	447693	4865691	K2WPP

T374	Siemens SWT1.824-101	454008	4869633	K2WPP
T379	Siemens SWT1.824-101	446038	4863431	K2WPP
T380	Siemens SWT2.030-101	444754	4861772	K2WPP

Transformer Stations

Project Name: K2 Wind Power Project
Datum and Projection: NAD83 (Canada); UTM 17N

Identifier	Equipment Make and Model	X(E,m)	Y(N,m)	Remarks
Tr91	Transformer	450057	4860572	K2WPP
Tr92	Transformer	450019	4860502	K2WPP
Tr93	Transformer	449626	4863347	K2WPP

Points of Reception (Receptors)

Table - Point of Reception Locations
Project Name: K2 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)
R5	Receptor	4.5	3	450974	4856517
R9	Receptor	4.5	3	449809	4853732
R10	Receptor	1.5	3	450415	4853522
R11	Receptor	4.5	3	449318	4851015
R12	Receptor	4.5	3	449305	4851127
R13	Receptor	4.5	3	449284	4851093
R14	Receptor	1.5	3	449254	4851106
R15	Receptor	1.5	3	449241	4851068
R16	Receptor	4.5	3	449214	4851075
R17	Receptor	1.5	3	449212	4851132
R18	Receptor	4.5	3	449182	4851140
R19	Receptor	4.5	3	449138	4851170
R20	Receptor	1.5	3	449075	4851162
R21	Receptor	4.5	3	449081	4851221
R22	Receptor	4.5	3	448988	4851203
R23	Receptor	1.5	3	449077	4851317
R24	Receptor	4.5	3	448960	4851228
R25	Receptor	4.5	3	448565	4851513
R27	Receptor	1.5	3	445042	4853466
R28	Receptor	4.5	3	445004	4853635
R29	Receptor	4.5	3	444799	4853528
R30	Receptor	4.5	3	444872	4853694
R31	Receptor	1.5	3	444330	4853871
R32	Receptor	4.5	3	444128	4854007
R35	Receptor	1.5	3	448699	4851328
R36	Receptor	4.5	3	451433	4859336
R37	Receptor	4.5	3	451348	4859240
R39	Receptor	4.5	3	450993	4859674
R40	Receptor	4.5	3	450710	4859802
R41	Receptor	4.5	3	450222	4859872
R42	Receptor	4.5	3	450297	4863102
R43	Receptor	7.5	3	452080	4862143
R47	Receptor	1.5	3	452562	4861875
R48	Receptor	4.5	3	452635	4861826

R49	Receptor	4.5	3	452793	4861696
R50	Receptor	1.5	3	453089	4861384
R51	Receptor	1.5	3	454308	4863782
R52	Receptor	4.5	3	454236	4863919
R53	Receptor	4.5	3	454049	4863971
R54	Receptor	1.5	3	453920	4864034
R55	Receptor	4.5	3	453863	4864060
R56	Receptor	1.5	3	453830	4864086
R57	Receptor	1.5	3	453830	4864073
R58	Receptor	4.5	3	453836	4864189
R59	Receptor	4.5	3	453533	4864199
R60	Receptor	4.5	3	453589	4864359
R61	Receptor	4.5	3	453349	4864456
R62	Receptor	4.5	3	453255	4864388
R63	Receptor	4.5	3	452983	4864476
R64	Receptor	1.5	3	449958	4869464
R65	Receptor	4.5	3	453501	4867815
R66	Receptor	4.5	3	453574	4867406
R85	Receptor	4.5	3	446952	4854888
R108	Receptor	4.5	3	448044	4856756
R109	Receptor	4.5	3	448845	4856779
R113	Receptor	4.5	3	448882	4857139
R120	Receptor	4.5	3	449081	4857497
R122	Receptor	4.5	3	448528	4857656
R123	Receptor	4.5	3	448778	4857658
R124	Receptor	4.5	3	448562	4857809
R171	Receptor	1.5	3	443597	4860872
R178	Receptor	4.5	3	443641	4861532
R189	Receptor	1.5	3	443775	4862192
R190	Receptor	4.5	3	443780	4862280
R197	Receptor	1.5	3	443937	4862735
R200	Receptor	4.5	3	443887	4863040
R270	Receptor	4.5	3	443559	4867095
R282	Receptor	4.5	3	453251	4867514
R291	Receptor	4.5	3	453143	4867845
R297	Receptor	4.5	3	443462	4868253
R308	Receptor	4.5	3	445636	4868818
R311	Receptor	1.5	3	443746	4868974
R314	Receptor	1.5	3	445350	4869092
R317	Receptor	4.5	3	450115	4869218
R320	Receptor	1.5	3	443344	4869392
R322	Receptor	1.5	3	449932	4869489
R323	Receptor	1.5	3	444796	4869571
R324	Receptor	4.5	3	444863	4869697
R326	Receptor	4.5	3	449676	4869753
R329	Receptor	4.5	3	445047	4870034
R330	Receptor	4.5	3	443438	4870126
R339	Receptor	4.5	3	447918	4870727
R344	Receptor	4.5	3	443265	4871116
R345	Receptor	1.5	3	447466	4871156
R354	Receptor	4.5	3	445806	4871574
R373	Receptor	4.5	3	443135	4872580
R378	Receptor	4.5	3	444562	4872799
R381	Receptor	4.5	3	444381	4872868
R391	Receptor	4.5	3	448636	4870826
R509	Receptor	4.5	3	445385	4869073
R515	Receptor	4.5	3	443618	4870667
R516	Receptor	4.5	3	445450	4870751
R518	Receptor	4.5	3	445441	4870860
R520	Receptor	1.5	3	447916	4871424

R523	Receptor	1.5	3	447888	4871627
R529	Receptor	4.5	3	448077	4871955
R538	Receptor	7.5	3	444221	4872749
R540	Receptor	4.5	3	443696	4873143
R541	Receptor	1.5	3	443572	4873178
R543	Receptor	4.5	3	443447	4873307
R548	Receptor	4.5	3	448118	4873663
R549	Receptor	1.5	3	444968	4873723
R561	Receptor	1.5	3	443072	4874488
R564	Receptor	1.5	3	442895	4874656
R565	Receptor	4.5	3	443439	4874666
R605	Receptor	4.5	3	445173	4856417
R606	Receptor	4.5	3	445110	4855144
R607	Receptor	4.5	3	445063	4855157
R608	Receptor	4.5	3	445055	4854998
R609	Receptor	1.5	3	445696	4856135
R610	Receptor	1.5	3	445784	4856243
R611	Receptor	4.5	3	445882	4856171
R612	Receptor	1.5	3	446050	4856096
R613	Receptor	4.5	3	446093	4856010
R615	Receptor	1.5	3	446653	4855765
R616	Receptor	4.5	3	447432	4855205
R619	Receptor	4.5	3	447852	4856476
R621	Receptor	4.5	3	448594	4856983
R639	Receptor	7.5	3	445023	4862536
R640	Receptor	4.5	3	444782	4863399
R654	Receptor	4.5	3	448167	4873497
R655	Receptor	7.5	3	448539	4873355
R656	Receptor	4.5	3	448757	4873572
R657	Receptor	4.5	3	449261	4872856
R660	Receptor	4.5	3	449792	4872832
R661	Receptor	4.5	3	449740	4873031
R662	Receptor	4.5	3	449591	4872493
R663	Receptor	4.5	3	450565	4872329
R664	Receptor	7.5	3	451046	4871967
R665	Receptor	4.5	3	451444	4871679
R666	Receptor	4.5	3	452110	4871302
R667	Receptor	1.5	3	452454	4871236
R668	Receptor	4.5	3	452493	4871050
R669	Receptor	4.5	3	451984	4871235
R670	Receptor	4.5	3	451539	4870636
R671	Receptor	4.5	3	451375	4869847
R672	Receptor	4.5	3	450843	4869255
R673	Receptor	4.5	3	450339	4868291
R675	Receptor	4.5	3	449662	4867085
R676	Receptor	4.5	3	449201	4866095
R679	Receptor	4.5	3	448217	4860549
R680	Receptor	4.5	3	448153	4860651
R681	Receptor	4.5	3	447771	4861276
R682	Receptor	1.5	3	446909	4861761
R683	Receptor	4.5	3	449068	4860691
R684	Receptor	1.5	3	449047	4860549
R686	Receptor	4.5	3	449296	4862501
R687	Receptor	4.5	3	450729	4864776
R688	Receptor	1.5	3	451033	4865768
R691	Receptor	4.5	3	452177	4867946
R693	Receptor	1.5	3	447972	4871755
R694	Receptor	1.5	3	447948	4871669
R695	Receptor	1.5	3	447803	4871225
R696	Receptor	1.5	3	447260	4870218

R697	Receptor	4.5	3	446096	4868091
R698	Receptor	4.5	3	445786	4867733
R699	Receptor	4.5	3	445779	4867708
R700	Receptor	4.5	3	445751	4867420
R701	Receptor	4.5	3	445289	4866810
R705	Receptor	1.5	3	443973	4864401
R706	Receptor	4.5	3	444010	4864388
R707	Receptor	4.5	3	443944	4864375
R708	Receptor	1.5	3	443979	4864330
R709	Receptor	4.5	3	443881	4864263
R712	Receptor	4.5	3	448315	4868329
R713	Receptor	4.5	3	448332	4868346
R716	Receptor	4.5	3	448767	4869316
R717	Receptor	4.5	3	452659	4868045
R719	Receptor	4.5	3	451566	4868721
R720	Receptor	4.5	3	451335	4868401
R721	Receptor	4.5	3	451131	4868910
R722	Receptor	4.5	3	450445	4869178
R723	Receptor	4.5	3	450474	4869389
R724	Receptor	4.5	3	449134	4869951
R725	Receptor	1.5	3	448969	4870257
R727	Receptor	4.5	3	447049	4868185
R733	Receptor	4.5	3	449005	4866829
R734	Receptor	4.5	3	449701	4866596
R735	Receptor	4.5	3	450299	4866021
R736	Receptor	4.5	3	450999	4865780
R737	Receptor	4.5	3	451274	4865555
R738	Receptor	4.5	3	451436	4865628
R739	Receptor	4.5	3	451670	4865464
R740	Receptor	1.5	3	451706	4865270
R741	Receptor	4.5	3	450481	4862640
R742	Receptor	4.5	3	450544	4863189
R743	Receptor	1.5	3	450306	4862985
R744	Receptor	4.5	3	450127	4863363
R747	Receptor	4.5	3	449309	4863833
R748	Receptor	4.5	3	449252	4863823
R749	Receptor	4.5	3	448323	4864358
R750	Receptor	4.5	3	447902	4864356
R752	Receptor	1.5	3	446887	4865035
R753	Receptor	4.5	3	446781	4864987
R754	Receptor	4.5	3	444282	4868680
R755	Receptor	4.5	3	443815	4867627
R756	Receptor	1.5	3	443631	4867710
R757	Receptor	4.5	3	443478	4867844
R758	Receptor	4.5	3	443608	4867638
R759	Receptor	4.5	3	443495	4867590
R760	Receptor	1.5	3	443558	4867507
R761	Receptor	4.5	3	443561	4867340
R762	Receptor	4.5	3	443389	4866477
R763	Receptor	4.5	3	443730	4866354
R764	Receptor	4.5	3	443730	4866291
R765	Receptor	4.5	3	443767	4866241
R766	Receptor	4.5	3	443674	4866060
R767	Receptor	4.5	3	443690	4865706
R768	Receptor	4.5	3	443766	4864914
R770	Receptor	4.5	3	443868	4864437
R771	Receptor	4.5	3	443870	4864404
R773	Receptor	1.5	3	443832	4864245
R774	Receptor	4.5	3	443813	4864207
R775	Receptor	4.5	3	443821	4864029

