Appendix F:

Noise Assessment Report

Stantec

Windlectric Inc.

Noise Assessment Report

For

Amherst Island Wind Project

H340642-0000-07-124-0002
Rev. 14
May 4, 2015

Windlectric Inc.

Noise Assessment Report

For

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H340642-0000-07-124-0002
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Project Report

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Windlectric Inc.
Amherst Island Wind Project

Noise Assessment Report

Hatch

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May 4, 2015
Date

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Noise Assessment Report Revision Summary

Rev. #	Summary
5	The Noise Assessment Report dated March 22, 2013 (Revision 4) has been revised to address MOE comments submitted by Kristina Rudzki. The following changes were made: • Table B.5 Wind Turbine Generator Sound Power Level Adjustment was added in Appendix B.
6	The Noise Assessment Report dated September 5, 2013 (Revision 5) has been revised to address MOE comments submitted by Mahdi Zangeneh. The following changes were made: • Figure A.1 was modified to provide a better view of the receptor congested areas where receptor IDs were obscured. The figure size was increased to A0. • Sound power values in Table B.5 were converted from dBA to dB units. • Figure C.3 showing noise contours and WTG proximity at noise receptor R557 was added.
7	The Noise Assessment Report dated June 2, 2014 (Revision 6) has been revised to address the addition of a “hunting shack/bunkie” as an existing receptor with the ID R727. The following changes were made: • Updated Table B.1 to reflect change of WTG model for S07, S18, S26 from SWT-2.3-113 to the SWT 2.221-113 • Table C.1 updated to reflect addition of existing non-participant receptor R727 and change of WTG model for S07, S18, and S26. • Table C.2 updated to reflect change of WTG model for S07, S18, and S26 • Figures A.1, and A.2 updated to include receptor R727 • Figures C.1, C.2, and C.3 were updated to include receptor R727 and reflect the noise contours based on change of WTG model for S07, S18, and S26 • Appendix B – Updated Contract Acoustic Emissions documents and added additional documents detailed below as provided by Siemens: ◆ Summary SWT-2.3-113 Rev 1 P6.024.13 Test Report Summary ◆ Amherst Island MOE Acoustic Letter from Siemens
8	Administrative changes only.
9	The Noise Assessment Report Rev 8 was revised to address the following changes: • Receptors R027 and R505 were changed from ‘Vacant’ to ‘Existing’ and relocated. • Receptors R728 (garage guest house), R729 (house), R730 (boathouse) and R731 (trailer) were added to the model, all non-participant. Figures A.1, A.2, C.1 and C.2 were re-sized to A0 and insets were included to better show areas with high receptor density.
10	Added Figure A.3 showing potential locations for switching station on the mainland, corrected error in noise model parameter that affected results of Rev. 9 only, updated Tables C.1 and C.2 and Figure C.2 as a result.
11	The total number of turbine locations was reduced by 9 to 27 from 36. Change in turbine models to SWT-2.942-113 at 13 locations and to SWT-2.772-113 at 14 locations. All figures and tables have been updated accordingly. Figure C.3 has been removed from the report as turbine S06 has been removed from the layout.
12	Administrative changes. Appendix B - Added SWT-3.2-113 IEC 2A Technical Specifications Rev 4 as provided by Siemens.
13	Siemens provided updated sound power spectra for the SWT-2.772-113 and SWT-2.942-113 WTG models. The study was updated to reflect the new sound power levels.
14	Units of sound power values in Table B.5 were changed from dBA to dB. The total capacity of the project after one turbine removal was changed from 75 MW to 74.3 MW.

REPORT DISCLAIMER

This report has been prepared by Hatch for the sole and exclusive use of Windlectric Inc. (Proponent), for the purpose of assisting the management of the Client in making decisions with respect to the potential development of the Amherst Island Wind Project, and for attachment to their application for a Renewable Energy Approval from the Ontario Ministry of the Environment and Climate Change (MOECC) and shall not be (a) used for any other purpose, or (b) provided to, relied upon or used by any third party.

This report contains opinions, conclusions and recommendations made by Hatch, using its professional judgment and reasonable care. Use of or reliance upon this report by Client is subject to the following conditions:

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(b) the report being read as a whole, with sections or parts hereof read or relied upon in context;

(c) the conditions of the site may change over time or may have already changed due to natural forces or human intervention, and Hatch takes no responsibility for the impact that such changes may have on the accuracy or validity or the observations, conclusions and recommendations set out in this report; and

the report is based on information made available to Hatch by the Client or by certain third parties (Siemens, Land Information Ontario, First Base Solutions), including publicly available information; and unless stated otherwise in the Agreement, Hatch has not verified the accuracy, completeness or validity of such information, makes no representation regarding its accuracy and hereby disclaims any liability in connection therewith.

1. Introduction

This report presents the results of the noise assessment study required for Wind Farms under Ontario Regulation 359/09 [1] and its amendment Ontario Regulation 521/10 [2], as part of the Renewable Energy Approval ("REA") Process.

Windlectric Inc. (hereinafter referred to as the "Proponent") is proposing to develop the Amherst Island Wind Project, an approximately 75-MW wind energy project (the "Project"). The Project will be located on Amherst Island, within Loyalist Township in the County of Lennox and Addington, Ontario about 11 km southwest of Kingston.

A total of 28 sound sources were included in this study. Thirteen (13) Siemens SWT-2.942-113, fourteen (14) SWT-2.772-113 wind turbine generators (WTGs), and one 34.5-kV/115-kV/85-MVA substation transformer were evaluated for noise compliance, in an area extending approximately 14 km by 5 km. It should be emphasized that the Project capacity of 77 MW evaluated for noise impact will be reduced to 74.3 MW or less and only twenty six (26) wind turbine generators will be installed. Removal of one (1) WTG will further reduce the overall noise impact from the Project.

The report was prepared according to the publication entitled "Noise Guidelines for Wind Farms" [3] by the Ministry of the Environment (2008) and includes a general description of the Project, noise sources, noise receptors, assessment of compliance, and all supporting information relevant to the Project.

2. Project General Description

It is intended to permit 27 locations for thirteen (13) Siemens SWT-2.942-113, fourteen (14) SWT-2.772-113 wind turbine generators (for a total capacity of 77 MW), and one 34.5-kV/115-kV/85-MVA substation transformer, for a total of 28 noise sources. Basic characteristics of the proposed WTG models are available in Table 3.1.

The 34.5-kV power from the WTGs will be transmitted to the substation where it will be stepped up to 115 kV by a 34.5-kV/115-kV/85-MVA transformer.

The Project is considered to be a Class 4 Wind Facility, according to the classification presented in Ontario Regulation 359/09.

2.1 Site Location

The Project will be located on Amherst Island, within Loyalist Township in the County of Lennox and Addington, Ontario. The Project Area, extending 14 km by 5 km, is situated about 11 km southwest of Kingston on land, most of which is zoned as prime agricultural, and the rest as rural. Figure A.1 in Appendix A shows the geographical location of the Project along with topographical features. The detailed Land Use Schedule obtained from Loyalist Township, is available in Figure A.2 of Appendix A.

2.2 Acoustical Environment

The Project WTGs will be situated on private land on the island. There are no major industrial facilities on the island; however a number of large manufacturing facilities, such as Lafarge cement plant and Lennox generating station, are located on the mainland along the shore opposite to the Project Area. Noise emitted by these facilities can be heard along the island north shore during day and night time. The Frontenac II, a vessel used to transport people and goods from the mainland to the island, is a significant background noise contributor near the town of Stella. Stella, the largest populated center on the island, is located in the middle of the northern side of the Project. Most of the noise receptors on the island are located along its shoreline.

2.3 Approach to the Study

The sound pressure levels at the Points of Reception (POR) used to model the noise receptors were predicted using procedures from ISO 9613-2, which is a widely used standard for evaluation of noise impact in environmental assessments referenced in the Noise Guidelines for Wind Farms document [3].

The sound power levels for the WTGs were provided by Siemens, and are included in Appendix B. This information is presented as frequency spectra from 63 Hz to 8,000 Hz, for wind speeds from 6 to 10 m/s.

At this stage of project design, the transformer manufacturer has not been selected. Thus, the sound power level was estimated based on the National Electrical Manufacturers Association (NEMA) standard, which represents a worst-case scenario (highest sound emissions) for the transformers.

The software package CADNA-A, which implements ISO 9613-2 standard recommended by the MOECC in Reference [3], was used to predict the noise levels at the POR. Some of the

CADNA-A configurations recommended by the MOECC that were used in the modeling are shown in Figure 2.1, with more details available in Appendix D. The height contours for the area were taken from the Ontario Base Maps ("OBM"). Any obstacle, (ground surface or physical barrier) that did not break the source-POR line of site was not taken into account as attenuation contribution (no negative path difference).

For modelling purposes, the vegetation and other obstacles (such as barns) that block some of the POR from the sources have not been incorporated. Exclusion of these obstacles from the model results in more conservative sound pressure levels predicted at the POR. In reality, these obstacles may help reduce noise impact at the POR.

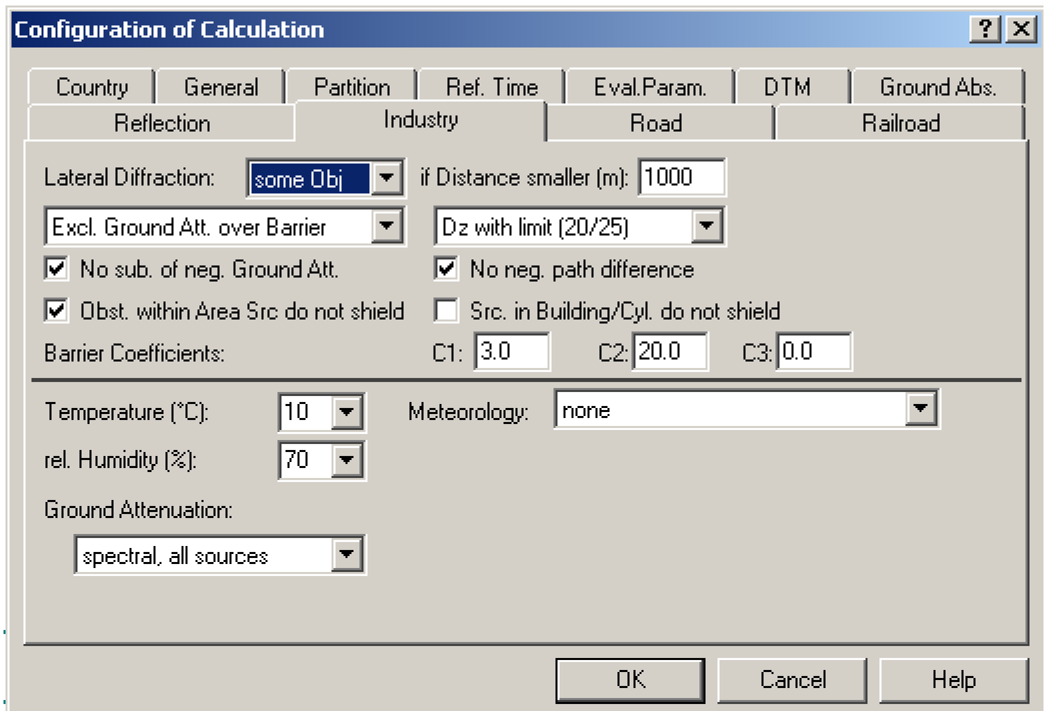

Figure 2.1 CADNA-A Configurations

3. Noise Sources

A total of 27 WTGs and one substation transformer were evaluated in this study. Table B.1 and Table B.2 in Appendix B present the coordinates of each source included in the model. The sound power levels of the sources are listed in Table B.6.

3.1 Substation Transformer

The Proponent will have one substation containing one 34.5-kV/115-kV/85-MVA transformer as part of the Project. The 34.5-kV electrical power generated by the WTGs will be stepped up to 115-kV by the transformer.

Since the transformer make and model have not been selected at this point, although it is known that the transformer will be of ONAF (oil natural air forced) type, a conservative estimate of sound power level was based on the data from NEMA TRI – 1993 (2000) with a reference sound-producing surface area of 62.9-m^2. This standard provides the maximum sound level values for transformers, and manufacturers routinely meet this specification. The results, based on NEMA, will slightly overestimate the impact on the POR since the actual transformer to be procured for the project will be below the NEMA specified sound levels.

The NEMA levels were converted into frequency spectra using empirical correlations for transformer noise [4]. This calculation is available in Figure B.1 of Appendix B. The basic transformer dimensions are expected to be similar to those shown in Figure B.2. The noise source height representing the transformer was assumed at 4.0 m above ground level.

Power transformers are considered by the MOECC to be tonal noise sources. A 5-dB penalty was added to the sound power spectrum, as recommended by Publication NPC-104, “Sound Level Adjustments” for tonality [8]. Table B.6 in Appendix B shows the frequency spectrum used to model the substation transformer.

The Proponent is committed to installing a transformer that will emit the same, or lower, noise levels than the one modeled.

3.2 Unit Transformers

Each WTG has a 34.5-kV unit transformer located outside of the tower right beside the tower base. These transformers are not considered significant noise sources relative to WTGs, as stated by the Guidelines for Wind Farms document [3].

3.3 Switching Station

The project includes a switching station to be located outside of the island. Figure A.3 in Appendix A shows the two potential locations for the switching station. The electrical hardware used in the station is not considered to be a significant noise source.

3.4 Wind Turbine Generators

The Proponent is planning to permit a total of twenty seven (27) locations, where thirteen (13) Siemens SWT-2.942-113 and fourteen (14) Siemens SWT-2.772-113 wind turbine generators are modelled. The basic characteristics of the SWT-2.942-113 and SWT-2.772-113 models are presented in Table 3.1. More technical details on the WTGs, including acoustical data provided by Siemens, can be found in Appendix B. WTG coordinates are presented in Table B.1 while sound power level spectra used in the modeling are available in Table B.6. According to the manufacturer and Reference [3], wind turbines do not present any tonality issues; therefore no tonality penalty was added to the sound power spectrum.