R776	Receptor	1.5	3	443953	4863695
R777	Receptor	4.5	3	443943	4863639
R778	Receptor	4.5	3	443949	4863543
R779	Receptor	1.5	3	443912	4863319
R780	Receptor	4.5	3	443952	4863322
R781	Receptor	7.5	3	443768	4861974
R782	Receptor	4.5	3	443870	4861872
R783	Receptor	4.5	3	443859	4861531
R784	Receptor	4.5	3	443745	4861165
R785	Receptor	4.5	3	443659	4861156
R813	Receptor	1.5	3	449867	4859949
R814	Receptor	4.5	3	449570	4860256
R815	Receptor	4.5	3	449273	4860427
R817	Receptor	4.5	3	450489	4861141
R818	Receptor	1.5	3	450739	4861547
R819	Receptor	4.5	3	451006	4861667
R820	Receptor	4.5	3	451106	4862013
R821	Receptor	4.5	3	451066	4862725
R822	Receptor	4.5	3	451334	4862487
R823	Receptor	4.5	3	451582	4863259
R824	Receptor	4.5	3	452047	4863911
R825	Receptor	4.5	3	452148	4863876
R827	Receptor	4.5	3	452232	4865108
R828	Receptor	4.5	3	451869	4865022
R839	Receptor	1.5	3	448939	4851235
R840	Receptor	4.5	3	449018	4851193
R841	Receptor	4.5	3	449099	4851144
R842	Receptor	4.5	3	449110	4851076
R843	Receptor	4.5	3	448836	4851271
R844	Receptor	4.5	3	448793	4851290
R846	Receptor	1.5	3	448587	4851321
R847	Receptor	4.5	3	448613	4851424
R855	Receptor	4.5	3	446160	4852399
R856	Receptor	1.5	3	445407	4853332
R857	Receptor	4.5	3	445420	4853259
R858	Receptor	4.5	3	445770	4853158
R859	Receptor	4.5	3	446090	4852964
R860	Receptor	4.5	3	446371	4852845
R861	Receptor	4.5	3	446646	4852803
R862	Receptor	4.5	3	446971	4852530
R863	Receptor	4.5	3	447179	4852377
R864	Receptor	4.5	3	447726	4851996
R865	Receptor	4.5	3	448293	4851818
R867	Receptor	4.5	3	448662	4854223
R868	Receptor	4.5	3	449077	4854386
R869	Receptor	4.5	3	449221	4854322
R870	Receptor	1.5	3	448743	4854584
R872	Receptor	4.5	3	448561	4854526
R873	Receptor	4.5	3	448295	4854829
R874	Receptor	4.5	3	448063	4854604
R876	Receptor	4.5	3	447938	4854911
R877	Receptor	4.5	3	446811	4854599
R878	Receptor	4.5	3	446891	4854440
R880	Receptor	4.5	3	449696	4857155
R881	Receptor	4.5	3	449304	4857147
R882	Receptor	4.5	3	450165	4860028
R883	Receptor	4.5	3	453026	4864730
R884	Receptor	4.5	3	452751	4864704
R885	Receptor	4.5	3	453054	4865740
R900	Receptor	4.5	3	453931	4867363

R902	Receptor	4.5	3	454441	4866854
R904	Receptor	4.5	3	454713	4866913
R906	Receptor	4.5	3	455297	4866554
R907	Receptor	4.5	3	455475	4866515
R915	Receptor	4.5	3	455388	4869741
R916	Receptor	4.5	3	455055	4869638
R917	Receptor	4.5	3	454684	4870016
R918	Receptor	4.5	3	454376	4870042
R919	Receptor	4.5	3	454315	4870217
R920	Receptor	4.5	3	454136	4870360
R921	Receptor	4.5	3	453465	4870738
R922	Receptor	1.5	3	452689	4871120
R923	Receptor	1.5	3	450222	4872561
R924	Receptor	4.5	3	447828	4873798
R964	Receptor	4.5	3	451696	4872292
R970	Receptor	4.5	3	443677	4875191
R971	Receptor	1.5	3	443413	4874673
R975	Receptor	1.5	3	443983	4864420
R976	Receptor	4.5	3	448300	4868460
R977	Receptor	4.5	3	448397	4868407
R980	Receptor	4.5	3	444599	4854252
R981	Receptor	1.5	3	445799	4856291
R982	Receptor	1.5	3	446607	4857688
R983	Receptor	1.5	3	446461	4857727
R984	Receptor	4.5	3	454452	4868095
R985	Receptor	4.5	3	448784	4857113
R986	Receptor	4.5	3	448827	4857064
R988	Receptor	1.5	3	450036	4856020
R989	Receptor	1.5	3	450412	4856391
R990	Receptor	4.5	3	450955	4858167
R991	Receptor	4.5	3	451789	4859101
R992	Receptor	1.5	3	452075	4859967
R993	Receptor	4.5	3	452111	4859983
R994	Receptor	1.5	3	452163	4859959
R995	Receptor	1.5	3	452296	4860366
R996	Receptor	1.5	3	452318	4860403
R997	Receptor	1.5	3	452504	4860617
R998	Receptor	4.5	3	452673	4861005
R999	Receptor	4.5	3	452739	4861311
R1001	Receptor	1.5	3	450115	4867754
R1002	Receptor	4.5	3	449013	4865984
R1004	Receptor	4.5	3	448492	4856611
R1020	Receptor	4.5	3	453171	4861579
R1021	Receptor	4.5	3	454261	4864096
R1024	Receptor	4.5	3	455060	4865479
R1025	Receptor	4.5	3	455202	4865432
R1026	Receptor	1.5	3	455230	4865776
R1027	Receptor	4.5	3	455251	4865807
R1028	Receptor	4.5	3	455520	4866039
R1029	Receptor	4.5	3	455592	4866270
R1030	Receptor	1.5	3	455605	4866265
R1031	Receptor	4.5	3	456139	4867402
R1032	Receptor	1.5	3	456270	4867790
R1033	Receptor	1.5	3	456272	4867825
R1034	Receptor	4.5	3	456508	4867885
R1078	Receptor	4.5	3	450482	4853736
R1079	Receptor	4.5	3	450606	4853617
R1080	Receptor	4.5	3	450288	4853319
R1081	Receptor	1.5	3	450280	4853068
R1082	Receptor	4.5	3	450015	4852619

R1084	Receptor	4.5	3	449645	4852225
R1085	Receptor	4.5	3	449532	4851770
R1086	Receptor	4.5	3	449353	4851379
R1087	Receptor	4.5	3	449123	4851217
R1088	Receptor	1.5	3	449169	4851208
R1089	Receptor	1.5	3	449133	4851251
R1090	Receptor	1.5	3	449213	4851239
R1092	Receptor	1.5	3	449161	4851302
R1093	Receptor	1.5	3	449223	4851264
R1094	Receptor	1.5	3	449227	4851299
R1095	Receptor	1.5	3	449254	4851324
R1096	Receptor	4.5	3	449262	4851355
R1102	Receptor	4.5	3	443883	4864871
R1103	Receptor	4.5	3	443565	4867410
R1104	Receptor	4.5	3	443558	4867439
R1105	Receptor	4.5	3	443558	4867463
R1106	Receptor	4.5	3	442790	4873892
R1107	Receptor	4.5	3	442941	4874263
R1113	Receptor	4.5	3	448218	4872241
R1114	Receptor	4.5	3	447814	4871568
R1116	Receptor	4.5	3	449070	4851105
R1117	Receptor	4.5	3	447286	4855257
R1180	Receptor	7.5	3	449414	4850621
R1193	Receptor	4.5	3	454654	4863230
R1194	Receptor	4.5	3	453535	4861099
R1259	Receptor	1.5	3	453326	4861253
R1260	Receptor	4.5	3	453050	4861166
R1261	Receptor	1.5	3	453076	4861224
R1262	Receptor	4.5	3	453133	4861300
R1263	Receptor	4.5	3	453174	4861328
R1264	Receptor	4.5	3	455288	4863383
R1265	Receptor	4.5	3	455229	4863266
R1266	Receptor	4.5	3	454892	4863598
R1267	Receptor	4.5	3	454662	4863703
R1268	Receptor	1.5	3	454528	4863652
R1297	Receptor	4.5	3	450458	4850327
R1298	Receptor	7.5	3	450567	4850469
R1299	Receptor	4.5	3	449993	4850428
R1300	Receptor	4.5	3	450341	4850566
R1301	Receptor	4.5	3	450148	4850822
R1302	Receptor	4.5	3	449643	4850906
R1303	Receptor	1.5	3	449187	4850845
R1304	Receptor	4.5	3	449344	4850941
R1305	Receptor	1.5	3	449525	4850960
R1306	Receptor	4.5	3	449400	4850959
R1307	Receptor	4.5	3	451463	4851624
R1316	Receptor	4.5	3	451165	4853012
R1414	Receptor	4.5	3	449251	4851231
R1415	Receptor	1.5	3	449275	4851201
R2449	Receptor	4.5	3	446107	4865288

Vacant Lot Surrogate Receptors

Table - Vacant Lot Surrogate Receptor Locations

Project Name: K2 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)
V1436	VLSR	4.5	3	447985	4873855
V1437	VLSR	4.5	3	448998	4873236
V1438	VLSR	4.5	3	449414	4872978
V1440	VLSR	4.5	3	449790	4872928
V1441	VLSR	4.5	3	450720	4872269
V1442	VLSR	4.5	3	451075	4872061
V1446	VLSR	4.5	3	451785	4871659
V1447	VLSR	4.5	3	452310	4871361
V1451	VLSR	4.5	3	452724	4871090
V1452	VLSR	4.5	3	453820	4870483
V1453	VLSR	4.5	3	454158	4870283
V1459	VLSR	4.5	3	456085	4867312
V1460	VLSR	4.5	3	456189	4867263
V1461	VLSR	4.5	3	456103	4867116
V1462	VLSR	4.5	3	455857	4866695
V1464	VLSR	4.5	3	455308	4869506
V1465	VLSR	4.5	3	455005	4868919
V1466	VLSR	4.5	3	454835	4868626
V1467	VLSR	4.5	3	454665	4868332
V1468	VLSR	4.5	3	454636	4868446
V1469	VLSR	4.5	3	453259	4867698
V1470	VLSR	4.5	3	454518	4869979
V1471	VLSR	4.5	3	454482	4870011
V1472	VLSR	4.5	3	452587	4868061
V1473	VLSR	4.5	3	452126	4868364
V1475	VLSR	4.5	3	452744	4868881
V1476	VLSR	4.5	3	452653	4871032
V1477	VLSR	4.5	3	449738	4869688
V1479	VLSR	4.5	3	447841	4871444
V1480	VLSR	4.5	3	447805	4871755
V1481	VLSR	4.5	3	449383	4872925
V1483	VLSR	4.5	3	447800	4873830
V1488	VLSR	4.5	3	445015	4873684
V1489	VLSR	4.5	3	444996	4873983
V1492	VLSR	4.5	3	443394	4873268
V1494	VLSR	4.5	3	442715	4873703
V1495	VLSR	4.5	3	442783	4873628
V1496	VLSR	4.5	3	443003	4873259
V1497	VLSR	4.5	3	442985	4873367
V1498	VLSR	4.5	3	443080	4873367
V1502	VLSR	4.5	3	443129	4870795
V1503	VLSR	4.5	3	443217	4870646
V1505	VLSR	4.5	3	443274	4870274
V1506	VLSR	4.5	3	443314	4870529
V1507	VLSR	4.5	3	443366	4870155
V1509	VLSR	4.5	3	444374	4872643
V1511	VLSR	4.5	3	443868	4871758
V1512	VLSR	4.5	3	445217	4870211

V1513	VLSR	4.5	3	446788	4871259
V1514	VLSR	4.5	3	447062	4871112
V1515	VLSR	4.5	3	447166	4870256
V1516	VLSR	4.5	3	447587	4870814
V1517	VLSR	4.5	3	447119	4869920
V1518	VLSR	4.5	3	446333	4868514
V1519	VLSR	4.5	3	445856	4868776
V1520	VLSR	4.5	3	447318	4867970
V1521	VLSR	4.5	3	448491	4868836
V1522	VLSR	4.5	3	449835	4869537
V1523	VLSR	4.5	3	450039	4869404
V1524	VLSR	4.5	3	449157	4866907
V1525	VLSR	4.5	3	450408	4868245
V1526	VLSR	4.5	3	449828	4866456
V1527	VLSR	4.5	3	450503	4866101
V1528	VLSR	4.5	3	452060	4868254
V1529	VLSR	4.5	3	450952	4865816
V1530	VLSR	4.5	3	453150	4867644
V1531	VLSR	4.5	3	452090	4865183
V1532	VLSR	4.5	3	452961	4865488
V1533	VLSR	4.5	3	452601	4864899
V1534	VLSR	4.5	3	454811	4866681
V1536	VLSR	4.5	3	455449	4866358
V1537	VLSR	4.5	3	455152	4863434
V1547	VLSR	4.5	3	455138	4863356
V1549	VLSR	4.5	3	453214	4861413
V1550	VLSR	4.5	3	453455	4862342
V1551	VLSR	4.5	3	453485	4862436
V1552	VLSR	4.5	3	453939	4863233
V1556	VLSR	4.5	3	452121	4864035
V1557	VLSR	4.5	3	450455	4864443
V1558	VLSR	4.5	3	450503	4865961
V1559	VLSR	4.5	3	450129	4866101
V1560	VLSR	4.5	3	449466	4866572
V1561	VLSR	4.5	3	446991	4864979
V1562	VLSR	4.5	3	445189	4866457
V1563	VLSR	4.5	3	445945	4867809
V1564	VLSR	4.5	3	446168	4868486
V1566	VLSR	4.5	3	443688	4866886
V1567	VLSR	4.5	3	443693	4867629
V1568	VLSR	4.5	3	444568	4869409
V1569	VLSR	4.5	3	443598	4867828
V1570	VLSR	4.5	3	443404	4870043
V1571	VLSR	4.5	3	443290	4870071
V1572	VLSR	4.5	3	443324	4869839
V1573	VLSR	4.5	3	443361	4869680
V1575	VLSR	4.5	3	443373	4869215
V1578	VLSR	4.5	3	443411	4868742
V1579	VLSR	4.5	3	443430	4868538
V1582	VLSR	4.5	3	443518	4867848
V1583	VLSR	4.5	3	443529	4867652
V1586	VLSR	4.5	3	443553	4867340
V1587	VLSR	4.5	3	443567	4867250
V1589	VLSR	4.5	3	443608	4866743
V1590	VLSR	4.5	3	443693	4866733
V1591	VLSR	4.5	3	443731	4866198
V1592	VLSR	4.5	3	443679	4865900
V1598	VLSR	4.5	3	443778	4864712
V1599	VLSR	4.5	3	443797	4864385
V1601	VLSR	4.5	3	443234	4864381

V1604	VLSR	4.5	3	443811	4864311
V1605	VLSR	4.5	3	443823	4864242
V1606	VLSR	4.5	3	443818	4864193
V1607	VLSR	4.5	3	443823	4865080
V1608	VLSR	4.5	3	443977	4864469
V1609	VLSR	4.5	3	443877	4864361
V1610	VLSR	4.5	3	443880	4864304
V1611	VLSR	4.5	3	443877	4864263
V1612	VLSR	4.5	3	443941	4863783
V1613	VLSR	4.5	3	445162	4862879
V1614	VLSR	4.5	3	446979	4864853
V1615	VLSR	4.5	3	447093	4864777
V1616	VLSR	4.5	3	445290	4862808
V1617	VLSR	4.5	3	446771	4861971
V1618	VLSR	4.5	3	449327	4862752
V1619	VLSR	4.5	3	449409	4862728
V1620	VLSR	4.5	3	448118	4861160
V1621	VLSR	4.5	3	449790	4863266
V1622	VLSR	4.5	3	451220	4862449
V1623	VLSR	4.5	3	450185	4859982
V1624	VLSR	4.5	3	452630	4861119
V1625	VLSR	4.5	3	452190	4860343
V1626	VLSR	4.5	3	451645	4859179
V1627	VLSR	4.5	3	452857	4861327
V1628	VLSR	4.5	3	452256	4860304
V1629	VLSR	4.5	3	452204	4860226
V1630	VLSR	4.5	3	452348	4860252
V1631	VLSR	4.5	3	452303	4860171
V1632	VLSR	4.5	3	452275	4860136
V1633	VLSR	4.5	3	452249	4860107
V1634	VLSR	4.5	3	452228	4860060
V1635	VLSR	4.5	3	452216	4860020
V1636	VLSR	4.5	3	452187	4859982
V1637	VLSR	4.5	3	452448	4860209
V1638	VLSR	4.5	3	452403	4860228
V1639	VLSR	4.5	3	452374	4860188
V1640	VLSR	4.5	3	452360	4860143
V1641	VLSR	4.5	3	452327	4860100
V1644	VLSR	4.5	3	451922	4858914
V1645	VLSR	4.5	3	451766	4859004
V1646	VLSR	4.5	3	450971	4857977
V1648	VLSR	4.5	3	451033	4856385
V1650	VLSR	4.5	3	450905	4856421
V1651	VLSR	4.5	3	450888	4856446
V1652	VLSR	4.5	3	450848	4856464
V1653	VLSR	4.5	3	450704	4856568
V1654	VLSR	4.5	3	451010	4856353
V1655	VLSR	4.5	3	450924	4857926
V1656	VLSR	4.5	3	450235	4856825
V1657	VLSR	4.5	3	449956	4856975
V1662	VLSR	4.5	3	447694	4861244
V1665	VLSR	4.5	3	444656	4863024
V1666	VLSR	4.5	3	443913	4862555
V1667	VLSR	4.5	3	443870	4863459
V1669	VLSR	4.5	3	443856	4862910
V1670	VLSR	4.5	3	443813	4862465
V1672	VLSR	4.5	3	443643	4861268
V1673	VLSR	4.5	3	443605	4860960
V2009	VLSR	4.5	3	446337	4857511
V2012	VLSR	4.5	3	446398	4857386