Table 3.1 Basic Characteristics of Siemens SWT-2.942-113 and SWT-2.772-113 WTG Models

	SWT-2.942-113	SWT-2.772-113
Official model name as provided by Siemens*	SWT-3.2-113 2A, Rev.0, Max. Power 2942 kW	SWT-3.2-113 2A, Rev.0, Max. Power 2772 kW
Type	3-bladed, horizontal axis	3-bladed, horizontal axis
Hub height	99.5 m	99.5 m
Nominal capacity	2.942 MW	2.772 MW
Total maximum sound power	105.0 dBA	104.0 dBA
Rotor diameter	113 m	113 m
Swept area	10,000 m^2	10,000 m^2
Blade length	55 m	55 m
Rotor chord	4.2 m	4.2 m
Rotor tilt	6 deg	6 deg
Rotor speed range	6–13 rpm	6–13 rpm
Cut-in wind speed	11 km/h (3 m/s)	11 km/h (3 m/s)
Nominal wind speed	45 km/h (12.5 m/s)	45 km/h (12.5 m/s)
Cut-out wind speed	90 km/h (25 m/s)	90 km/h (25 m/s)

* SWT-3.2-113 2A, Rev.0, Max. Power 2942 kW" model has been referred in the report as SWT-2.942-113 and "SWT-3.2-113 2A, Rev.0, Max. Power 2772 kW" model has been referred in the report as SWT-2.772-113.

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

Following the Noise Guidelines for Wind Farms (2008), the wind shear for summer nights (June 21 to September 20, 11 p.m. to 7 a.m.) was calculated based on direct wind measurements from the meteorological masts existing on the island, and was determined to be 0.45 as reported in Table B.5. The adjustment is not shown on Table B.5 for the following reasons:

1. Using the adjustment process would have resulted in the assessment being completed using the highest wind speed sound data provided by the manufacturer which would not have been the worst case (note that all wind speeds from 7-10 m/s have the same total sound power level).

2. An analysis of the various permutations of combinations of noise data for the two turbine models proposed was completed and determined that the 10 m/s sound data for both models resulted in the worst case predictions for the receptors, which is why the results of the report are based on this scenario.

The acoustical data provided by Siemens is available in Table B.5 and Table B.6. The acoustical data used in the analysis (Table B.6) is equivalent to the worst case scenario sound emissions reported by Siemens, which corresponds to the wind speed of 10 m/s for SWT-2.942-113 model and SWT-2.772-113 model. These noise emissions were tested in accordance with IEC 61400-11 and were calculated based on measurements from the SWT-2.942-113 and SWT-2.772-113 models.

3.5 Adjacent Wind Farms

The closest wind farms proposed in the vicinity of the Project are Ernestown and Dorland, both located on the mainland, north and northwest of the Project, respectively. The information regarding these adjacent wind projects was obtained from their official web sites http://www.ernestownwind.com and http://www.gileadpower.com/projects_eastern_dorland.htm.

Ernestown wind farm is a 10-MW project containing five WTGs. The shortest distance from the Ernestown WTGs to the Amherst Island Wind Project noise receptors is 5260 m.

Dorland wind farm is an 80-MW project for which no layout is publicly available. Since no data on the WTG locations can be presently obtained, the Dorland project site boundary, available at the web site, was used as a reference. It was determined that the closest Amherst Island Wind Project noise receptor is located at 5574 m from the Dorland project site boundary.

Following the Noise Guidelines for Wind Farms document [3], no noise contribution from the adjacent wind farms was taken into account since there are no adjacent WTGs at less than 5000 m from the Project noise receptors.

4. Noise Receptors and Points of Reception

The noise receptors modeled in the study were obtained using Ontario Base Maps, high-resolution satellite imagery, and data from site inspections. The Loyalist municipality was contacted for the approved building permits and all corresponding locations were considered as noise receptors. Also, the noise receptors corresponding to the vacant lots were added based on parcel information provided by First Base Solutions (Teranet Data - 2012) and located according to the requirements outlined in Ontario Regulation 359/09, and its amendment Ontario Regulation 521/10. All Noise Receptors within 1500 m of the project WTGs and 1000 m of the project substation transformer were assessed and included in the noise report.

The noise receptors were represented by points of reception (POR) in the CADNA model. Each noise receptor was modeled by two POR: one placed in the middle of the receptor footprint and elevated at 4.5 m above ground; and another one by a point located within 30-m distance from the receptor center where the sound pressure is maximum at 1.5-m above ground elevation.

The minimum distance between WTGs and non-participating noise receptors was kept above 550 m. The minimum distance from the existing participating noise receptors was kept at 400 m. No distance restrictions were applied for the participating vacant lot noise receptors. The distances were measured between the noise receptor footprint center and WTG tower center.

The total number of noise receptors located within 1500 m from any of the Project WTGs and within 1000 m from the Project substation is 369. As specified by the Noise Guidelines for Wind Farms, the noise receptors were classified as either participating or non-participating. Participating noise receptors correspond to land owners that have some Project related infrastructure on their property. Infrastructure includes wind turbine generators, substation, underground collector cables, access roads, operation and maintenance building, and storage building. For this Project, there are a total of 44 participating noise receptors. All other potential noise receptors (325) are considered non-participating for the purpose of verifying compliance with the MOECC guidelines.

Receptor R730, which was raised by its owner very late in the process, does not appear to be a “dwelling” as that term is used in Regulation 359/09. Windlectric has nevertheless agreed with the MOECC to include results for this location as an alternative to spending the additional time (and risking process delay) on a specific investigation of its features and has instructed Hatch to include this structure in this analysis.

5. Mitigation Measures

An acoustical barrier is required at the substation transformer in order to achieve noise compliance at the noise receptors located in the vicinity of the substation. The material for the barriers was assumed to be Durisol Richmond Panel manufactured by Armtec. Table B.3 in Appendix B presents absorption coefficients used in the CADNA-A model, while Figure B.2 shows details of the proposed barrier. The barrier will be continuous and its surface density will be 184 kg/m^2, exceeding the 20-kg/m^2 requirement established by the MOECC. More information on the Durisol Richmond Panel can found in Appendix B. The Proponent is committed to using barrier material which will have equivalent or higher absorption coefficients than those used in the modeling.

Table B.4 lists UTM coordinates, height, and length of the substation barrier as it was modeled in CADNA-A.

6. Noise Impact Assessment

The purpose of the acoustic assessment report is to demonstrate that the Project is in compliance with the noise performance limits. All noise receptors considered in the study were assumed to be located in Class 3 areas as defined in Publication NPC-232 [9]. A Class 3 area means a rural area with an acoustical environment that is dominated by natural sounds having little or no traffic. Table 6.1 shows the performance limits set by the MOECC for Class 3 areas, according to Noise Guidelines for Wind Farms publication.

Table 6.1 Sound Pressure Limits for Class 3 Areas

Wind Speed at 10-m Height [m/s]	**4**	**5**	**6**	**7**	**8**	**9**	**10**
POR sound pressure limits (dBA)	40.0	40.0	40.0	43.0	45.0	49.0	51.0

For this study, the overall ground attenuation coefficient was assumed to be 0.7, as recommended by the MOECC for evaluating the noise impact of renewable energy facilities. The maximum sound pressure level specified at 6 m/s (40.0 dBA) was used as the compliance criterion for the POR representing the non-participating noise receptors.

As outlined by Section 6.7 of the Noise Guidelines for Wind Farms [3], a manual calculation was carried out to confirm the results obtained using CADNA-A for a single source-POR pair. For this Project, MathCAD was used as a calculating tool, and the source-POR pair selected was S11 and POR at 4.5 m representing R080 noise receptor. R080 is a non-participating noise receptor located 575 m from wind turbine generator S11. The MathCAD printout is included in Appendix D and confirms the results of the CADNA-A model. In addition, a sample calculation from the CADNA-A model for R080 is provided in Appendix D to demonstrate the outputs as well as the inputs placed into the CADNA-A software.

6.1 Compliance with Performance Limits

Table C.1 in Appendix C presents calculated sound pressure levels at the POR corresponding to non-participating noise receptors and it also lists distances to the nearest noise sources.
Table C.2 lists results for the POR representing participating noise receptors. Figure C.1 displays sound pressure contours calculated at 4.5 m. Figure C.2, presented in A0 size, shows more detail regarding setback from wind turbines and property lines, along with the 40 dBA contour line (as per MOECC's request on August 28, 2013). Satellite imagery was not added for clarity of the other elements.

The findings of this study show that all non-participating noise receptors are compliant with MOECC guidelines based on the performance limit of 40 dBA and 550-m noise receptor-WTG distance.

7. Conclusions and Recommendations

For the Amherst Island Wind Project, the sound pressure levels at the noise receptors have been estimated using the CADNA-A model based on ISO 9613-2. The performance limits used for comparison correspond to Class 3 areas with 40.0-dBA limit.

Based on the results obtained in this study it is concluded that the sound pressure levels, resulting from the Amherst Island Wind Project operation based on 27 WTG locations and one substation transformer, at the noise receptors located within 1500 m from any of the Project wind turbine generators and within 1000 m from the Project substation will be compliant with the MOECC requirements for Class 3 areas of 40.0 dBA at all times.

It should be emphasized that the Project capacity of 77 MW evaluated for noise impact will be reduced to approximately 74.3 MW or less and only twenty six (26) wind turbine generators will be installed resulting in further reduction of the overall noise impact.

8. References

[1]. Ontario Regulation 359/09; Environmental Protection Act; Renewable Energy Approvals under Part V.0.1 of the Act.

[2]. Ontario Regulation 521/10 made under the Environmental Protection Act; Amending Ontario Regulation 359/09.

[3]. Noise Guidelines for Wind Farms; Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities; Ministry of the Environment; October 2008.

[4]. Robert D. Stevens; Chris Hung; Toward A Realistic Estimate of Octave Band Sound Levels for Electric Transformers

[5]. NEMA; Standards Publication No. TR 1-1993 (R2000); Transformers, Regulators and Reactors; National Electrical Manufacturers Association.

[6]. ISO 1996-1 Description; Measurement and Assessment of Environmental Noise – Part 1; Basic Quantities and Assessment Procedures.

[7]. International Organization for Standardization (ISO). Standard 1913-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation

[8]. NPC-104, "Sound Level Adjustments," Ontario Ministry of the Environment

[9]. MOE 1995; Sound Level Limits for Stationary Sources in Class 3 Areas (Rural); Publication NPC-232; Ontario Ministry of the Environment.

[10]. MOE 1995; Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban); Publication NPC-205; Ontario Ministry of the Environment.

Appendix A

Geographic Location of Project Study Area, Wind Farm Layout, Land Use Schedule


Area of Interest 1
Area of Interest 2
Area of Interest 3
Area of Interest 4
Area of Interest 5
North Channel
Lake Ontario
MAIN STREET
MCDONALDS LANE
STELLA 40 FOOT ROAD
2ND CONCESSION ROAD
3RD CONCESSION ROAD
EMERALD 40 FOOT ROAD
SOUTH SHORE ROAD
FRONT ROAD
LOWER 40 FOOT ROAD
ART MCGINNIS ROAD
Legend
Substation Transformer
Wind Turbine Generator SWT - 2.772-113
Wind Turbine Generator SWT - 2.942-113
Noise Receptor - Existing, Participating
Noise Receptor - Vacant, Participating
Noise Receptor - Existing, Non Participating
Noise Receptor - Vacant, Non Participating
Ferry Connection
Road
Watercourse
40 dBA at 4.5 m Sound Pressure Contour
550 m from WTG
1500 m from WTG
Parcel (PIN)
Participating Parcel
Waterbody
Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2011.
2. Spatial referencing UTM NAD 83.
3. The receptor icons are located in the position defined by the UTM coordinates in the tables.
0 200 400 800 Metres
1:14,000
NORTH
Windlectric Inc.
HATCH
Figure A.1
Windlectric Inc.
Amherst Island Wind Project
Area Location Plan
H340642-1000-50-015-0003 Rev. 12
Path: P:\ALGONQUI\340642\SPECIALIST_APPS\GIS\Map Documents\Layout\WindLayout_LayoutS3MW4_Noise_Location_A0.mxd
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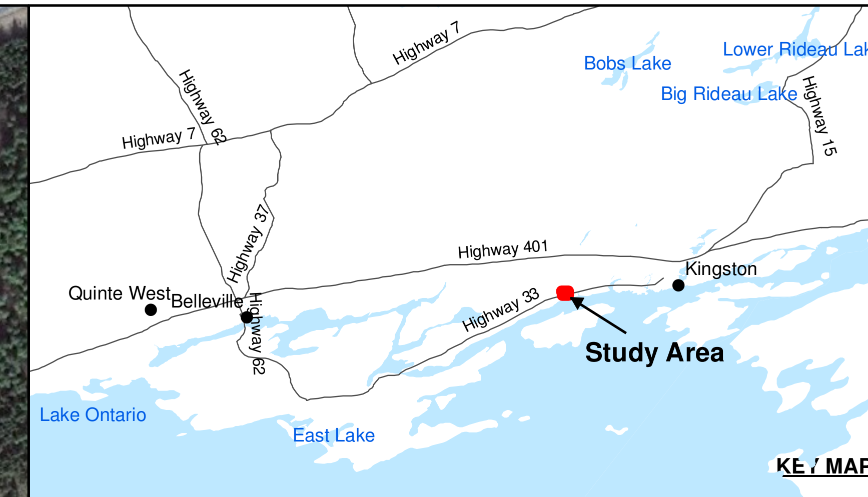

Legend

- Road
- Watercourse
- Potential Switching Station

	Easting	Northing
A	362,565.4	4,896,448.9
B	363,023.0	4,897,213.4

Notes:
1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2014.
2. Spatial referencing UTM NAD 83, Zone 18.