V2013	VLSR	4.5	3	445763	4856285
V2014	VLSR	4.5	3	448115	4856915
V2015	VLSR	4.5	3	448664	4857617
V2016	VLSR	4.5	3	446837	4855662
V2017	VLSR	4.5	3	446983	4855567
V2018	VLSR	4.5	3	447381	4855350
V2019	VLSR	4.5	3	448834	4857192
V2020	VLSR	4.5	3	448858	4857227
V2021	VLSR	4.5	3	448867	4857260
V2022	VLSR	4.5	3	448891	4857282
V2023	VLSR	4.5	3	448895	4857305
V2024	VLSR	4.5	3	448912	4857322
V2025	VLSR	4.5	3	448930	4857337
V2026	VLSR	4.5	3	448940	4857379
V2027	VLSR	4.5	3	448957	4857395
V2028	VLSR	4.5	3	448964	4857419
V2029	VLSR	4.5	3	448988	4857447
V2030	VLSR	4.5	3	448995	4857468
V2031	VLSR	4.5	3	448141	4856705
V2032	VLSR	4.5	3	448271	4854921
V2033	VLSR	4.5	3	449754	4855974
V2034	VLSR	4.5	3	450199	4856762
V2035	VLSR	4.5	3	450235	4856411
V2036	VLSR	4.5	3	450478	4856352
V2037	VLSR	4.5	3	450968	4856309
V2038	VLSR	4.5	3	451044	4856272
V2041	VLSR	4.5	3	449461	4854137
V2044	VLSR	4.5	3	451415	4851343
V2046	VLSR	4.5	3	448908	4854383
V2047	VLSR	4.5	3	449163	4854211
V2048	VLSR	4.5	3	448413	4853662
V2049	VLSR	4.5	3	448792	4854211
V2051	VLSR	4.5	3	448060	4851830
V2052	VLSR	4.5	3	446976	4854679
V2053	VLSR	4.5	3	446650	4854078
V2054	VLSR	4.5	3	446702	4855631
V2056	VLSR	4.5	3	444676	4853766
V2057	VLSR	4.5	3	444894	4854722
V2058	VLSR	4.5	3	444832	4854761
V2059	VLSR	4.5	3	444350	4853993
V2234	VLSR	4.5	3	445192	4853360
V2236	VLSR	4.5	3	453201	4870654
V2237	VLSR	4.5	3	445850	4852967
V2238	VLSR	4.5	3	448194	4861142
V2240	VLSR	4.5	3	448942	4863716
V2357	VLSR	4.5	3	444167	4853911
V2389	VLSR	4.5	3	448636	4851320
V2391	VLSR	4.5	3	449039	4851170
V2392	VLSR	4.5	3	449169	4851092
V2393	VLSR	4.5	3	449287	4851028
V2394	VLSR	4.5	3	449332	4850909
V2395	VLSR	4.5	3	449223	4851160
V2396	VLSR	4.5	3	449180	4851229
V2414	VLSR	4.5	3	450638	4850224
V2422	VLSR	4.5	3	445462	4865834
V2424	VLSR	4.5	3	453151	4861373
V2425	VLSR	4.5	3	453191	4861289
V2428	VLSR	4.5	3	443987	4863395
V2429	VLSR	4.5	3	452873	4868859
V2430	VLSR	4.5	3	448743	4870342

V2431	VLSR	4.5	3	445514	4865808
V2433	VLSR	4.5	3	445766	4864103
V2434	VLSR	4.5	3	448768	4857814
V2445	VLSR	4.5	3	444116	4869717
V2447	VLSR	4.5	3	443308	4874570
V2448	VLSR	4.5	3	447927	4851877
V2450	VLSR	4.5	3	455239	4866389
V2455	VLSR	4.5	3	450083	4852928
V2476	VLSR	4.5	3	452594	4861850
V2477	VLSR	4.5	3	453224	4862184
V2478	VLSR	4.5	3	445682	4856327
V2479	VLSR	4.5	3	453976	4863998
V2485	VLSR	4.5	3	443622	4870286
V2487	VLSR	4.5	3	451864	4868493
V2488	VLSR	4.5	3	447972	4871480
V2496	VLSR	4.5	3	445740	4856176
V2504	VLSR	4.5	3	443038	4872763
V2505	VLSR	4.5	3	443070	4872413
V2537	VLSR	4.5	3	450536	4853455
V2548	VLSR	4.5	3	455557	4866292

Participating Receptors (Participants)

Table - Participating Receptor Locations

Project Name: K2 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)
P7	Receptor	4.5	3	449606	4853977
P8	Receptor	1.5	3	449638	4853970
P38	Receptor	4.5	3	450906	4859511
P44	Receptor	4.5	3	452193	4861695
P45	Receptor	4.5	3	452447	4862154
P46	Receptor	1.5	3	452406	4862157
P67	Receptor	4.5	3	453767	4867280
P316	Receptor	4.5	3	444930	4869212
P325	Receptor	1.5	3	450093	4869668
P331	Receptor	4.5	3	454180	4870123
P340	Receptor	4.5	3	452974	4870734
P367	Receptor	4.5	3	448483	4872303
P507	Receptor	4.5	3	445608	4868917
P614	Receptor	4.5	3	446203	4856197
P618	Receptor	4.5	3	447752	4856041
P641	Receptor	4.5	3	444243	4863555
P650	Receptor	1.5	3	446163	4862181
P651	Receptor	4.5	3	446127	4862323
P652	Receptor	1.5	3	445465	4865670
P653	Receptor	4.5	3	445315	4865759
P658	Receptor	1.5	3	449504	4872785
P659	Receptor	4.5	3	449544	4872774
P677	Receptor	4.5	3	447290	4862827
P678	Receptor	4.5	3	446887	4861966
P685	Receptor	4.5	3	448634	4861317
P689	Receptor	1.5	3	451471	4866598

P690	Receptor	4.5	3	451555	4866540
P702	Receptor	4.5	3	444719	4865833
P703	Receptor	1.5	3	444661	4865697
P704	Receptor	4.5	3	444145	4864600
P710	Receptor	4.5	3	446756	4866346
P711	Receptor	4.5	3	447430	4866606
P718	Receptor	4.5	3	451676	4868371
P729	Receptor	4.5	3	447394	4867730
P730	Receptor	4.5	3	448000	4867423
P731	Receptor	4.5	3	448722	4867010
P732	Receptor	4.5	3	448805	4867079
P746	Receptor	4.5	3	449171	4863557
P751	Receptor	1.5	3	447541	4864665
P816	Receptor	4.5	3	449984	4860186
P866	Receptor	1.5	3	447713	4852450
P871	Receptor	1.5	3	448619	4854619
P875	Receptor	4.5	3	448031	4854972
P886	Receptor	4.5	3	449751	4856987
P901	Receptor	4.5	3	454122	4867047
P903	Receptor	4.5	3	454575	4866668
P905	Receptor	1.5	3	455030	4866856
P1022	Receptor	4.5	3	454451	4864008
P1023	Receptor	4.5	3	454433	4864047
P1083	Receptor	1.5	3	449829	4852527

13 APPENDIX B — ADDITIONAL DOCUMENTATION

13.1 Siemens A/G

13.1.1 Siemens SWT-2.3-101 Turbine

There are several specification documents for the Siemens SWT-2.3-101 turbine and its noise- and power-reduced variants on the following pages. These include the following.

- A letter from Siemens Energy Inc. stating the rated power and maximum broadband source sound power level for the 6 variants of the Siemens SWT-2.3-101 turbine that will be used in the K2WPP.
- Wind-speed-dependent broadband and octave band source sound power level specifications for the Siemens SWT-2.3-101 turbine and its five additional noise- and power-reduced variants. The specifications are compliant with IEC 61400-11 and therefore CAN/CSA 61400-11-07.

SIEMENS

December 17, 2012

To Whom It May Concern

Re. Kingsbridge II (K2) Wind Project

Dear Sir/Madam,

In respect of the K2 Wind Project, Siemens will be providing SWT 2.3-101 wind turbine generators and those that have been de-rated to the following nameplates: SWT 2.221-101, SWT 2.126-101, SWT 2.030-101, SWT 1.903-101 and SWT 1.824-101. Siemens guarantees the values shown in the table below are the maximum power levels and maximum broadband sound power levels respectively.

Official Nameplate	Maximum Rated Power	Maximum Broadband Sound Power Level
SWT 2.300-101	2.300 MW	106 dBA
SWT 2.221-101	2.221 MW	105 dBA
SWT 2.126-101	2.126 MW	104 dBA
SWT 2.030-101	2.030 MW	103 dBA
SWT 1.903-101	1.903 MW	102 dBA
SWT 1.824-101	1.824 MW	101 dBA

Siemens confirms the attached acoustic emissions data sheets correspond to each of the nameplate wind turbines listed above. 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 99.5m.

Regards,

John D. Amos
Head of Engineering
Siemens Energy, Inc.
Wind Power Americas

Enclosures (6)

Siemens Energy, Inc.

4400 Alafaya Trail
Orlando, FL 32826

SIEMENS

Contract Acoustic Emission, SWT-2.3-101, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-0000-775-00
HST, JES / 2012.12.19
Strictly Confidential

SWT-2.3-101, Rev. 4, Max. Power 2300 kW
Contract Acoustic Emission, Hub Height 99.5m
Kingsbridge II - 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]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.7	100.6	105.1	106.0	106.0	106.0	106.0	106.0	106.0

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	86.7	86.2	85.0	83.8	83.2
125	90.8	91.7	91.5	89.5	89.3
250	95.5	96.5	96.1	94.3	93.9
500	97.9	98.6	98.4	98.1	97.6
1000	100.9	101.6	101.7	101.9	101.8
2000	98.3	99.6	99.8	100.3	100.7
4000	92.8	94.2	94.4	95.0	95.3
8000	78.9	80.4	80.8	81.4	82.0

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

Measurement Uncertainty
A margin corresponding to +1.5dB(A) is applicable.

Tonal Audibility
The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002.

Siemens Wind Power A/S

p 1/1
SWT-2.3-101 99.5 m Acoustic Emission std ver
T20110701

SIEMENS

Contract Acoustic Emission, SWT-2.3-101, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-0000-776-00
HST, JES / 2012.12.19
Strictly Confidential

SWT-2.3-101, Rev. 4, Max. Power 2221 kW
Contract Acoustic Emission, Hub Height 99.5m
Kingsbridge II - 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]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.7	100.5	104.2	105.0	105.0	105.0	105.0	105.0	105.0

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	86.3	86.0	84.8	84.9	84.5
125	90.3	91.6	91.1	90.5	89.6
250	96.5	97.5	96.4	95.7	94.9
500	97.7	98.3	97.2	97.0	96.6
1000	99.2	99.9	100.1	100.0	100.2
2000	96.5	97.2	98.9	99.0	99.4
4000	92.2	93.5	93.6	95.4	95.5
8000	77.1	77.9	80.8	80.7	80.5

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

Measurement Uncertainty
A margin corresponding to +1.5dB(A) is applicable.

Tonal Audibility
The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002.

Siemens Wind Power A/S

p 1/1
SWT-2.3-101 99.5 m Acoustic Emission std ver
T20110701

Zephyr North

SIEMENS

Contract Acoustic Emission, SWT-2.3-101, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-0000-777-00
HST, JES / 2012.12.19
Strictly Confidential

SWT-2.3-101, Rev. 4, Max. Power 2126 kW
Contract Acoustic Emission, Hub Height 99.5m
Kingsbridge II - 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]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.7	100.3	103.3	104.0	104.0	104.0	104.0	104.0	104.0

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	86.0	85.6	84.6	84.6	84.2
125	89.8	91.0	90.7	90.1	89.2
250	96.4	97.2	94.7	94.0	93.1
500	97.1	97.6	96.3	96.0	95.6
1000	97.7	98.3	99.3	99.2	99.3
2000	95.1	95.7	97.8	97.9	98.4
4000	91.6	92.8	92.5	94.3	94.4
8000	77.0	77.7	79.3	79.2	79.0

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

Measurement Uncertainty
A margin corresponding to +1.5dB(A) is applicable.

Tonal Audibility
The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002.

Siemens Wind Power A/S

p 1/1
SWT-2.3-101 99.5 m Acoustic Emission std ver
T20110701

Zephyr North

SIEMENS

Contract Acoustic Emission, SWT-2.3-101, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-0000-778-00
HST, JES / 2012.12.19
Strictly Confidential

SWT-2.3-101, Rev. 4, Max. Power 2030 kW
Contract Acoustic Emission, Hub Height 99.5m
Kingsbridge II - 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]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.6	99.8	102.4	103.0	103.0	103.0	103.0	103.0	103.0

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	85.8	85.4	84.4	84.5	84.2
125	89.5	90.2	90.4	90.3	89.8
250	96.0	95.7	94.9	94.7	94.0
500	96.5	96.0	95.0	94.8	94.4
1000	96.2	97.3	97.8	97.6	97.8
2000	93.6	95.9	96.9	97.0	97.4
4000	90.9	91.6	91.6	92.5	92.6
8000	76.7	78.5	79.2	79.4	79.3

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

Measurement Uncertainty
A margin corresponding to +1.5dB(A) is applicable.

Tonal Audibility
The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002.

Siemens Wind Power A/S

p 1/1
SWT-2.3-101 99.5 m Acoustic Emission std ver
T20110701

SIEMENS

Contract Acoustic Emission, SWT-2.3-101, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-0000-779-00
HST, JES / 2012.12.19
Strictly Confidential

SWT-2.3-101, Rev. 4, Max. Power 1903 kW
Contract Acoustic Emission, Hub Height 99.5m
Kingsbridge II - 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]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.4	99.0	101.4	102.0	102.0	102.0	102.0	102.0	102.0

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	85.5	85.1	84.2	84.3	84.0
125	89.0	89.8	90.0	89.9	89.5
250	95.6	95.3	94.4	94.2	93.6
500	95.2	94.8	93.8	93.6	93.2
1000	94.5	95.9	96.4	96.3	96.4
2000	92.6	94.8	95.8	95.9	96.4
4000	90.1	90.7	90.6	91.5	91.7
8000	76.5	78.0	78.6	78.8	78.8

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

Measurement Uncertainty
A margin corresponding to +1.5dB(A) is applicable.

Tonal Audibility
The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002.

Siemens Wind Power A/S

p 1/1
SWT-2.3-101 99.5 m Acoustic Emission std ver
T20110701

SIEMENS

Contract Acoustic Emission, SWT-2.3-101, Hub Height 99.5 m
Document ID: E W EN OEN DES TLS-10-0000-780-00
HST, JES / 2012.12.19
Strictly Confidential

SWT-2.3-101, Rev. 4, Max. Power 1824 kW
Contract Acoustic Emission, Hub Height 99.5m
Kingsbridge II - 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]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.2	98.1	100.4	101.0	101.0	101.0	101.0	101.0	101.0

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	85.3	84.9	84.0	84.0	83.8
125	88.6	89.5	89.6	89.5	89.1
250	95.2	94.9	94.0	93.8	93.2
500	93.8	93.5	92.6	92.4	92.0
1000	92.8	94.4	95.0	94.9	95.1
2000	91.5	93.7	94.7	94.9	95.3
4000	89.2	89.7	89.6	90.4	90.7
8000	76.2	77.5	78.0	78.2	78.1

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

Measurement Uncertainty
A margin corresponding to +1.5dB(A) is applicable.

Tonal Audibility
The sound level test reports for the Siemens Wind Turbine Generators have shown that the SWT-2.3-101 wind turbine generators produce no tonal audibility above 3 dB determined in accordance with IEC 61400-11:2002.

Siemens Wind Power A/S

p 1/1
SWT-2.3-101 99.5 m Acoustic Emission std ver
T20110701

13.2 Vestas Wind Systems A/S

13.2.1 V80 Turbine

An email listing from Cynthia Wong of Vestas Wind Systems A/S summarizing the IEC 61400-11-compliant broadband and octave band source sound power levels for the Class 1 V80-1.8MW turbine follows.

From: Cynthia Wong [mailto:xxxxxxxx@vestas.com]
Sent: 23 October 2007 18:15
To: Russell, Stewart C
Subject: FW: Kingsbridge II octave band data V80 V82 alpha=020

10 m wind speed related sound power values for modeling purposes

Turbine: V80/1800

Hub height: 78

v10	LwA	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
3 m/s									
4 m/s	101.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5 m/s	102.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6 m/s	103.3	85.3	91.9	96.3	98.5	97.3	94.0	85.5	5.6
7 m/s	104.1	85.8	92.9	97.4	99.1	97.6	95.1	87.6	77.7
8 m/s	104.4	86.0	93.0	97.7	99.1	97.9	95.8	88.3	86.3
9 m/s	104.4	86.9	93.3	97.0	99.3	98.6	95.5	87.6	80.4
10 m/s									
11 m/s									
12 m/s									
13 m/s									
14 m/s									

The values are valid for the following conditions

Meas. Standard: IEC 61400-11:2002, using amendment procedure above 95% RP

Wind shear: 0.20

Max turbulence at 10 m height: 0.16

Inflow angle: 0 +/-2 deg

Air density: 1,225 kg/m3

The warranty values are valid for the A-weighted sound power levels. Octave band values must be regarded as informative.

The warranty is regarded as exceeded when a measured value minus the uncertainty on the value is larger than our warranted value.

13.2.2 V47 Turbine

Broadband and octave band source sound power level data for the Vestas V47 turbine situated in the Kingsbridge Wind Power Project are included in the Aercoustics Engineering Limited report (AEL, 2005) which has previously been submitted to the Ontario Ministry of Environment. For brevity, it has not been repeated here.

13.3 Enercon GmbH

13.3.1 Enercon E82 Turbine

Broadband and octave band source sound power level data for the Enercon E82 turbines of the Suncor Ripley Wind Project 1 are found in the Noise Impact Assessment appendix (Appendix G: Ripley Wind Power Project Acoustic Assessment) portion of the environmental assessment report for the SRWP1 project (HFP, 2005). This document has previously been submitted to the Ontario Ministry of Environment, and, for brevity, it has not been repeated here.

13.3.2 Enercon E33 Turbine

Broadband and octave band source sound power level data for the Enercon E33 turbine follow.

ENERCON ENERGY FOR THE WORLD	Sound Power Level E-33	Page 1 of 3

Sound Power Level

of the

ENERCON E-33

Operational Mode I

(Data Sheet)

Imprint

Publisher: ENERCON GmbH • Dreekamp 5 • 26605 Aurich • Germany
Phone: +49 4941 927-0
Fax: +49 4941 927-109

Revision

Revision: 1.0

Department: ENERCON GmbH / Site Assessment

Glossary

WEC means an ENERCON wind energy converter.

WECs means more than one ENERCON wind energy converter.

Document information:		© Copyright ENERCON GmbH. All rights reserved.	
Author/Revisor/ date:	Sch/ July 2010	Documentname	SIAS-04-SPL E-33 OM I Rev1_0-eng-eng.doc
Approved / date:	MK/ July 2010	Revision /date:	1.0 / July 2010
Translator /date:			

ENERCON ENERGY FOR THE WORLD	Sound Power Level E-33	Page 2 of 3

Sound Power Level for the E-33 with 330 kW rated power

in relation to standardized wind speed v_S at 10 m height					
hub height / v_s at 10 m height	37 m	44 m	49 m	50 m	
5 m/s	90.9 dB(A)	91.0 dB(A)	91.3 dB(A)	91.3 dB(A)	
6 m/s	95.1 dB(A)	96.0 dB(A)	96.5 dB(A)	96.5 dB(A)	
7 m/s	98.6 dB(A)	98.9 dB(A)	99.0 dB(A)	99.0 dB(A)	
8 m/s	99.7 dB(A)	99.8 dB(A)	99.9 dB(A)	99.9 dB(A)	
9 m/s	100.0 dB(A)	100.0 dB(A)	100.0 dB(A)	100.0 dB(A)	
10 m/s	100.0 dB(A)	100.0 dB(A)	100.0 dB(A)	100.0 dB(A)	
95% rated power	100.0 dB(A)	100.0 dB(A)	100.0 dB(A)	100.0 dB(A)	

Measured value at 95% rated power				***100.8 dB(A)*** *CarlBroEng. P8.008.04*	

1. The relation between the sound power level and the standardized wind speed v_S in 10 m height as shown above is valid on the premise of a logarithmic wind profile with a roughness length of 0.05 m.
2. A tonal penalty of 5 dB according to (ETSU97) has to be taken into account (valid in the near vicinity of the turbine according to IEC 61 400 -11 ed. 2).
3. The sound power level values given in the table are valid for the **Operational Mode I** (defined via the rotational speed range of 18 – 43 rpm). The respective power curve is the calculated power curve E-33 dated Febuary 2004 (Rev. 2.x).
4. The values displayed in the tables above are based on official and internal measurements of the sound power level. If available the official measured values are given in this document as a reference (in italic print). The extracts of the official measurements can be made available upon request. The values given in the measurement extracts do not replace the values given in this document. All measurements have been carried out according to the recommended German and international standards and guidelines as defined in the measurement reports, respectively.
5. Due to the typical measurement uncertainties, if the sound power level is measured according to one of the accepted methods the measured values can differ from the values shown in this document in the range of +/- 1 dB.

   Accepted measurement methods are:

   a) IEC 61400-11 ed. 2 („Wind turbine generator systems – Part 11: Acoustic noise measurement techniques; Second edition"), and

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b) the FGW-Guidelines („Technische Richtlinie für Windenergieanlagen – Teil 1: Bestimmung der Schallemissionswerte", published by the association "Fördergesellschaft für Windenergie e.V.", 18th revision).

If the difference between total noise and background noise during a measurement is less than 6 dB a higher uncertainty must be considered.