0 50 100 200 Metres

1:4,000

NORTH

Figure A.3
Windlectric Inc.
Amherst Island Wind Project
Switching Station

Windlectric Inc.
HATCH™

H340642-1000-50-015-0014 Rev. 0

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Appendix B

Noise Sources

Table B.1 Wind Turbine Generator List (27 WTGs)

ID	Equipment Make and Model	UTM NAD 83, Zone 18		Spectra ID	Total Sound Power [dBA]	Height [m]
		X[m]	Y[m]			
S01	Siemens SWT-2.772-113	359172	4889551	SWT_2772_113_10ms	104	99.5
S02	Siemens SWT-2.772-113	366489	4890373	SWT_2772_113_10ms	104	99.5
S03	Siemens SWT-2.942-113	361257	4887434	SWT_2942_113_10ms	105	99.5
S04	Siemens SWT-2.942-113	360408	4890076	SWT_2942_113_10ms	105	99.5
S05	Siemens SWT-2.942-113	362668	4888881	SWT_2942_113_10ms	105	99.5
S07	Siemens SWT-2.772-113	366812	4891637	SWT_2772_113_10ms	104	99.5
S09	Siemens SWT-2.772-113	360951	4887104	SWT_2772_113_10ms	104	99.5
S11	Siemens SWT-2.772-113	361641	4887206	SWT_2772_113_10ms	104	99.5
S12	Siemens SWT-2.942-113	368952	4892526	SWT_2942_113_10ms	105	99.5
S13	Siemens SWT-2.772-113	367813	4891841	SWT_2772_113_10ms	104	99.5
S14	Siemens SWT-2.942-113	366790	4891157	SWT_2942_113_10ms	105	99.5
S16	Siemens SWT-2.942-113	361904	4889060	SWT_2942_113_10ms	105	99.5
S18	Siemens SWT-2.772-113	367607	4892193	SWT_2772_113_10ms	104	99.5
S19	Siemens SWT-2.772-113	365107	4889563	SWT_2772_113_10ms	104	99.5
S20	Siemens SWT-2.942-113	362894	4889249	SWT_2942_113_10ms	105	99.5
S21	Siemens SWT-2.772-113	364881	4889039	SWT_2772_113_10ms	104	99.5
S22	Siemens SWT-2.942-113	361447	4890656	SWT_2942_113_10ms	105	99.5
S26	Siemens SWT-2.772-113	367371	4892536	SWT_2772_113_10ms	104	99.5
S27	Siemens SWT-2.942-113	365916	4890146	SWT_2942_113_10ms	105	99.5
S28	Siemens SWT-2.942-113	369091	4893127	SWT_2942_113_10ms	105	99.5
S29	Siemens SWT-2.772-113	359562	4889909	SWT_2772_113_10ms	104	99.5
S30	Siemens SWT-2.772-113	367040	4892941	SWT_2772_113_10ms	104	99.5
S31	Siemens SWT-2.772-113	362343	4891028	SWT_2772_113_10ms	104	99.5
S33	Siemens SWT-2.942-113	369337	4892806	SWT_2942_113_10ms	105	99.5
S34	Siemens SWT-2.772-113	363324	4889901	SWT_2772_113_10ms	104	99.5
S36	Siemens SWT-2.942-113	364589	4888397	SWT_2942_113_10ms	105	99.5
S37	Siemens SWT-2.942-113	365501	4889854	SWT_2942_113_10ms	105	99.5

Table B.2 Location of Substation Transformers
Sound power level includes a 5-dBA tonality penalty.

ID	Description	UTM NAD 83, Zone 18		Spectra ID	Total sound power [dBA]	Height [m]
		X[m]	Y[m]			
Sub	34.5-kV/115-kV/ 85-MVA substation transformer	363269.13	4891095.48	Tr_34.5kV_115kV_85MW	105.2	4.0

Table B.3 Absorption Coefficient Spectrum for Acoustical Barrier at the Substation Transformer

Material name	Spectra ID	Octave Spectrum									
		31.5	63	125	250	500	1000	2000	4000	8000	Aw
Durisol Richmond Panel	Durisol Richmond	0	0	0.29	0.53	0.97	0.87	0.89	0.90	0	0.8

Table B.4 Sound Barrier Coordinates

Barrier ID	Source ID	Absorption Spectra ID	UTM NAD 83, Zone 18		Length [m]	Height [m]
			X[m]	Y[m]		
Barrier_Sub	Sub	Durisol Richmond	363265.12	4891094.03	17.04	6.0
			363266.88	4891090.09		
			363274.64	4891093.56		
			363272.91	4891097.41		

Table B.5 Wind Turbine Generator Sound Power Level Adjustment

Make and Model	Siemens SWT-2.772-113									
Electrical Rating [kW]	2772									
Hub Height [m]	99.5									
Wind Shear Coefficient	0.45									
Octave Band Sound Power Level [dB]										
	Manufacturer's Emissions Levels					**Adjusted Sound Power Level**				
Wind Speed [m/s]	**6**	**7**	**8**	**9**	**10**	**6**	**7**	**8**	**9**	**10**
Frequency [Hz]										
63	116.0	117.2	117.5	117.4	117.7	117.7				
125	107.4	109.1	109.7	109.3	109.8	109.8				
250	103.5	103.4	102.9	103.6	103.8	103.8				
500	99.7	99.5	98.7	98.8	99.4	99.4				
1000	97.7	97.6	97.5	97.6	97.4	97.4				
2000	96.0	96.1	95.9	96.0	95.7	95.7				
4000	93.4	94.3	95.1	94.6	94.0	94.0				
8000	83.8	84.6	84.3	84.1	85.7	85.7				
Combined [dBA]	103.8	104.0	104.0	104.0	104.0	104.0				

Make and Model	Siemens SWT-2.942-113									
Electrical Rating [kW]	2942									
Hub Height [m]	99.5									
Wind Shear Coefficient	0.45									
Octave Band Sound Power Level [dB]										
	Manufacturer's Emissions Levels					**Adjusted Sound Power Level**				
Wind Speed [m/s]	**6**	**7**	**8**	**9**	**10**	**6**	**7**	**8**	**9**	**10**
Frequency [Hz]										
63	116.2	117.0	117.6	117.6	117.4	117.4				
125	108.9	109.0	109.5	110.0	109.8	109.8				
250	104.5	104.6	104.4	104.8	104.7	104.7				
500	100.7	100.8	100.3	99.9	100.5	100.5				
1000	98.6	98.8	98.5	98.2	98.9	98.9				
2000	96.9	97.2	97.8	97.9	97.3	97.3				
4000	94.3	95.3	95.0	94.9	94.8	94.8				
8000	84.5	85.2	85.2	84.9	83.1	83.1				
Combined [dBA]	104.7	105.0	105.0	105.0	105.0	105.0				

Table B.6 Sound Power Spectra Used for Modelling the Noise Sources
The WTG spectra are site adjusted.
The data does not include tonality penalties for the transformer.

Spectra ID	Description	Octave Spectrum [dBA]									
		31.5	63	125	250	500	1000	2000	4000	8000	Total
SWT_2772_113_10ms*	Provided by Siemens for SWT-2.772-113 model for 10 m/s wind speed		91.5	93.7	95.2	96.2	97.4	96.9	95.0	84.6	104.0
SWT_2942_113_10ms*	Provided by Siemens for SWT-2.942-113 model for 10 m/s wind speed		91.2	93.7	96.1	97.3	98.9	98.5	95.8	82.0	105.0
Tr_34.5kV_115kV_85MW	Estimated for 34.5 kV/115-kV/85-MW transformer using sound levels from NEMA TR 1-1993 (R2000) and empirical equations from Stevens & Hung paper	55.6	72.8	85.9	91.4	96.8	94.0	90.2	85.0	74.9	100.2

* For both models (SWT-2.772-113and SWT-2.942-113) different wind speeds and combinations were tested as per data provided by Siemens. The results show that the worst case scenario corresponds to the 10 m/s for both models.

Estimated Frequency Spectra for Transformers

Substation transformer - 34.5kV/115kV/85MVA - Oil filled

From Robert D. Stevens and Chris Hung, "Toward a realistic estimate of octave band sound levels for electrical transformers" paper

Average LpA	82.0 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2, immersed power transformers
Ref. Sound Producing Surface Area:	62.9 m^2	Estimated based on similar transformer dimensions and similar methodology as described in IEEE C57.12.90-2010

Correction factors to be used with meters^2

Freq. [Hz]	**31**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Correction [dB]	-5.0	-1.0	2.0	0.0	0.0	-6.0	-11.0	-16.0	-24.0

Sound Power Level calculated as Lw=Average LpA + 10*log(Estimated surface area in m^2) + C

Freq. [Hz]	**31**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Combined [dB]**
Sound Power, Lw [dB]	95.0	99.0	102.0	100.0	100.0	94.0	89.0	84.0	76.0	**107.0**

Resulting A-weighted sound power level, LwA

Freq. [Hz]	**31**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Combined [dBA]**
A-Weight [dB]	-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	**-**
Sound Power, LwA [dBA]	55.6	72.8	85.9	91.4	96.8	94.0	90.2	85.0	74.9	**100.2**

Figure B.1 Substation Transformer Sound Power Calculations

Amherst Island SWT-3.2-113 2A, Rev.0, Max. Power 2772 kW Standard Acoustic Emission, Hub Height 99.5 m

Sound Power Levels

The sound power level is presented with reference to the code IEC 61400-11 ed. 2.1 (2006-12) 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 (L_{WA}) presented are valid for the corresponding wind speeds referenced to a height of 10.0 m above ground level.

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	12	Up to cut-out
Typical Values	90.9	95.5	100.1	103.8	104.0	104.0	104.0	104.0	104.0	104.0	104.0

Table 1: Noise emission, L_{WA} [dB(A) re 1 pW]

Typical Sound Power Frequency Distribution
Typical spectra for L_{WA} in dB(A) re 1pW for the corresponding center frequencies are tabulated below for 6 - 10 m/s referenced to a height of 10.0 m above ground level.

	typical Spectral Levels				
	Wind Speed (m/s)				
Octave band, center frequency [Hz]	6	7	8	9	10
63	89.8	91.0	91.3	91.2	91.5
125	91.3	93.0	93.6	93.2	93.7
250	94.9	94.8	94.3	95.0	95.2
500	96.5	96.3	95.5	95.6	96.2
1000	97.7	97.6	97.5	97.6	97.4
2000	97.2	97.3	97.1	97.2	96.9
4000	94.4	95.3	96.1	95.6	95.0
8000	82.7	83.5	83.2	83.0	84.6

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

Tonality
Typical tonal audibility for the Siemens wind turbine generators has not exceeded 3 dB(A) as determined in accordance with IEC 61400-11 ed. 2.1 (2006-12)

Measurement Uncertainty
A measurement uncertainty range of -1.5dB(A) to +1.5dB(A) is applicable.

Amherst Island SWT-3.2-113 2A, Rev.0, Max. Power 2942 kW Standard Acoustic Emission, Hub Height 99.5 m

Sound Power Levels

The sound power level is presented with reference to the code IEC 61400-11 ed. 2.1 (2006-12) 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 (L_{WA}) presented are valid for the corresponding wind speeds referenced to a height of 10.0 m above ground level.

Wind speed [m/s]	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Up to cut-out**
Typical Values	90.9	95.5	100.1	104.7	105.0	105.0	105.0	105.0	105.0	105.0	105.0

Table 1: Noise emission, L_{WA} [dB(A) re 1 pW]

Typical Sound Power Frequency Distribution
Typical spectra for L_{WA} in dB(A) re 1pW for the corresponding center frequencies are tabulated below for 6 - 10 m/s referenced to a height of 10.0 m above ground level.

	typical Spectral Levels				
	Wind Speed (m/s)				
Octave band, center frequency [Hz]	**6**	**7**	**8**	**9**	**10**
63	90.0	90.8	91.4	91.4	91.2
125	92.8	92.9	93.4	93.9	93.7
250	95.9	96.0	95.8	96.2	96.1
500	97.5	97.6	97.1	96.7	97.3
1000	98.6	98.8	98.5	98.2	98.9
2000	98.1	98.4	99.0	99.1	98.5
4000	95.3	96.3	96.0	95.9	95.8
8000	83.4	84.1	84.1	83.8	82.0

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

Tonality
Typical tonal audibility for the Siemens wind turbine generators has not exceeded 3 dB(A) as determined in accordance with IEC 61400-11 ed. 2.1 (2006-12)

Measurement Uncertainty
A measurement uncertainty range of -1.5dB(A) to +1.5dB(A) is applicable.

SIEMENS

Siemens D3 platform – 3.0-MW and 3.2-MW direct drive wind turbines

Reduced complexity, increased profitability

Answers for energy.

Your trusted partner

Siemens has been a major driver of innovation in the wind power industry since 1980 when wind turbine technology was still in its infancy.

Technology has changed with the times, but Siemens's commitment to providing its customers with proven wind turbine solutions remains the same.

The combination of robust and reliable turbines, highly efficient solutions for power transmission and distribution, and a deep understanding of the entire energy market ensures that Siemens will continue to take the wind power industry to new levels.

Long-lasting customer relationships – based on a track record of successful, reliable project deliveries – provide a sound, sustainable, and profitable investment.

Drawing on more than 30 years of experience in the wind power industry, a strong focus on renewables, and a global network of highly skilled and trained employees, Siemens has proven itself to be a trustworthy and reliable business partner and will continue to be so in the future.

With an increasing number of turbines being installed at inland, coastal, and offshore sites, reliability and best in class maintenance under challenging conditions are essential for optimizing the return on investment throughout a project's life cycle.