6. The sound power level of a wind turbine depends on several factors such as but not limited to regular maintenance and day-to-day operation in compliance with the manufacturer's operating instructions. Therefore, this data sheet can not, and is not intended to, constitute an express or implied warranty towards the customer that the E-33 WEC will meet the exact sound power level values as shown in this document at any project specific site.

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Author/Revisor/ date:	Sch/ July 2010	Documentname	SIAS-04-SPL E-33 OM I Rev1_0-eng-eng.doc
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Translator /date:			

TEST REPORT

DANAK
Reg. nr. 134

SOUND POWER LEVEL **WIND TURBINE ENERCON E-33** **D-26506 LEYBUCHTPOLDER** Report no.: P8.008.04 Aalborg, July 2, 2004 J. no.: 35.8520.01 PHe/RQL/PHe	Pages total: 20
Client: ENERCON GmbH Dreekamp 5 D-26605 Aurich, Germany Phone +49 4941 927	Claimant: Dipl. Phys. Sabine Schulz
Performed by: Peter Henningsen, M.Sc.	Signatory: Peter Henningsen, M. Sc.

Summary:

For the ENERCON wind turbine type E-33, serial number 31001, the following acoustic data has been determined according to IEC 61400-11 ED. 2, 2002-12, and draft amendment 1, 2004-02-06:

Standardized wind speed, V_s [m/s]	6	7	8	9	10*
Apparent sound power level, L_{WA} [dB re 1 pW]	98,0	100,0	100,9	100,8	-
Uncertainty [dB]	1,2	1,2	1,5	1,5	-

* 10 m/s corresponds to more than 95% of rated power. No data is available.

Third octave band spectra
Tonality, max value of $\Delta L_{a,k}$: 15,1 dB ±2,5 dB (tone at 107 Hz, k = 6)

The measurements were carried out on June 25, 2004, at D-26506 Leybuchtpolder, Germany.

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Report no. P8.008.04

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1 INTRODUCTION

ENERCON GmbH has requested Acoustica · Carl Bro a|s to carry out acoustic noise measurements from an ENERCON E-33 wind turbine erected at D-26506 Leybuchtpolder, Germany.

Acoustica · Carl Bro a|s is accredited by DANAK (Danish Accreditation) under EN ISO/IEC 17025 to perform testing using the relevant standards.

2 METHODOLOGY

2.1 Standard

The measurements, data reduction, and calculations were carried out according to the standard IEC 61400 –11, second edition, 2002-12 "Wind turbine generator systems – Part 11: Acoustic noise measurement techniques" and draft amendment 1, dated 2004-02-06.

The draft amendment is still under revision. The major implications are the use of A-weighting for the tonality analysis, and the exclusion of data for which the electrical power exceeds 95% of the rated power.

(The next paragraphs in italics is not part of the accredited test report)

This is incorporated in the latest version of the German guideline "Technische Richtlinien für Windenergieanlagen,. Teil 1: Bestimmung der Schallemissionswerte. Revision 15, Stand 01.01.2004", published by Fördergesellshaft Windenergie e.V.

The data acquired during the measurements may also be used for analysis and documentation according to other versions of the standards (e.g. IEC 61400-11:1998, IEC 61400-11 Ed. 2 without amendment 1, FGW Revison 15 or earlier)

2.2 Deviations from IEC 61400-11 Ed. 2 Amd. 1

As 95% of the maximum produced electrical power corresponds to a standardized wind speed of 9,2 m/s, no data are available at the integer wind speed 10 m/s.

In order to get a sufficiently large number of data points, the wind direction tolerance has been expanded from ±15° to ±30° for the background noise at low wind speeds.

The third octave spectra are given for the sound power levels, not the sound pressure levels.

2.3 Options used from IEC 61400-11 Ed. 2 Amd. 1

The wind speed has been determined from the electric output and the power curve (method 1).

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3 CHARACTERIZATION OF THE WIND TURBINE

Table 1. Information about the wind turbine as provided by the manufacturer.

Manufacturer	ENERCON
Model number	E-33
Serial number	31001
Further identification	Prototype, Leybuchtpolder
Configuration	Horizontal axis, upwind rotor
Rotor center height	50 m
Horizontal distance from rotor center to tower axis	2,4 m
Diameter of rotor	33,4 m
Tower type	Tube
Power control	Pitch
Rotational speed	Variable, 18 – 45 min^{-1}
Power curve	(See table 2)
Rated power output	330 kW
Vortex generators, stall strips, serrated trailing edges	No
Blade type	ENERCON-30-5
Number of blades	3
Gear manufacturer	-
Gear model number	-
Gear serial number	-
Gear configuration	-
Gear ratio	-
Generator manufacturer	ENERCON
Generator model number	E-33
Generator rated power	330 kW
Generator rotational speed	18 – 45 rpm
Generator voltage	440 V

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The power curve used is listed below and is provided by the manufacturer.
Reference: WIND-consult GmbH, report WICO 246LK801/03, date April 16, 2004

Table 2. Power output at sea level air density (1,225 kg/m^3)

Normalized Hub Height Wind Speed [m/s]	Power Output [kW]
2,62	1,57
3,02	3,92
3,50	7,70
4,01	13,72
4,49	21,53
5,02	31,93
5,49	42,64
6,01	56,01
6,52	73,68
7,00	93,69
7,53	117,53
7,99	141,25
8,51	169,93
9,02	200,36
9,48	225,28
10,00	254,08
10,48	276,75
10,99	296,76
11,50	312,54
12,00	321,91
12,47	327,43
13,00	332,74
13,54	334,62
14,01	336,70
14,46	336,84
14,96	336,33
15,45	335,79
15,98	335,40
16,46	335,89
17,04	335,83
17,51	333,84
17,99	334,78
18,55	333,37
19,01	333,65
19,49	333,87
19,98	333,48
20,39	333,96
20,94	333,52

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4 PHYSICAL ENVIRONMENT

Table 3. The physical environment at and near the site of the wind turbine and the measuring positions

Site location	Latitude 53,513° North, longitude 7,149° East. Alter Sielweg, D-26506 Leybuchtpolder, Germany
Topography within 1 km from turbine	Flat, agricultural land. Altitude at turbine: Close to sea level. Relative altitudes within a 1 km radius: ±2 m
Surface characteristics	Crops, approx. 0,7 m tall
Nearby reflecting structures	Circular container for liquid manure. Heigth approx. 3 m, diameter approx. 15 m. Wavy surface. Estimated influence on results due to reflections < 0,5 dB.
Other nearby sound sources	Aircraft.

Figure 1. Site map

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Figure 2. Photo taken in the direction of the turbine from the reference microphone position

Figure 3. Photo taken in the direction of the turbine from the wind mast

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Figure 4. Photo of the microphone on the measurement board

5 INSTRUMENTATION

Table 4. Instrumentation used for measurements and analysis

Description	Manufacturer	Type	ACA no.	Calibrated	Next calibration
Sound Analyzer	Brüel & Kjær	2260	616	18-09-02	18-09-04
Microphone 1/2"	Brüel & Kjær	4189	617	06-02-04	06-02-05
Calibrator	Brüel & Kjær	4231	618	22-04-04	22-10-04
Anemometer	Autohelm	ZC80	690	14-01-04	14-01-06
Tape recorder	Sony	TCD-D8	636	23-06-03	23-06-05
Portable PC	Toshiba	T9100	2762		
Data acquisition card	National Instr.	DAQCard-6024E	776		
Data acq. software	Acoustica	Windturbine 3.2.0	861		
Tonality software	Acoustica	TonalityWT 2.0.0			
Weather station	Oregon Scientific	BA11	8037		

The power converter installed by the manufacturer in the control system was used.

The anemometer and the wind direction transducer were placed at a height of 10 meters above the ground. The distance to the wind turbine was 80 m. The compass bearing from the tower towards the anemometer was 310°.

No secondary windscreen was used.

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Table 5. Microphone positions

Position	Horizontal distance from tower centerline	Vertical distance from tower foundation
1 (ref. pos.)	72 m	-1 m
2	-	-
3	-	-
4	-	-

No measurements were carried out in positions 2, 3, and 4.

6 ACOUSTIC DATA

The measurements were carried out during the following period:
June 25, 2004, between 12 h and 23 h local time.

The wind speed was determined based on the measured power output and the power curve shown in table 2.

The measured electrical power output is normalized based on the meteorological conditions during the measurements (temperature and barometric pressure).

Using the power curve given in table 2, the normalized wind speed at hub height is found for each 1-minute period of total noise.

The standardised wind speed at the reference height of 10 meters is found using formula (7) in IEC 61400-11 Ed. 2.

From the power curve it appears that 95% of the maximum output (95% of 336 kW) is produced at a normalized hub height wind speed of 12,0 m/s. This corresponds to a standardized wind speed of 9,2 m/s at 10 meters height. The cut-in appears at 2 m/s.

Measured data pairs (1 minute periods) of total noise were excluded from the analysis and calculations if:

- The measured average power output exceeds 95% of the maximum power point from the power curve
- The measured average power is less than the power that corresponds to a standardised wind speed of 5,5 m/s (lower limit of 6 m/s bin)
- The minimum measured power output is less than or equal to 0 kW
- The wind direction deviates more the than ±15° from a true downwind direction in the reference microphone position.
- The sound pressure is influenced by loud background noise.

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The correction factor K was found and used for calculation of the standardised wind speed for the background noise data pairs.

Measured data pairs (1 minute periods) of background noise were excluded from the analysis and calculations if:

- The standardised wind speed is outside the interval 5,5 m/s to 10,5 m/s.
- The wind direction deviates more the than ±15° from a true downwind direction in the reference microphone position. For some of the data at low wind speeds this limit is expanded to ±30 °.
- The sound pressure is influenced by loud background noise.