Over the past 30 years, Siemens has accumulated millions of hours of service experience. Drawing on this substantial knowledge, the company has established a flexible range of service solutions that are designed to optimize the output of wind turbines.

Intelligent ways to drive down the cost of electricity

Wind power is coming of age. It could soon be directly competitive with traditional energy sources. Driving down the levelized cost of wind energy is a key target for Siemens as we strive to make wind power independent of subsidies.

Innovation and industrialization are the main drivers of this. And our new platform strategy, founded on the knowledge and experience of more than 30 years in wind power, is a milestone along this path.

Standardization and modularization are fundamental to the new platform approach because they allow us to streamline the entire manufacturing and installation process. The organization of our product platforms into categories allows standardized modules, such as rotors, generators, towers, and hubs – to be used with different products. The total number of different components is thus kept to a minimum.

Each of our products is now a member of one of four platforms: the Siemens G2, Siemens D3, Siemens G4, and Siemens D6. "G" denotes geared turbines, "D" signifies direct drive technology, and the associated numbers represent the predominant power rating.

Therefore, the D3 platform is comprised of onshore direct drive wind turbines with a power rating of 3.0-MW and 3.2-MW.

Through continuous monitoring of our installed D3 fleet, Siemens engineers were able to boost the performance of the entire product platform. We increased the standard rating of 3.0-MW to 3.2-MW. This translates into 200,000 additional watts of product capacity for you, and 200,000 more reasons to choose Siemens.

Outstanding performance with reduced complexity

The Siemens 3.0-MW and 3.2-MW wind turbines of the D3 platform embody proven innovation in the field of direct drive generators, with hundreds of units already installed and operational.

As wind power plants develop capacities similar to conventional power plants, power-generation companies throughout the world are striving for greater efficiency and cost-effectiveness. Siemens's solution: increase availability and profitability through innovative technology and reduced complexity.

Siemens direct drive turbines of the D3 and D6 platforms offer innovation through the consistent implementation of a common, highly efficient generator concept. With less than half the moving parts of a conventional geared turbine, the direct drive wind turbines improve performance, reliability, and maintainability. In addition, the compactet design allows for cost-effective transportation and installation.

Performance and profitability go hand in hand

With its direct drive wind turbines, Siemens started with the ambitious goal of making a more cost-effective machine in order to become competitive with conventional power plants. Thanks to innovative engineering, that vision is becoming a reality.

In designing a wind turbine, a holistic view of the design, and construction, materials, processes, manufacture, and installation is critical. The gearless 3.0-MW and 3.2-MW wind turbines carefully balance all these factors in a compact system. Service personnel have been involved in the development process in order to optimize working conditions and serviceability.

Reduced complexity

The Siemens D3 platform offers the simplest and most straightforward wind turbine design. Regardless of the reliable track record of gearboxes over the years, the gearbox is fundamentally the most complex component of a wind turbine. Eliminating the gearbox reduces complexity and can increase reliability.

Replacing the gearbox, the coupling, and the high-speed generator with a low-speed generator eliminates two-thirds of the conventional drivetrain arrangement. As a result, the number of rotating and wear-prone parts is vastly reduced compared to a geared machine.

Siemens has opted for a permanent magnet generator for improved efficiency. Unlike an electrically-excited machine with a gearbox, a permanent magnet-excited machine does not expend any energy on the excitation itself. The D3 platform wind turbine generators also have an outer rotor, where the rotor spins on the outside of the stator. This design feature allows the rotor to operate within narrower tolerances, which helps to keep the dimensions of the nacelle compact.

Simplified design

Due to the removal of the gearbox and other design simplifications, Siemens has given service technicians more space within the nacelle. Here, key components are readily accessible and can be replaced without impacting others. The wind turbines of the D3 platform have a dual-cooling system that provides even cooling of the generator via a top-mounted, passive cooling system for improved energy efficiency.

The key components of a wind turbine – the blade, rotor hub, tower, and controller – are all adopted from the existing Siemens geared-turbine portfolio. The utilization of proven components alongside rigorous testing on rigs and in the field enables Siemens to eliminate many of the variables traditionally associated with the introduction of such an innovative product.

Innovative tower solution

Higher towers significantly increase the energy yield of a wind turbine. At the same time, they pose considerable challenges in terms of transportability and cost. Siemens offers an innovative and economically viable tower concept to allow its wind turbines to reach heights above 100 meters. The bolted steel shell tower consists of multiple tower sections, which are mounted on top of each other and assembled together on-site. The modular concept of the bolted steel shell tower allows for very high hub heights (in excess of 140 meters) with very few requirements in terms of transport. The tower is erected in a short time and requires minimal maintenance. In fact, the HRC bolts require no re-torquing during the tower's lifetime.

Ease of transportation and construction

The D3 platform has a compact, lightweight design and has been engineered to meet even the most demanding of transportation routes. Key bridge and tunnel clearance specifications have been carefully considered when engineering the machine, and as a result, the 3.0-MW and 3.2-MW wind turbines can navigate many of the most demanding transport routes.

Simplified design and an innovative tower concept allow for maximum profitability.

Proven technology, advanced performance

Grid performance with the Siemens NetConverter®

Siemens sets the standard in the field of grid compliance. Power conversion is implemented by the Siemens's NetConverter® system. This system is characterized by full conversion of the power generated, efficiently decoupling generator and turbine dynamics from the grid.

The NetConverter® system offers maximum flexibility in the turbine's response to voltage and frequency control, fault ride-through, and output adjustment. As a result, Siemens wind turbines can be configured to comply with a variety of relevant grid codes in major markets and can be readily connected to the grid.

Siemens IntegralBlade® technology

The rotors of the D3 platform benefit from blades manufactured using patented IntegralBlade® technology.

The blades are made in one piece from fiberglass-reinforced epoxy resin during a single production step. As a result, all glue joints – the potential weak points that could expose the structure to cracking, water ingress, ice formation, and lightning damage – are eliminated.

Siemens WebWPS SCADA system

Via a standard Web browser, the Siemens WebWPS SCADA system provides a variety of status views of electrical, mechanical, meteorological, and grid station data as well as operation and fault status.

Wind turbine condition monitoring

Siemens's wind turbine condition monitoring compares the vibration levels of the main nacelle components with a set of established reference spectra and instantly detects deviations from normal operating conditions.

This allows Siemens to proactively plan the service and maintenance of the wind turbines, as any unusual event can be categorized and prioritized based on severity.

Turbine Load Control (TLC)

The Turbine Load Control system continuously monitors the structural loading on the wind turbine. In case the loads exceed normal values, the turbine automatically regulates operation to bring loads back within the design envelope.

In addition, the TLC system – an optional feature of the D3 platform – monitors the accumulated fatigue loading on the turbine and thus provides key input for fact-based asset management.

High Wind Ride Through (HWRT)

Wind turbines are normally programmed to shut down if the 10-minute mean wind speed exceeds 25 m/s. This may lead to significant challenges for the grid system if the turbines in large wind farms are shut down more or less simultaneously.

The Siemens D3 platform works to enhance grid stability due to High Wind Ride Through – an optional feature of the D3 platform. This replaces the fixed high-wind shut-down threshold with an intelligent load-based reduction in output power at some storm-level wind speeds.

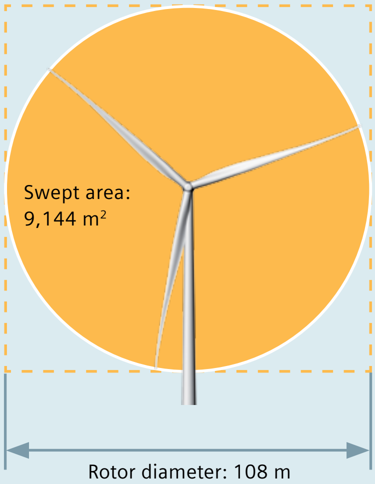
Service

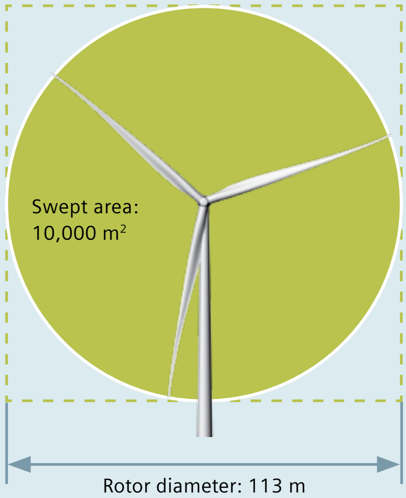
From the highly qualified local technician to the senior engineer at service headquarters, it is the Siemens service team's track record and the vast amount of experience gained over time that makes the difference.

Siemens offers tailor-made service solutions for each of our turbine platforms, e.g. the SWPS-100B, the SWPS-200A, and the SWPS-300W service solutions for onshore wind turbines.

Further improvements in safety

Safety is at the heart of all Siemens operations. From production to installation, operation, and service, Siemens strives to set the standard for a zero-harm culture.





SWT-3.0-101 / SWT-3.2-101	
IEC Class	IA
Rotor diameter	101 m
Blade length	49 m
Swept area	8,000 m^2
Hub height	74.5 – 99.5 m*
Power regulation	Pitch regulated
Annual output at 8.5 m/s	12,814 MWh (3.0-MW) 13,135 MWh (3.2-MW)
Nacelle weight	78 tons
Rotor weight	60 tons

*Site specific

The toughest turbine for the roughest conditions

Extreme wind conditions place tremendous loads on a turbine.This turbine is built to deliver reliable performance under the world's harshest operating conditions.

The turbine utilizes the same rotor as Siemens's SWT-2.3-101 geared machine. Through the application of proven components, Siemens balances innovation with a secure investment.

SWT-3.0-108 / SWT-3.2-108	
IEC Class	IA
Rotor diameter	108 m
Blade length	53 m
Swept area	9,144 m^2
Hub height	79.5 m
Power regulation	Pitch regulated
Annual output at 8.5 m/s	13,228 MWh (3.0-MW) 13,650 MWh (3.2-MW)
Nacelle weight	78 tons
Rotor weight	60 tons

The durable choice for strong wind conditions

When winds are strong, the turbine offers a superior combination of a large rotor and robust design.

The B53 quantum blade of the 108-meter rotor uses Siemens's innovative aeroelastic blade design, which allows a larger rotor diameter and higher energy output without compromising structural loads. As a result, the turbine provides a lower cost of energy in heavy wind conditions.

SWT-3.0-113 / SWT-3.2-113	
IEC Class	IIA
Rotor diameter	113 m
Blade length	55 m
Swept area	10,000 m^2
Hub height	79.5 – 142 m*
Power regulation	Pitch regulated
Annual output at 8.5 m/s	13,938 MWh (3.0-MW) 14,402 MWh (3.2-MW)
Nacelle weight	78 tons
Rotor weight	67 tons

Getting the most out of moderate conditions

Offering the largest rotor in the Siemens D3 platform, the turbine is designed to increase energy output at sites with moderate wind conditions.

Once again, the competitive edge of a Siemens turbine is based on innovative blade design. The B55 quantum blade benefits from an optimized root design that derives maximum power from the wind. Furthermore, the turbine has reduced noise emissions due to a lower rotor speed. With its combination of high energy output and low noise levels, this turbine is the ideal choice for most inland sites across the globe.

Offering three rotor sizes and a standard rating of 3.0-MW and 3.2-MW, the D3 platform is a perfect combination of performance and profitability for all wind conditions.

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E-mail: support.energy@siemens.com

Wind Power
Order No. E50001-E310-A199-X-7600
RS 15_01_003

Technical Specifications SWT-3.2-113 IEC IIA

Rotor
Type ....3-bladed, horizontal axis
Position............................Upwind
Diameter...........................113 m
Swept area ....10,000 m²
Nominal speed.................14.4 rpm
Speed range....................4-16.5 rpm
Power regulation ....Pitch regulation with variable speed
Rotor tilt ....6 degrees

Blade
Type ....Self-supporting
Blade length ....55 m
Tip chord ....0.63 m
Root chord ....4.2 m
Aerodynamic profile ....Siemens proprietary airfoils, FFA-W3-XXX
Material ....GRE
Surface gloss ....Semi-gloss, < 30 / ISO2813
Surface color ....Light grey, RAL 7035

Aerodynamic Brake
Type ....Full span pitching
Activation ....Active, hydraulic

Load-Supporting Parts
Hub ....Nodular cast iron
Fixed shaft ....Nodular cast iron
Nacelle bed frame............Nodular cast iron

Mechanical Brake
Type ....Hydraulic disc brake
Position ....Generator rear end
Number of callipers 3

Canopy
Type ....Totally enclosed
Surface gloss ....Semi-gloss, 20-40 / ISO-2813
Color ....Light grey, RAL 7035
Material............................Fire retardant GFRP with inlayed EMC shielding

Generator
Type ....Synchronous, PMG
Nominal power ....3.4 MW

Grid Terminals (LV)
Nominal power ....3.2 MW
Voltage ....690 V
Frequency ....50 Hz or 60 Hz

Yaw System
Type ....Active
Yaw bearing ....Externally geared
Yaw drive ....8 (optional 10) electric gear motors
Yaw brake ....Passive friction brake

Controller
Type ....Microprocessor
SCADA system ....WPS
Controller designation .....SICS

Tower
Type ....Tubular steel tower
Hub height ....83.5 m, 88 m, 92.5 m, 115 m, 127.5 m, or 142.5 m
Corrosion protection ....Painted
Surface gloss ....Semi-gloss, 20-40 / ISO-2813
Color ....Light grey, RAL 7035

Operational Data
Cut-in wind speed ....3-5 m/s
Nominal power at ....12-13 m/s
Cut-out wind speed ....32 m/s with High Wind Ride Through
High Wind Ride Through activation ....Above 22 m/s
Maximum 3 s gust ....59.5 m/s

Weights (approximately)
Rotor ....67 Metric tons
Nacelle ....78 Metric tons

Siemens Wind Power and its affiliates reserve the right to change the above specifications without prior notice.

SIEMENS

December 16, 2014

To: Ontario Ministry of Environment

Re: Amherst Island Wind Project

Dear Sir/Madam,

With respect to the Amherst Island Wind Project, Siemens Canada Limited ("Siemens") will provide its SWT D3 Direct Drive wind turbine generators, with a maximum power output of 2,772 kW or 2,942 kW each. In accordance with the Turbine Supply Agreement between Siemens and Algonquin Power, Siemens will guarantee the maximum broadband sound power levels for those Units at the maximum rated power level shown in the table below.

	Maximum Rated Power Level	Maximum Broadband Sound Power Level	Hub Height
SWT D3 Direct Drive Wind Turbine Generator, Maximum Power rating 2,772kW	2,772 kW	104.0 dB	99.5m
SWT D3 Direct Drive Wind Turbine Generator, Maximum Power rating 2,942kW	2,942 kW	105.0 dB	99.5m

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

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

Based on the testing of the SWT-2.3-113 and SWT3.2-113 model wind turbine generators, Siemens does not expect that the tonality generated by the SWT D3 Direct Drive wind turbine generators listed above with a Maximum Power of 2,772 kW or a Maximum Power of 2,942 kW will be higher than 3 dB when tested in accordance with the IEC 61400-11:2002 Code with amendment 1 dated 2006-05.

Best regards,

Donald R. Marcucci

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

cc: Alex Tsopelas, Algonquin Power

TEST REPORT

ilac-MRA DANAK
TEST Reg.nr. 134

Wind Turbine noise measurement, IEC 61400 ed. 2.1
Siemens SWT-3.2-113 2A Rev. 0 mode -2 dB

Report no.: P6.119.15
Aarhus 31. March 2015
Project: 35.6342.27

Client:

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

Commissioned by:

Tomas R. Hansen

Telephone: +45 9942 2605

Prepared by:
Mathias Bødker Borup

Checked by:
Bo Søndergaard

Signatory:
Bo Søndergaard
Bo Søndergaard

Ver. 2007.11.30 PHe

Summary:

For the Siemens wind turbine type SWT-3.2-113 2A mode -2dB, serial number 3000364, the following acoustic data has been determined according to IEC 61400-11 Edition 2.1:

Standardized wind speed [m/s]	6	7*	8*	9*	10*
Power [kW]	1781	2508	2746	2771	2772
Apparent Sound Power Level L_{WA} [dB re 1 pW]	102,3	102,5	102,2	102,2	102,6
Uncertainty U_c [dB]	0,9	1,0	1,1	1,3	1,2
Tonal Audibility ΔL_a [dB]	-9,8	-11,8	-	-10,9	-7,7

* correspond to more than 95% of rated power.

Third octave band spectra are found in Figure 12.

The measurements were carried out on the 21st of March 2015, at Flø wind farm, Brande, Denmark.

TEST REPORT

This Test Report may only be reproduced in full.
The test results are valid for the tested object only.
Text written in *italics* is not part of the accredited test.

DANAK
TEST Reg.nr. 134

Wind Turbine noise measurement, IEC 61400 ed. 2.1
Siemens SWT-3.2-113 2A Rev. 0 mode -1 dB

Report no.: P6.120.15
Aarhus 31. March 2015
Project: 35.6342.27

Client:

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

Commissioned by:

Tomas R. Hansen

Telephone: +45 9942 2605

Prepared by:
Mathias Bødker Borup

Checked by:
Bo Søndergaard

Signatory:
Bo Søndergaard

Bo Søndergaard

Ver. 2007.11.30 PHe

Summary:

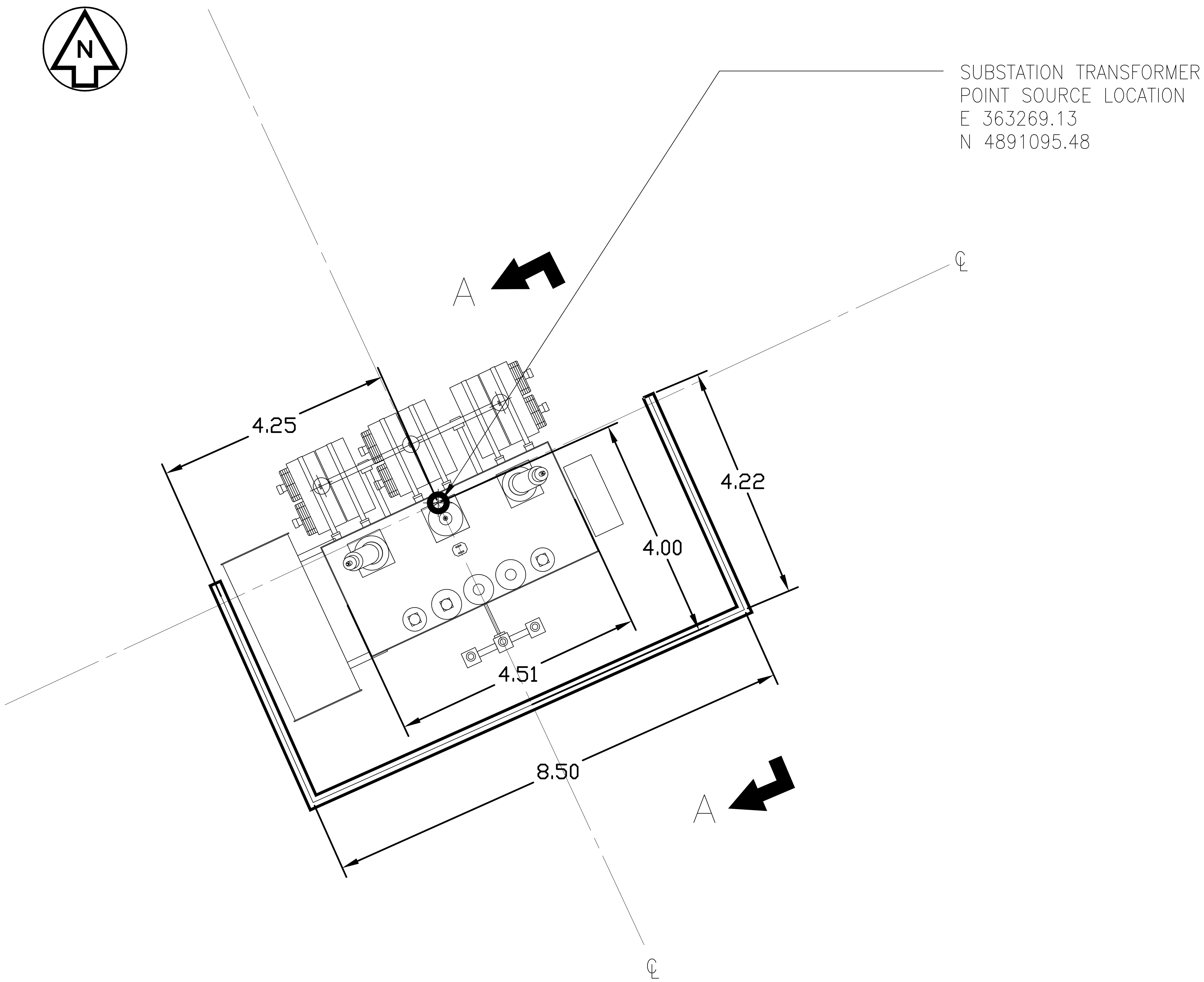
For the Siemens wind turbine type SWT-3.2-113 2A mode -1 dB, serial number 3000364, the following acoustic data has been determined according to IEC 61400-11 Edition 2.1:

		6	7	8*	9*	10*
Standardized wind speed	[m/s]	6	7	8*	9*	10*
Power	[kW]	1788	2564	2893	2940	2942
Apparent Sound Power Level L_{WA}	[dB re 1 pW]	103,6	104,1	103,6	103,6	104,1
Uncertainty U_c	[dB]	1,1	1,1	1,4	1,4	1,5
Tonal Audibility ΔL_a	[dB]	-	-8,5	-6,2	-7,9	-7,8

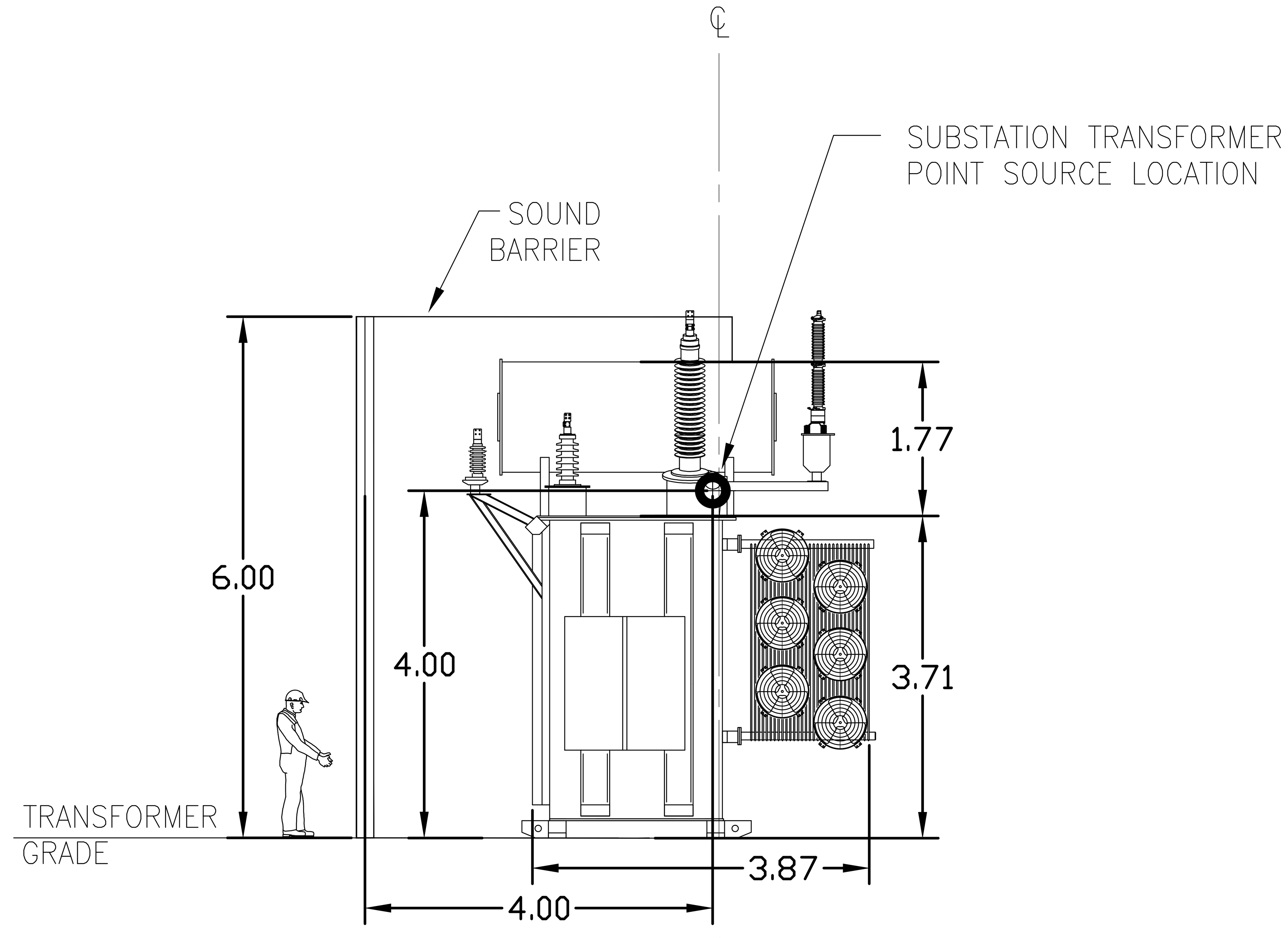
* correspond to more than 95% of rated power.

Third octave band spectra are found in Figure 12.

The measurements were carried out on the 21st of March 2015, at Flø wind farm, Brande, Denmark.



PLAN VIEW



SECTION VIEW
A–A

ALL DIMENSIONS IN METERS

Figure B.2

WINDLECTRIC INS
AMHERST ISLAND WIND PROJECT

HATCH™

SUBSTATION TRANSFORMER AND SOUND BARRIER

662 Cromwell Avenue
Saint Paul, MN 55114
USA

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Toll Free :(888) 645-TEST
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Investigative Chemistry, Non Destructive Testing, Metallurgical Analysis, Geotechnical, Failure Analysis, Materials Testing, Construction Materials, Product Evaluation, Welder Qualification

SOUND ABSORPTION TESTING CONDUCTED ON COMPOSITE CONCRETE PANELS

(Richmond Panel– Lid Side - Natural Stone Pattern)

Prepared for:
DURISOL, INC.
Attn. Jason Scarrow
PO Box 400
51 Arthur Street South
Mitchell, Ontario, Canada NOK1NO

Client Purchase Order Number: Verbal

Prepared By:

Mathew N. Botz
Project Manager
Product Testing Department
(651) 659-7353

Reviewed By:

Kyle T. Hall
Sr. Engineering Technician
Product Testing Department

The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

NVLAP®
NVLAP LAB CODE 200046-0

Noise Reduction Coefficient (ASTM C423-02)

INTRODUCTION:

This report presents the results of sound absorption testing conducted on concrete panels. The test unit was submitted by Mr. Jason Scarrow. This work was completed on October 20, 2006.

This report must not be reproduced except in full with the approval of Stork Twin City Testing Corporation. The data in this report relates only to the items tested.