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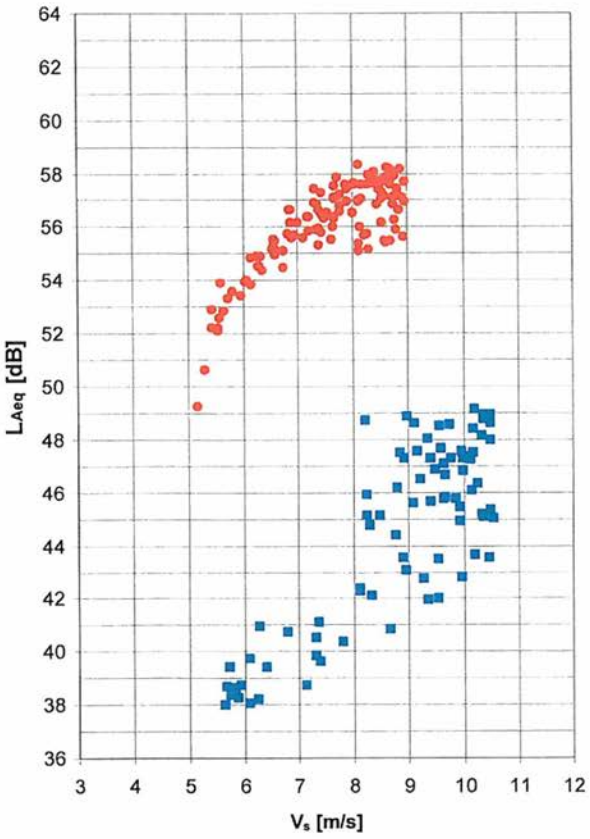

Figure 5. Measured data pairs at the reference microphone position used in analysis and calculations. Red circles: Total noise. Blue squares: Background noise.

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Zephyr North

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6.1 Apparent sound power levels

The apparent sound power levels $L_{WA,k}$ are calculated using 4th order regression analysis of data pairs (total noise and background noise separately).

Table 6. Apparent sound power levels at integer wind speeds

Standardized wind speed V_s [m/s]	6	7	8	9	10*
Apparent sound power level $L_{WA,k}$ [dB]	98,0	100,0	100,9	100,8	-

* 10 m/s corresponds to more than 95% of rated power. No data is available.

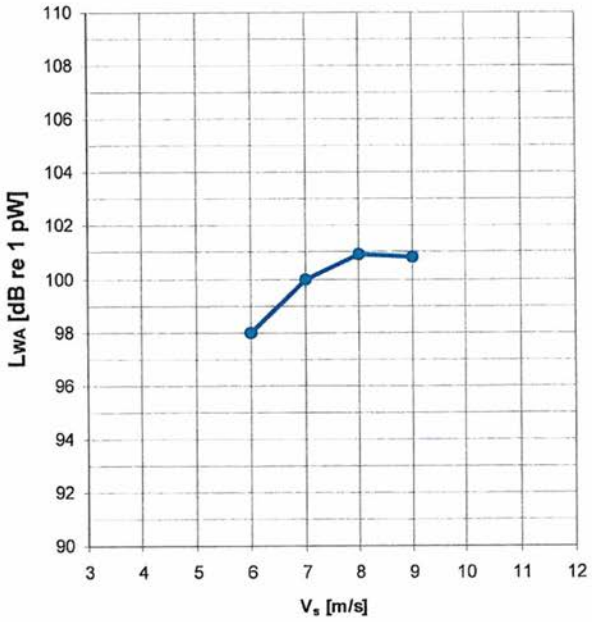

Figure 5. Apparent sound power levels at integer wind speeds

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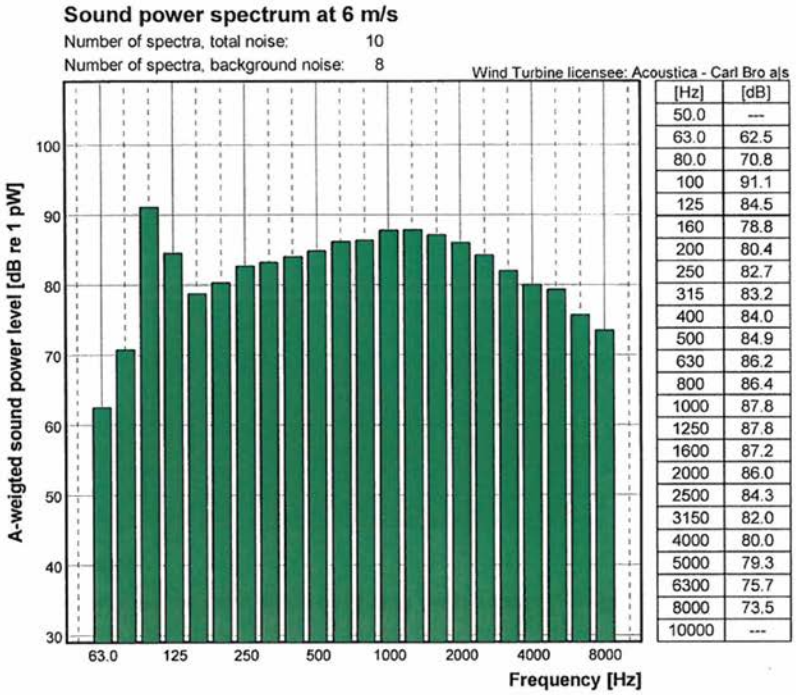
6.2 Third octave spectra

All sound power levels are A-weighted and corrected for the influence of the background noise.



[Hz]	[dB]
50.0	---
63.0	62.5
80.0	70.8
100	91.1
125	84.5
160	78.8
200	80.4
250	82.7
315	83.2
400	84.0
500	84.9
630	86.2
800	86.4
1000	87.8
1250	87.8
1600	87.2
2000	86.0
2500	84.3
3150	82.0
4000	80.0
5000	79.3
6300	75.7
8000	73.5
10000	---

Figure 6. Third octave spectrum at the standardised wind speed 6 m/s.

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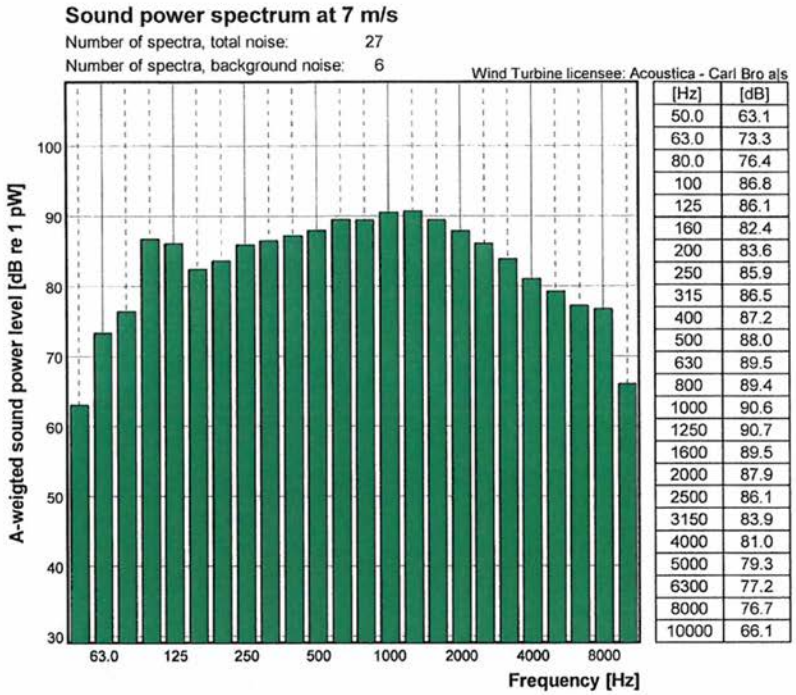

[Hz]	[dB]
50.0	63.1
63.0	73.3
80.0	76.4
100	86.8
125	86.1
160	82.4
200	83.6
250	85.9
315	86.5
400	87.2
500	88.0
630	89.5
800	89.4
1000	90.6
1250	90.7
1600	89.5
2000	87.9
2500	86.1
3150	83.9
4000	81.0
5000	79.3
6300	77.2
8000	76.7
10000	66.1

Figure 7. Third octave spectrum at the standardised wind speed 7 m/s.

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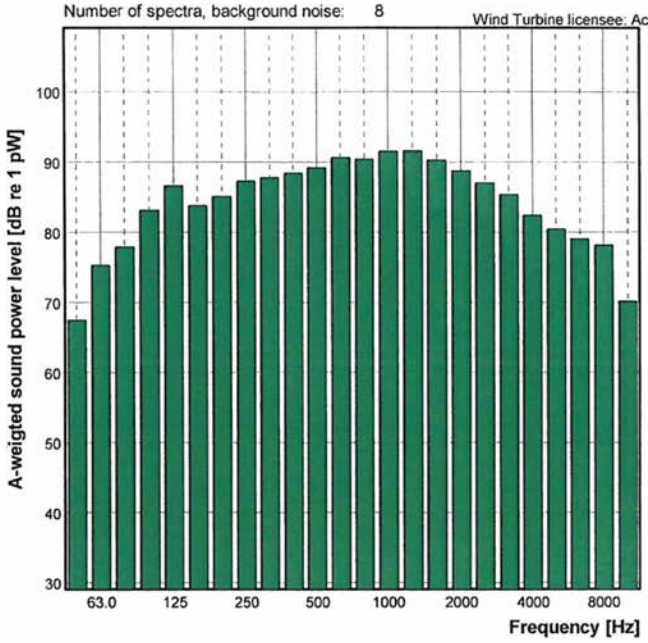
Sound power spectrum at 8 m/s

Number of spectra, total noise: 32
Number of spectra, background noise: 8

Wind Turbine licensee: Acoustica - Carl Bro a|s



[Hz]	[dB]
50.0	67.4
63.0	75.3
80.0	77.9
100	83.2
125	86.6
160	83.8
200	85.1
250	87.3
315	87.8
400	88.4
500	89.2
630	90.6
800	90.4
1000	91.5
1250	91.6
1600	90.3
2000	88.7
2500	87.0
3150	85.4
4000	82.5
5000	80.4
6300	79.0
8000	78.1
10000	70.1

Figure 8. Third octave spectrum at the standardised wind speed 8 m/s.

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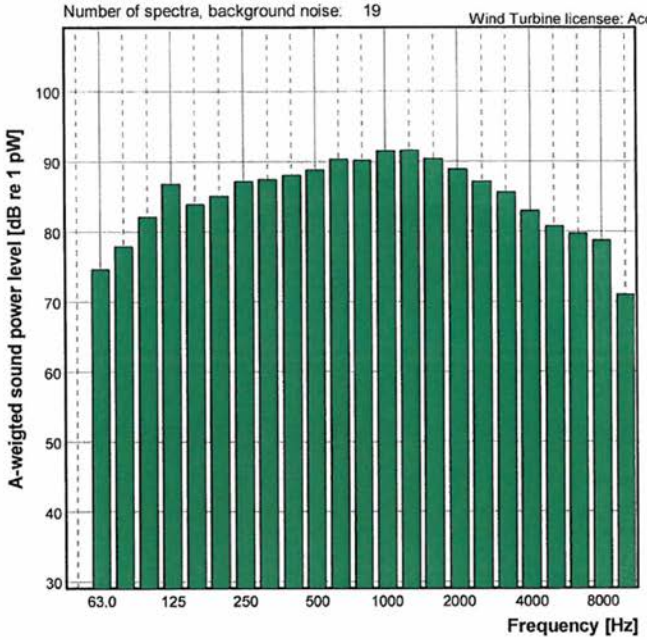
Sound power spectrum at 9 m/s

Number of spectra, total noise: 32
Number of spectra, background noise: 19

Wind Turbine licensee: Acoustica - Carl Bro a|s



[Hz]	[dB]
50.0	---
63.0	74.6
80.0	77.9
100	82.1
125	86.8
160	83.9
200	85.0
250	87.1
315	87.4
400	88.1
500	88.8
630	90.4
800	90.2
1000	91.5
1250	91.6
1600	90.4
2000	88.9
2500	87.1
3150	85.6
4000	83.0
5000	80.8
6300	79.7
8000	78.8
10000	71.0

Figure 9. Third octave spectrum at the standardised wind speed 9 m/s.

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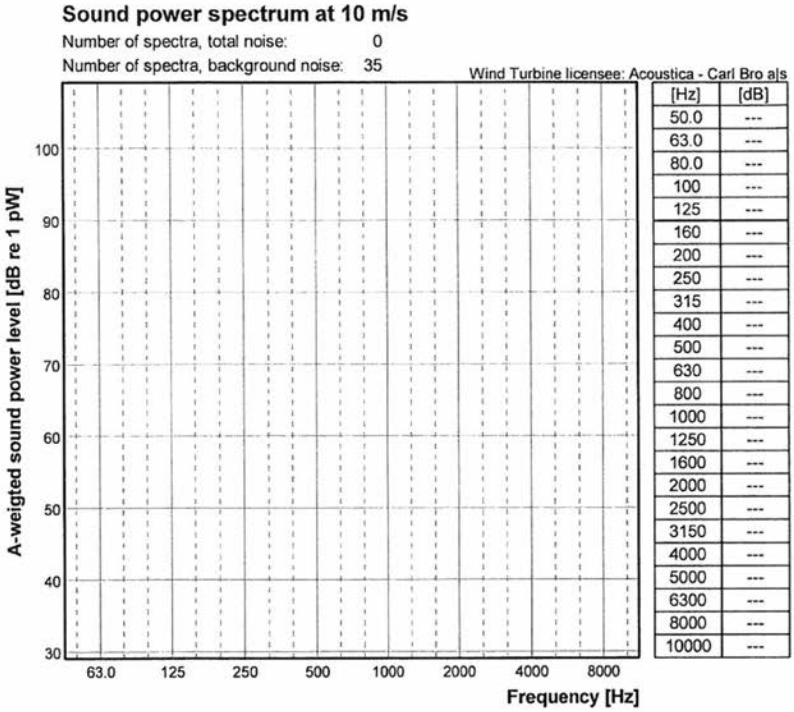

Figure 10. Third octave spectrum at the standardised wind speed 10 m/s. 10 m/s corresponds to more than 95% of rated power. No data is available

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Zephyr North

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6.3 Tonality

The tonality analysis was carried out using A-weighting.

The level of the background noise in the critical bands was more than 6 dB below the total noise.

Only tones with $\Delta L_{a,k} \geq$ -3,0 dB are shown.

Table 7. Tonality

Integer wind speed, k [m/s]	6	7	8	9
Tone frequency [Hz]	107	109	126	126
Critical bandwidth [Hz]	101	101	101	101
Eff. noise bandwidth [Hz]	3,1	3,1	3,1	3,1
$\Delta L_{tn,j,k}$ j = 1 [dB]	13,0		-8,1	-3,2
$\Delta L_{tn,j,k}$ j = 2 [dB]	3,6	7,6	-2,2	-3,3
$\Delta L_{tn,j,k}$ j = 3 [dB]	11,1	1,1	-2,2	-6,1
$\Delta L_{tn,j,k}$ j = 4 [dB]	8,9	6,9	-8,5	-5,5
$\Delta L_{tn,j,k}$ j = 5 [dB]	15,1	6,8	-4,5	-7,4
$\Delta L_{tn,j,k}$ j = 6 [dB]	12,8	13,1	-5,3	-3,2
$\Delta L_{tn,j,k}$ j = 7 [dB]	13,0	8,6		-2,6
$\Delta L_{tn,j,k}$ j = 8 [dB]	7,5	6,8	-1,8	-2,1
$\Delta L_{tn,j,k}$ j = 9 [dB]	8,9	5,3	-5,7	-5,2
$\Delta L_{tn,j,k}$ j = 10 [dB]	9,3	2,5	-5,3	-7,0
$\Delta L_{tn,j,k}$ j = 11 [dB]	14,9	6,5	-7,6	-5,0
$\Delta L_{tn,j,k}$ j = 12 [dB]	15,1		-4,1	-5,8
ΔL_K [dB]	12,2	6,9	-4,8	-4,4
L_a [dB]	-2,9	-2,9	-2,9	-2,9
$\Delta L_{a,k}$ [dB]	15,1	9,8	-1,9	-1,5

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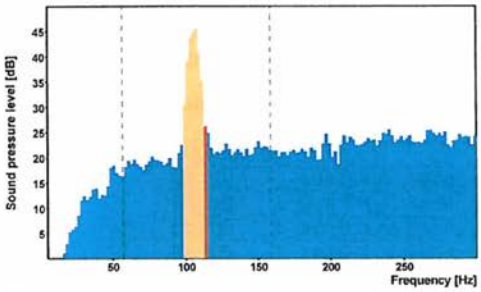
Tonality: IEC 61400, 2. ed., 2002-12



Frequency resolution [Hz]:	2,0
Effective Noise Bandwidth [Hz]:	3,1
Critical Bandwidth [Hz]:	101
Lower Frequency Limit [Hz]:	57
Upper Frequency Limit [Hz]:	158
10*log(dfc/df):	15,2
Tone Frequency [Hz]:	107,8
Tonal lines:	7
Tone Level, Lpt [dB]:	48,8
Masking Noise Lines:	43
Avg. Masking Noise Level, Lpn,avg [dB]:	20,7
Avg. Background Noise Level, Lpb,avg [dB]:	0,0
Corr. Avg. Masking Noise Level, Lpn,avg [dB]:	20,6
Corr. Masking Noise Level, Lpn,avg,c [dB]:	35,8
Tone Level Difference, dLtn [dB]:	13,0

Wind Class: 6 [m/s], Spectrum no. 1775, Standardised Wind Speed, Vs: 6,8 m/s

Tonality-WT licensee: Acoustica - Carl Bro a|s

**Figure 11. Typical 10 s energy averaged spectrum.
Amber: Tones. Red: Excluded lines. Blue: Masking noise.
Critical band is marked with dotted vertical lines.**

7 NON-ACOUSTIC DATA

Table 8. Non-acoustic data

Wind speed determination method	Method 1 (electric output and power curve)
Air temperature	11°C – 13°C
Atmospheric pressure	1013 hPa – 1020 hPa
Roughness length	0,05 m (estimated)
Wind direction	265° - 310°

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8 UNCERTAINTY

The uncertainties are given as the expanded combined standard uncertainties with a coverage factor of k = 2, corresponding approximately to a 95% level of confidence

Table 9. Calculated statistical type A uncertainty components

	Total noise U_A
Standardised wind speed, V_s = 6 m/s	0,6 dB
Standardised wind speed, V_s = 7 m/s	0,6 dB
Standardised wind speed, V_s = 8 m/s	0,9 dB
Standardised wind speed, V_s = 9 m/s	0,9 dB
Standardised wind speed, V_s = 10 m/s	- dB

Table 10. Evaluated type B uncertainty components

Component	Value
Calibration, U_{B1}	0,2 dB
Instrument, U_{B2}	0,2 dB
Board, U_{B3} (L_{WA})	0,3 dB
Board, U_{B3} (third octave bands)	1,7 dB
Board, U_{B3} (tonality)	1,7 dB
Distance, U_{B4}	0,1 dB
Impedance, U_{B5}	0,1 dB
Turbulence, U_{B6}	0,4 dB
Wind speed, derived, U_{B7}	0,5 dB*
Direction, U_{B8}	0,3 dB
Background, U_{B9}	0,1 – 0,3 dB
Reflections	0,5**

* Larger than usual because the calibration state of the power converter used was not known
** Estimated maximum influence of the container close to the microphone position.

Table 11. Combined and expanded uncertainty

Acoustical quantity	Combined and expanded uncertainty, $U = k \cdot u_c$ (coverfactor, k=2)
Apparent sound power level, V_S = 6 m/s	1,2 dB
Apparent sound power level, V_S = 7 m/s	1,2 dB
Apparent sound power level, V_S = 8 m/s	1,5 dB
Apparent sound power level, V_S = 9 m/s	1,5 dB
Apparent sound power level, V_S = 10 m/s	-
Third octave band spectrum	3 - 4 dB
Tonality	2,5 dB

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13.4 Ontario Ministry of Environment

13.4.1 Email form Deborah Penney of Ontario MoE

The following email from the Ontario MoE defines the modified Section 6.3.2 used in this report in place of Section 6.3.2 of the MoE (2008) Noise Guidelines.

Subject: PDNWP- Noise - modified 6.3.2 wording

Date: Mon, 4 Jun 2012 15:58:08 -0400

This e-mail is being sent as a follow-up to our phone discussion last Friday afternoon. We had discussed and explained the modified 6.3.2 method for selecting receptor locations when a wind farm includes a transformer substation. Here is the wording for the modified section 6.3.2:

6.3.2 Wind Farm Includes Transformer Substation

a) Dwellings up to Two Storey High

i. either of the following:

- 4.5 m above grade at the centre of the dwelling, or
- at the centre of the highest storey of the dwelling; or

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

The location from i. or ii. above, that results in the higher noise impact, must be selected.

b) Three Storey or Higher Dwelling

(unchanged)

Let me know ASAP if there is anything more needed from me or the Ministry with regards to the noise issues at this time.

Please provide an estimate as to when the updated report can be expected to be ready for our review.

Thanks and regards,

Deborah Penney, P.Eng.

Senior Engineer - Noise

Ministry of the Environment

END