Stork Twin City Testing Corporation has been accredited by the U.S. Department of Commerce and the National Institute of Standards and Technology (NIST, formerly NBS) under their National Voluntary Laboratory Accreditation Program (NVLAP) for conducting ASTM C423 test procedures. This report may not be used to claim product endorsement by NVLAP, NIST or any agency of the U.S. Government.

TEST RESULTS SUMMARY:

Durisol Concrete Panels

				Test Results		
Test #	**Panel Identification**	**Exposed Surface**	**Weight (psf)**	**NRC**	**SAA**	**--**
1	Richmond Panel, Natural Stone Pattern	Lid Side	37.8	0.80	0.80	--

See 'TEST DATA' section for detailed results.

SPECIMEN DESCRIPTION: (Also see "Test Results")

The specimens were described as concrete panels and were identified by Durisol Inc. as Richmond Panels, RDNBP, with a Natural Stone / Natural Stone pattern. Each panel measured 48" x 36-1/2" x 8" and weighed 460-lbs each (37.8-psf). A total of six (6) panels were tested, for a total of 72-ft^2. The 'Lid' surface with the Natural Stone Pattern was tested. The panels were positioned in a 2x3 orientation. Side by side joints were flat butt-joints and stacked panels had tongue & groove joints.

TEST PROCEDURE

Sound Absorption Test

ASTM C 423-02," Sound Absorption and Sound Absorption Coefficient by the Reverberation Room Method", was followed in every respect. The panels were tested in Type A Mounting (on the floor). The panel edge/perimeter was covered with 8" tall border walls constructed from 5/8" sheetrock

NRC was calculated by rounding the sound absorption coefficients for 250, 500, 1000 and 2000 Hz to the nearest 0.05. SAA was calculated by rounding the sound absorption coefficients for the twelve frequencies from 200 Hz to 2500 Hz to the nearest 0.01.

TEST EQUIPMENT:

Manufacturer	Model	Description	S/N
Norwegian Electronics	NE830	Real Time Analyzer	11511
Brüel & Kjær	3923	Rotating Microphone Boom	815424
Norsonic (Source Rm)	1230	Pressure Condenser Microphone	26361
Brüel & Kjær (Term Rm)	4192	Pressure Condenser Microphone	2360314

REMARKS:

The test sample will be retained for a period of **15-days** and then discarded unless notified by the client.

F:\Product\MMFILES\MNB\2006 - REPORTS MNB\80467-Durisol-1.doc

TEST RESULTS:

Filename: test 1

ASTM C423 - Sound Absorption

Client	Product	Model #	Quantity	Comment
Durisol Inc.	Richmond Panel	RDNBP	1	Lid Side

Sample Size - Wt.: 108.0 in x 96.0 in x 8" - 2760 lbs

Sample Description: Durisol Inc.: : Concrete Panel: Richmond Panel - RDNBP : Natural Stone / Natural Stone Pattern : 3' x 4' at 460-lbs each, 6 panels total :

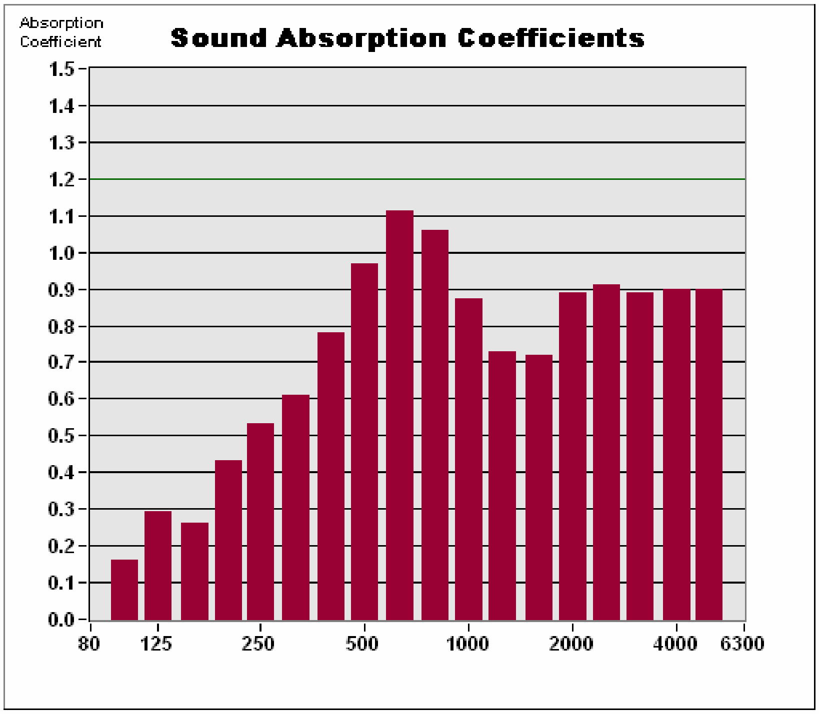
Time Stamp: Fri, Oct 20, 2006 - 10:30 AM

Total Sample Area: 72.0 ft²

F (Hz)	Absorption Coefficient	Absorption (Sabins)*
100	0.16	11.53
125	0.29	21.14
160	0.26	18.73
200	0.43	30.66
250	0.53	38.49
315	0.61	43.93
400	0.78	55.85
500	0.97	69.98
630	1.11	79.60
800	1.06	76.37
1000	0.87	62.99
1250	0.73	52.27
1600	0.72	52.07
2000	0.89	64.41
2500	0.91	65.16
3150	0.89	64.29
4000	0.90	64.62
5000	0.90	65.09

Temp (°C)	R.H. (%)	ATM (mbar)
21.5	54	982

* total absorption based on 72.0 ft²



SAA = 0.80 NRC = 0.80

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NOISE CONTROL /

DURISOL PRECAST NOISE BARRIERS

ATTRACTIVE, SOUND-ABSORPTIVE WALLS MADE OF DURABLE, FIELD-PROVEN DURISOL MATERIAL

Armtec's Durisol precast noise barriers are made of a proprietary material consisting of organic softwood shavings processed to an acoustically engineered size and bonded together under pressure with Portland cement. Durisol is highly sound absorptive, porous, rigid, non-combustible, thermally insulating and freeze-thaw resistant.

Durisol precast noise barriers are panel and post systems. They are engineered in-house and specify the size for posts and the depth and diameter of footings. Standard steel posts or optional concrete posts can be accommodated.

Our standard systems are noise absorptive on both sides. They can also incorporate solid noise reflective or transparent elements, as well as integrated traffic barriers and retaining wall panels.

Visual appeal
Wide variety of architectural textures, patterns and colours

Panel and post design
Lightweight, easy-to-install systems

Acoustical Characteristics
Noise Reduction Coefficient of 0.70 or greater

TYPICAL APPLICATIONS

- Roads and highways
- Bridges
- Acoustic enclosures
- Residential developments

MITCHELL SYSTEM

Posts are spaced 3.65m apart

Wall height
Engineered for heights up to 6m

Versatile
Ideal for slope conditions, directional changes and areas with difficult site access

Flexible
Panels can be modified on-site for short bays

RICHMOND SYSTEM

Posts are spaced 4.56m apart

Wall height
Engineered for heights up to 11m or more

Economical
Fewer panels reduces on-site handling and installation costs

OHIO SYSTEM

Posts are spaced up to 7.3m apart

Wall height
Engineered for heights up to 11m or more

Cost-effective
Longest post spacing of the Durisol systems

Unique
Ideal for straight runs of wall with good site access where noise absorption is not required on the residential side

DURISOL NOISE BARRIER/ RETAINING WALL

Combination noise barrier/ retaining wall system

Innovative design
Noise barrier and retaining wall panels are stacked on top of each other

Minimal space requirements
Useful in tight spaces

Functional
Well-suited for areas where there are grade differences between the two sides of a barrier

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Armtec is a leading Canadian infrastructure and construction materials company combining creative engineered solutions, relevant advice, dedicated people, proven products and a national presence with a local focus on exceptional customer service.

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Appendix C

Sound Pressure Levels at Points of Reception, Sound Pressure Contours from CADNA-A

Table C.1 Noise Impact Summary – Non-Participating Project Nose Receptors (325 receptors)

The table is sorted by noise receptors ID; "Vacant" = vacant lot noise receptor, "Existing" = existing dwelling; "Total" = combined contribution from all sources (substation and WTGs); blank cells in "Sound pressure" columns = POR at more than 5000 m from source.

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R005	Existing	359893	4890564	710	S04	3418	12.9	38.3	38.3	12.0	37.2	37.2	40.0
R008	Vacant	363457	4888709	780	S20	2394	16.7	39.1	39.1	15.9	37.8	37.8	40.0
R011	Existing	366872	4893632	711	S30	4406	9.1	36.5	36.5	8.3	35.4	35.4	40.0
R014	Existing	366786	4893503	617	S30	4262	13.9	37.5	37.5	11.0	36.5	36.5	40.0
R017	Vacant	358641	4888158	1491	S01	5482		30.6	30.6		29.2	29.2	40.0
R020	Existing	362062	4886820	571	S11	4442	9.0	38.4	38.4	8.2	37.4	37.4	40.0
R021	Existing	360101	4890790	777	S04	3183	13.9	36.9	36.9	13.0	35.7	35.7	40.0
R022	Existing	362789	4891859	942	S31	902	34.2	34.0	37.1	29.2	32.8	34.4	40.0
R025	Existing	367198	4890237	722	S02	4022	9.9	38.0	38.0	6.2	36.8	36.8	40.0
R026	Existing	367812	4891038	803	S13	4544	8.6	38.0	38.0	2.9	36.7	36.8	40.0
R027	Existing	365542	4892944	1498	S30	2929	19.5	32.7	32.9	16.6	31.4	31.5	40.0
R029	Existing	367962	4891160	697	S13	4693	4.7	38.3	38.3	2.5	37.1	37.1	40.0
R031	Existing	359345	4888662	905	S01	4617	8.4	34.7	34.7	7.6	33.5	33.5	40.0
R033	Existing	360714	4891207	917	S22	2557	16.9	35.6	35.6	16.0	34.0	34.1	40.0
R035	Existing	361623	4891803	1058	S31	1792	25.9	34.3	34.9	23.4	33.0	33.4	40.0
R036	Existing	368045	4894070	1408	S28	5626		33.7	33.7		32.2	32.2	40.0
R040	Existing	365623	4888851	766	S21	3253	9.7	38.7	38.7	5.8	37.4	37.4	40.0
R041	Existing	359946	4890749	816	S04	3341	13.2	36.8	36.8	12.3	35.6	35.6	40.0
R045	Vacant	357945	4889761	1245	S01	5489		31.1	31.1		29.8	29.8	40.0
R052	Vacant	360318	4890871	800	S04	2959	14.9	36.7	36.8	14.0	35.5	35.5	40.0
R054	Vacant	365772	4893093	1277	S30	3202	18.2	33.3	33.4	15.3	32.0	32.1	40.0
R055	Vacant	359694	4890626	729	S29	3606	12.1	37.3	37.3	11.2	36.1	36.2	40.0
R056	Existing	364908	4890729	1057	S37	1679	20.9	36.9	37.0	19.9	35.5	35.6	40.0
R060	Existing	358523	4889966	770	S01	4878	7.6	35.5	35.5	6.8	34.4	34.4	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R065	Existing	365563	4893048	1481	S30	3012	19.1	32.5	32.7	16.2	31.2	31.3	40.0
R066	Vacant	357961	4889769	1231	S01	5472		31.2	31.2		29.9	29.9	40.0
R068	Existing	364914	4890629	972	S37	1710	20.9	37.4	37.5	19.8	36.1	36.2	40.0
R069	Existing	367873	4894024	1366	S30	5456		33.8	33.8		32.4	32.4	40.0
R070	Existing	357913	4889708	1269	S01	5533		30.9	30.9		29.7	29.7	40.0
R074	Existing	369960	4893872	1145	S28	7244		33.7	33.7		32.4	32.4	40.0
R077	Vacant	367001	4889892	702	S02	3921	9.6	37.8	37.8	7.3	36.6	36.6	40.0
R078	Existing	360762	4891155	848	S22	2508	17.2	36.2	36.3	16.3	34.6	34.7	40.0
R079	Existing	359604	4890575	668	S29	3702	11.8	37.6	37.6	10.8	36.5	36.5	40.0
R080	Existing	362200	4887075	575	S11	4160	10.0	38.4	38.4	9.1	37.4	37.4	40.0
R081	Vacant	360150	4890764	735	S04	3137	14.1	37.2	37.3	13.2	36.1	36.1	40.0
R084	Vacant	361772	4892151	1260	S31	1832	25.6	32.3	33.1	23.1	30.9	31.6	40.0
R085	Existing	360668	4891181	939	S22	2602	16.7	35.6	35.6	15.8	34.0	34.1	40.0
R088	Vacant	360378	4885827	1399	S09	6010		30.8	30.8		29.6	29.6	40.0
R090	Existing	358709	4890096	715	S01	4668	8.2	36.6	36.6	7.5	35.5	35.6	40.0
R091	Existing	366966	4889848	709	S02	3902	9.8	37.7	37.7	7.5	36.5	36.5	40.0
R092	Existing	368778	4894417	1327	S28	6432		32.4	32.4		31.0	31.0	40.0
R093	Existing	359060	4888604	954	S01	4891	7.5	33.9	33.9	6.7	32.6	32.7	40.0
R094	Existing	367581	4893976	1168	S30	5185		34.1	34.1		32.7	32.7	40.0
R096	Existing	362996	4891908	1095	S31	857	34.7	33.2	37.0	32.7	31.9	35.3	40.0
R097	Existing	368666	4894336	1281	S28	6295		32.9	32.9		31.5	31.5	40.0
R098	Existing	359161	4890353	598	S29	4175	10.0	38.2	38.2	9.1	37.2	37.2	40.0
R099	Existing	368290	4891445	620	S13	5033		38.8	38.8		37.6	37.6	40.0
R100	Existing	357760	4889636	1414	S01	5699		29.9	29.9		28.6	28.6	40.0
R101	Existing	361821	4891454	673	S31	1491	28.1	37.5	38.0	25.6	36.4	36.7	40.0
R105	Existing	367259	4890334	771	S02	4062	8.9	37.9	37.9	5.9	36.7	36.7	40.0
R107	Existing	363640	4888526	957	S36	2596	15.8	37.9	37.9	15.0	36.4	36.5	40.0
R109	Existing	362949	4888140	792	S05	2972	14.5	37.7	37.7	13.6	36.4	36.4	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R112	Vacant	365595	4893202	1468	S30	3138	14.1	32.3	32.4	13.1	30.7	30.8	40.0
R114	Existing	366256	4889386	833	S27	3441	9.1	38.5	38.5	6.2	37.3	37.3	40.0
R118	Existing	367227	4893765	845	S30	4774	12.1	35.7	35.7	9.2	34.4	34.4	40.0
R122	Existing	363067	4891931	1157	S31	860	34.7	32.9	36.9	32.3	31.6	35.0	40.0
R123	Vacant	358576	4890039	770	S01	4810	7.8	35.7	35.7	7.0	34.6	34.6	40.0
R125	Existing	369190	4893990	869	S28	6591		35.7	35.7		34.4	34.4	40.0
R126	Existing	360677	4891064	871	S22	2592	16.7	36.4	36.4	15.7	35.0	35.0	40.0
R127	Existing	363902	4889092	977	S36	2101	17.9	38.7	38.8	17.0	37.2	37.3	40.0
R128	Existing	366068	4889271	813	S37	3341	7.7	38.7	38.7	6.6	37.5	37.5	40.0
R130	Existing	366563	4889572	804	S02	3629	10.1	38.2	38.2	9.2	37.0	37.0	40.0
R131	Existing	366560	4893285	590	S30	3953	10.8	37.9	37.9	9.8	37.0	37.0	40.0
R138	Existing	359899	4890759	851	S04	3387	13.0	36.6	36.6	12.2	35.4	35.4	40.0
R142	Existing	364168	4889387	794	S21	1930	18.7	39.0	39.0	10.3	37.6	37.6	40.0
R143	Vacant	367172	4893575	648	S30	4624	12.6	37.5	37.5	9.7	36.4	36.5	40.0
R145	Existing	364482	4890164	867	S19	1529	21.2	37.9	38.0	20.0	36.6	36.7	40.0
R149	Vacant	361532	4886274	938	S11	5125		35.6	35.6		34.3	34.3	40.0
R150	Vacant	366698	4889682	722	S02	3709	10.0	38.2	38.3	9.1	37.1	37.1	40.0
R151	Vacant	368981	4893971	851	S28	6395		35.9	35.9		34.7	34.7	40.0
R153	Vacant	368674	4893985	954	S28	6128		35.3	35.3		34.0	34.0	40.0
R157	Existing	360805	4891182	830	S22	2465	17.4	36.2	36.3	16.5	34.7	34.8	40.0
R159	Existing	358305	4889843	915	S01	5120		33.8	33.8		32.6	32.6	40.0
R160	Existing	366960	4889781	756	S02	3918	9.8	37.4	37.4	5.1	36.1	36.1	40.0
R162	Existing	357982	4889754	1207	S01	5455		31.4	31.4		30.1	30.1	40.0
R164	Existing	361050	4891333	785	S22	2232	18.7	36.3	36.3	17.8	35.1	35.2	40.0
R165	Existing	359814	4890699	829	S29	3478	12.7	36.9	36.9	11.7	35.7	35.7	40.0
R166	Existing	363313	4890643	742	S34	455	30.7	37.4	38.2	29.4	36.1	37.0	40.0
R167	Existing	359113	4888625	928	S01	4835	7.6	34.2	34.2	6.9	32.9	32.9	40.0
R168	Existing	361769	4886562	656	S11	4775	7.9	37.7	37.7	7.1	36.7	36.7	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R173	Existing	364889	4890554	930	S37	1708	21.0	37.7	37.8	19.9	36.4	36.5	40.0
R175	Vacant	367980	4894001	1413	S28	5534		34.0	34.0		32.6	32.6	40.0
R176	Vacant	369874	4893890	1093	S28	7171		34.1	34.1		32.8	32.8	40.0
R180	Vacant	366000	4889211	814	S37	3318	7.3	38.7	38.7	6.1	37.5	37.5	40.0
R182	Existing	360558	4890989	925	S04	2713	16.1	36.4	36.5	15.2	35.1	35.2	40.0
R183	Vacant	359023	4888530	1032	S01	4962	7.2	33.3	33.3	1.2	32.0	32.0	40.0
R184	Vacant	370001	4892471	744	S33	6871		37.3	37.3		36.1	36.1	40.0
R185	Vacant	358849	4890145	676	S01	4521	8.7	37.5	37.5	8.0	36.5	36.5	40.0
R186	Vacant	358699	4890036	678	S01	4691	8.2	36.9	36.9	7.4	35.9	35.9	40.0
R190	Existing	365881	4893230	1194	S30	3373	17.5	33.4	33.5	12.3	31.9	32.0	40.0
R192	Existing	366628	4889597	788	S02	3678	10.0	38.0	38.0	9.1	36.8	36.8	40.0
R193	Existing	360787	4891238	880	S22	2487	17.3	35.7	35.8	16.4	34.3	34.3	40.0
R194	Existing	366226	4893109	831	S30	3577	12.3	35.8	35.9	11.3	34.6	34.6	40.0
R197	Existing	368995	4891793	734	S12	5768		38.1	38.1		36.9	36.9	40.0
R201	Existing	357805	4889647	1371	S01	5653		30.2	30.2		28.9	28.9	40.0
R202	Existing	367665	4894018	1246	S30	5278		33.8	33.8		32.4	32.4	40.0
R203	Existing	360989	4886500	604	S09	5130		38.2	38.2		37.2	37.2	40.0
R204	Existing	360702	4885983	1148	S09	5721		32.7	32.7		31.4	31.4	40.0
R205	Vacant	358654	4890060	727	S01	4730	8.0	36.3	36.3	7.3	35.2	35.2	40.0
R213	Vacant	362172	4886997	570	S11	4243	9.7	38.4	38.4	8.8	37.5	37.5	40.0
R215	Vacant	363116	4888322	717	S05	2778	15.2	38.5	38.5	14.4	37.3	37.3	40.0
R216	Vacant	360447	4885766	1429	S09	6030		30.7	30.7		29.4	29.4	40.0
R219	Vacant	359279	4888645	912	S01	4682	8.1	34.6	34.6	7.4	33.3	33.3	40.0
R222	Existing	359277	4890416	581	S29	4050	10.4	38.3	38.3	9.6	37.3	37.3	40.0
R226	Vacant	365709	4893089	1339	S30	3151	18.4	33.0	33.2	15.5	31.7	31.8	40.0
R227	Existing	365574	4888708	768	S21	3318	9.6	38.2	38.2	5.9	37.0	37.0	40.0
R231	Existing	362126	4891540	556	S31	1227	30.3	38.0	38.7	25.1	37.1	37.4	40.0
R233	Existing	358904	4888447	1136	S01	5106		32.5	32.5		31.2	31.2	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R235	Vacant	365888	4889147	806	S37	3265	7.1	38.9	38.9	5.8	37.6	37.6	40.0
R239	Existing	366019	4889228	813	S37	3324	7.4	38.7	38.7	6.2	37.5	37.5	40.0
R244	Existing	360730	4891215	910	S22	2542	17.0	35.6	35.6	16.1	34.1	34.1	40.0
R245	Existing	365893	4893153	1166	S30	3334	13.3	33.7	33.7	12.3	32.2	32.3	40.0
R246	Existing	366902	4889729	765	S02	3881	9.8	37.4	37.4	5.1	36.2	36.2	40.0
R247	Existing	360436	4890915	839	S04	2839	15.5	36.6	36.7	14.6	35.4	35.4	40.0
R249	Vacant	362069	4885844	1428	S11	5387		31.5	31.5		30.2	30.2	40.0
R251	Vacant	366186	4889351	839	S27	3399	8.8	38.7	38.7	6.5	37.4	37.4	40.0
R253	Vacant	366368	4889475	809	S27	3497	10.1	38.5	38.5	5.9	37.3	37.3	40.0
R256	Vacant	368821	4891649	886	S12	5580		37.4	37.4		36.1	36.1	40.0
R259	Vacant	360151	4890808	775	S04	3132	14.2	36.9	36.9	13.2	35.6	35.7	40.0
R261	Existing	364674	4890296	851	S19	1617	21.0	38.1	38.2	19.9	36.8	36.9	40.0
R265	Existing	368058	4891269	622	S13	4792	4.7	38.8	38.8	2.7	37.7	37.7	40.0
R266	Existing	368149	4894137	1381	S28	5750		33.4	33.4		32.0	32.0	40.0
R267	Existing	365616	4893060	1428	S30	3060	18.9	32.7	32.9	15.9	31.4	31.5	40.0
R268	Existing	358467	4889930	801	S01	4942	7.4	35.1	35.1	6.6	34.0	34.0	40.0
R271	Existing	360734	4891167	877	S22	2536	17.0	36.0	36.0	16.1	34.4	34.5	40.0
R275	Existing	361386	4891597	943	S22	1949	24.9	35.2	35.6	19.5	33.9	34.1	40.0
R276	Existing	365906	4893126	1149	S30	3328	13.3	33.8	33.9	12.5	32.3	32.3	40.0
R278	Existing	366657	4889616	775	S02	3697	10.0	38.0	38.0	9.1	36.8	36.8	40.0
R280	Existing	364392	4890113	902	S19	1492	21.2	37.8	37.9	20.1	36.5	36.6	40.0
R282	Vacant	360437	4885826	1377	S09	5982		31.0	31.0		29.7	29.7	40.0
R283	Existing	362698	4891900	942	S31	987	28.8	33.9	35.1	28.2	32.2	33.7	40.0
R284	Vacant	361792	4892073	1181	S31	1771	26.0	32.8	33.6	23.6	31.5	32.1	40.0
R287	Vacant	366449	4893198	644	S30	3812	11.3	37.4	37.4	10.4	36.3	36.4	40.0
R288	Vacant	360601	4890918	864	S04	2674	16.3	37.0	37.1	15.4	35.8	35.8	40.0
R289	Vacant	366325	4893068	726	S30	3637	12.0	36.8	36.8	11.0	35.7	35.7	40.0
R291	Existing	363359	4888447	816	S05	2650	15.7	38.2	38.3	14.8	36.9	37.0	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R292	Existing	359462	4890503	602	S29	3853	11.2	38.1	38.1	10.2	37.1	37.1	40.0
R293	Existing	366725	4893495	637	S30	4207	9.8	37.3	37.3	9.0	36.3	36.3	40.0
R294	Vacant	360012	4890761	791	S04	3274	13.5	36.9	36.9	12.6	35.7	35.7	40.0
R295	Vacant	367768	4890950	892	S13	4501	8.8	37.7	37.7	3.9	36.4	36.4	40.0
R300	Existing	359452	4888735	863	S01	4488	8.8	35.3	35.3	8.0	34.0	34.0	40.0
R301	Existing	360046	4890779	790	S04	3239	13.7	36.8	36.9	12.8	35.6	35.6	40.0
R305	Existing	366313	4889429	820	S27	3470	10.1	38.5	38.5	6.2	37.3	37.3	40.0
R306	Existing	369559	4893778	802	S28	6838		36.6	36.6		35.4	35.4	40.0
R307	Existing	360208	4890842	792	S04	3071	14.4	36.7	36.7	13.5	35.5	35.5	40.0
R308	Existing	360481	4889210	870	S04	3366	12.8	36.9	37.0	11.9	35.6	35.6	40.0
R309	Existing	360738	4891222	908	S22	2534	17.0	35.5	35.6	16.2	34.1	34.2	40.0
R314	Existing	358234	4889849	984	S01	5187		33.2	33.2		32.0	32.0	40.0
R315	Existing	369384	4893953	876	S28	6749		35.6	35.6		34.4	34.4	40.0
R316	Existing	358861	4890030	571	S01	4535	8.7	38.6	38.6	7.9	37.7	37.7	40.0
R322	Existing	365833	4889090	834	S37	3256	7.2	38.8	38.8	5.9	37.5	37.5	40.0
R323	Vacant	366808	4889767	684	S02	3780	10.0	38.2	38.2	9.2	37.1	37.1	40.0
R324	Vacant	362433	4891633	611	S31	994	32.8	37.1	38.5	30.7	36.1	37.2	40.0
R326	Vacant	360840	4891142	778	S22	2430	17.6	36.7	36.7	16.7	35.4	35.5	40.0
R327	Vacant	367547	4890730	868	S14	4293	5.5	37.7	37.7	4.7	36.4	36.5	40.0
R331	Vacant	365802	4893036	1241	S30	3191	18.3	33.6	33.7	12.9	32.3	32.3	40.0
R332	Vacant	360897	4891167	751	S22	2373	17.9	36.8	36.9	17.0	35.6	35.7	40.0
R333	Existing	362146	4891676	677	S31	1264	25.5	36.2	36.6	24.6	35.0	35.4	40.0
R335	Existing	367376	4893735	863	S30	4882	11.7	35.8	35.8	8.9	34.6	34.6	40.0
R338	Existing	361116	4886227	892	S09	5323		35.4	35.4		34.2	34.2	40.0
R339	Existing	366644	4893340	561	S30	4053	10.4	38.3	38.3	9.5	37.3	37.3	40.0
R342	Existing	368512	4891540	762	S13	5262		37.9	37.9		36.6	36.6	40.0
R347	Existing	357871	4889681	1308	S01	5581		30.6	30.6		29.3	29.3	40.0
R348	Existing	360487	4890950	877	S04	2786	15.8	36.5	36.5	14.8	35.2	35.3	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R349	Existing	363772	4888688	867	S36	2460	16.4	38.3	38.3	15.4	36.8	36.9	40.0
R350	Existing	366311	4893115	750	S30	3651	12.0	36.5	36.5	11.0	35.3	35.3	40.0
R351	Vacant	366775	4889715	717	S02	3768	9.9	38.0	38.1	9.1	36.9	36.9	40.0
R352	Vacant	369763	4892264	689	S33	6598		38.4	38.4		37.3	37.3	40.0
R353	Existing	359505	4890524	618	S29	3807	11.3	37.9	38.0	10.4	36.9	36.9	40.0
R354	Vacant	364781	4890839	1220	S37	1533	21.6	36.0	36.2	20.6	34.6	34.8	40.0
R355	Vacant	362901	4891871	1011	S31	859	34.7	33.7	37.2	32.7	32.4	35.6	40.0
R356	Vacant	362602	4887414	984	S11	3741	11.5	35.7	35.7	10.6	34.3	34.3	40.0
R357	Vacant	366748	4889709	712	S02	3745	10.0	38.2	38.2	9.1	37.0	37.0	40.0
R360	Vacant	360396	4890844	768	S04	2884	15.3	37.1	37.1	14.3	35.9	35.9	40.0
R362	Vacant	369716	4892234	686	S33	6547		38.5	38.5		37.5	37.5	40.0
R364	Existing	358796	4888349	1259	S01	5249		31.8	31.8		30.4	30.4	40.0
R365	Vacant	360797	4891118	798	S22	2472	17.4	36.6	36.7	16.4	35.3	35.4	40.0
R369	Existing	360965	4890937	558	S22	2310	22.7	39.1	39.2	20.1	38.1	38.2	40.0
R374	Existing	369808	4893889	1046	S28	7111		34.4	34.4		33.1	33.1	40.0
R375	Existing	357788	4889639	1387	S01	5671		30.1	30.1		28.8	28.8	40.0
R380	Existing	362677	4891770	813	S31	897	34.2	35.0	37.7	32.2	33.8	36.1	40.0
R386	Existing	364270	4890005	947	S19	1480	21.1	37.9	38.0	20.0	36.5	36.6	40.0
R387	Existing	366670	4893402	591	S30	4109	10.2	37.9	37.9	9.3	36.9	36.9	40.0
R389	Vacant	361023	4891249	729	S22	2252	23.0	36.8	37.0	17.7	35.7	35.8	40.0
R390	Vacant	364033	4889676	743	S34	1612	20.2	38.7	38.7	19.3	37.3	37.3	40.0
R393	Vacant	368197	4894190	1388	S28	5819		33.2	33.2		31.8	31.8	40.0
R394	Existing	359641	4890604	699	S29	3661	11.9	37.4	37.4	11.0	36.3	36.3	40.0
R396	Existing	361426	4891626	970	S22	1918	25.1	35.1	35.5	19.7	33.8	34.0	40.0
R401	Vacant	366899	4893486	564	S30	4346	13.6	38.2	38.3	10.7	37.3	37.3	40.0
R405	Existing	362809	4886297	1480	S11	4820	7.7	31.6	31.6	7.0	30.3	30.3	40.0
R407	Existing	360590	4891007	926	S22	2681	16.3	36.4	36.5	15.4	35.1	35.1	40.0
R411	Existing	362360	4892437	1408	S31	1620	27.1	31.1	32.5	24.7	29.8	31.0	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R412	Existing	367587	4890848	855	S14	4325	9.4	38.1	38.1	4.1	36.8	36.8	40.0
R415	Existing	360594	4891137	980	S22	2676	16.3	35.6	35.7	15.4	34.1	34.1	40.0
R416	Existing	362577	4891721	731	S31	933	33.8	35.7	37.9	31.7	34.6	36.4	40.0
R417	Existing	362565	4887449	956	S11	3713	11.6	35.9	36.0	10.7	34.6	34.6	40.0
R420	Existing	368977	4891757	770	S12	5746		37.8	37.8		36.6	36.6	40.0
R421	Existing	361093	4891340	770	S22	2189	18.9	36.4	36.5	18.0	35.2	35.3	40.0
R422	Existing	368133	4894055	1334	S28	5693		33.9	33.9		32.5	32.5	40.0
R425	Existing	369291	4893952	849	S28	6665		35.9	35.9		34.7	34.7	40.0
R430	Vacant	359558	4890551	642	S29	3751	11.6	37.8	37.8	10.6	36.7	36.7	40.0
R431	Existing	366520	4893262	611	S30	3906	11.0	37.7	37.7	10.0	36.7	36.7	40.0
R433	Vacant	361494	4891408	754	S22	1803	25.8	37.0	37.3	23.2	35.9	36.1	40.0
R436	Existing	362930	4891822	987	S31	802	35.4	33.9	37.7	33.5	32.6	36.1	40.0
R439	Existing	365949	4889171	817	S37	3299	7.1	38.7	38.7	5.8	37.5	37.5	40.0
R440	Vacant	367787	4893861	1185	S30	5297		34.7	34.7		33.3	33.3	40.0
R447	Existing	360700	4891163	903	S22	2570	16.8	35.9	35.9	15.9	34.3	34.3	40.0
R450	Existing	367116	4890118	676	S02	3969	7.3	38.1	38.1	6.4	36.9	37.0	40.0
R454	Existing	368019	4891231	644	S13	4752	4.7	38.6	38.6	1.7	37.5	37.5	40.0
R459	Existing	367339	4893889	995	S30	4936	7.4	33.7	33.7	6.6	32.5	32.5	40.0
R460	Existing	358748	4890166	747	S01	4616	8.4	36.5	36.5	7.7	35.4	35.4	40.0
R462	Vacant	360797	4891042	755	S22	2472	21.8	37.1	37.2	16.4	35.9	35.9	40.0
R464	Vacant	367916	4891122	726	S13	4647	8.3	38.2	38.2	2.7	37.0	37.0	40.0
R465	Vacant	359201	4888621	931	S01	4762	7.9	34.3	34.3	7.1	33.0	33.0	40.0
R466	Existing	361721	4886415	794	S11	4930	7.4	36.4	36.4	6.6	35.3	35.3	40.0
R467	Existing	363656	4888940	822	S20	2190	17.6	38.9	38.9	16.7	37.5	37.6	40.0
R468	Existing	360663	4891152	928	S22	2607	16.7	35.8	35.8	15.7	34.2	34.2	40.0
R470	Vacant	366861	4893464	553	S30	4303	13.8	38.4	38.4	10.8	37.5	37.5	40.0
R473	Vacant	360111	4889023	1042	S29	3777	11.3	36.3	36.3	10.4	34.9	34.9	40.0
R474	Existing	359973	4890759	810	S04	3314	13.4	36.8	36.8	12.5	35.6	35.6	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Substation	POR at 4.5 m			POR at 1.5 within 30 m			Limit
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	
R476	Existing	362890	4887884	1021	S05	3234	13.4	36.3	36.3	12.6	34.9	34.9	40.0
R477	Existing	366920	4893657	726	S30	4460	13.2	36.4	36.4	8.2	35.2	35.2	40.0
R478	Existing	360615	4891158	972	S22	2655	16.4	35.6	35.6	15.4	34.0	34.1	40.0
R479	Existing	360802	4891262	885	S22	2473	17.4	35.6	35.7	16.4	34.2	34.2	40.0
R480	Existing	359029	4890238	626	S29	4326	9.4	38.3	38.3	8.6	37.3	37.3	40.0
R481	Existing	367777	4893927	1231	S30	5323		34.3	34.3		32.9	32.9	40.0
R483	Existing	360249	4889075	1014	S04	3634	11.8	36.4	36.4	10.9	35.0	35.0	40.0
R487	Existing	361390	4886229	978	S09	5217		35.3	35.3		34.1	34.1	40.0
R488	Existing	362754	4887614	1186	S11	3520	12.3	35.6	35.6	11.4	34.1	34.1	40.0
R493	Existing	363947	4889535	722	S34	1701	19.7	38.9	38.9	18.9	37.5	37.6	40.0
R498	Vacant	368372	4894049	1169	S28	5896		34.2	34.2		32.9	32.9	40.0
R502	Vacant	369943	4892403	728	S33	6800		37.5	37.5		36.4	36.4	40.0
R507	Existing	362913	4891806	964	S31	795	35.5	34.0	37.8	33.6	32.7	36.2	40.0
R508	Vacant	367543	4893804	999	S30	5060		35.2	35.2		33.8	33.8	40.0
R509	Vacant	360379	4890888	812	S04	2898	15.2	36.7	36.8	14.2	35.5	35.5	40.0
R511	Existing	366940	4893673	739	S30	4486	13.1	36.2	36.3	8.1	35.1	35.1	40.0
R514	Existing	361461	4886275	947	S11	5148		35.7	35.7		34.5	34.5	40.0
R516	Existing	364116	4889770	802	S34	1573	20.4	38.4	38.5	19.5	37.0	37.1	40.0
R517	Existing	368681	4894038	998	S28	6160		34.9	34.9		33.6	33.6	40.0
R518	Existing	359892	4890709	817	S04	3399	13.0	37.0	37.0	12.1	35.8	35.8	40.0
R519	Existing	367020	4890008	643	S02	3905	7.7	38.3	38.3	6.5	37.2	37.2	40.0
R522	Existing	359403	4890491	603	S29	3913	10.9	38.0	38.0	10.1	37.0	37.0	40.0
R523	Existing	361324	4891465	818	S22	1980	24.7	36.1	36.4	22.1	34.9	35.1	40.0
R524	Existing	361123	4891395	807	S22	2167	19.1	36.0	36.1	18.2	34.8	34.9	40.0
R525	Existing	359206	4890382	592	S29	4125	10.1	38.2	38.2	9.3	37.3	37.3	40.0
R526	Existing	362022	4891479	553	S31	1305	29.6	38.3	38.9	24.3	37.4	37.6	40.0
R527	Existing	361306	4891547	902	S22	2014	20.0	35.4	35.5	19.1	34.1	34.2	40.0
R528	Existing	367900	4894004	1368	S30	5468		33.9	33.9		32.5	32.5	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R531	Vacant	358037	4889756	1153	S01	5400		31.8	31.8		30.5	30.5	40.0
R532	Vacant	366125	4889308	829	S37	3369	7.8	38.7	38.7	6.4	37.5	37.5	40.0
R533	Existing	359064	4890367	676	S29	4268	9.6	37.4	37.4	8.8	36.3	36.3	40.0
R538	Existing	360529	4890971	903	S04	2743	16.0	36.5	36.5	15.1	35.1	35.2	40.0
R540	Vacant	358752	4890104	694	S01	4624	8.4	36.9	36.9	7.6	35.9	35.9	40.0
R541	Existing	359436	4890475	580	S29	3883	11.1	38.3	38.3	10.2	37.3	37.3	40.0
R545	Vacant	365229	4887408	1178	S36	4176	8.6	33.0	33.1	7.9	31.7	31.7	40.0
R547	Existing	360683	4891197	937	S22	2589	16.7	35.5	35.6	15.8	34.0	34.0	40.0
R549	Existing	360940	4891214	754	S22	2332	18.1	36.7	36.7	17.2	35.5	35.6	40.0
R551	Existing	357981	4889730	1204	S01	5462		31.4	31.4		30.1	30.1	40.0
R552	Existing	359148	4888646	906	S01	4794	7.8	34.4	34.4	7.0	33.1	33.2	40.0
R555	Existing	363019	4888085	870	S05	3020	14.3	37.1	37.2	13.4	35.8	35.8	40.0
R560	Existing	366733	4889671	743	S02	3745	9.9	38.0	38.0	9.1	36.8	36.8	40.0
R562	Existing	359240	4890437	618	S29	4082	10.3	37.8	37.8	9.5	36.8	36.8	40.0
R565	Existing	368500	4894374	1380	S28	6174		32.5	32.5		31.1	31.1	40.0
R568	Vacant	367503	4893727	913	S30	4985	11.4	35.7	35.8	8.5	34.4	34.5	40.0
R569	Vacant	358913	4890177	677	S01	4452	9.0	37.8	37.8	8.2	36.8	36.8	40.0
R570	Existing	367045	4893676	735	S30	4573	12.8	36.4	36.4	9.9	35.3	35.3	40.0
R571	Vacant	364037	4889790	721	S34	1514	20.7	38.6	38.6	19.8	37.2	37.3	40.0
R574	Vacant	361281	4891427	789	S22	2016	24.4	36.3	36.6	21.8	35.1	35.3	40.0
R576	Existing	361477	4891672	1017	S22	1882	25.3	34.9	35.3	22.8	33.6	33.9	40.0
R581	Existing	357958	4889741	1229	S01	5482		31.2	31.2		29.9	29.9	40.0
R582	Existing	368198	4891377	603	S13	4937	4.3	38.9	38.9	3.1	37.8	37.8	40.0
R584	Existing	359512	4890469	563	S29	3809	11.3	38.6	38.6	10.4	37.7	37.7	40.0
R585	Existing	362088	4891716	733	S31	1334	24.9	35.9	36.2	24.1	34.4	34.8	40.0
R587	Existing	367153	4893734	801	S30	4696	12.4	35.9	35.9	7.4	34.7	34.7	40.0
R590	Existing	369626	4893805	864	S28	6910		36.0	36.0		34.8	34.8	40.0
R593	Existing	360756	4891210	885	S22	2515	17.1	35.7	35.8	16.3	34.3	34.3	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R602	Existing	362078	4891512	552	S31	1262	30.0	38.2	38.8	24.7	37.3	37.5	40.0
R604	Vacant	359924	4888947	964	S01	3976	10.5	36.1	36.1	9.7	34.8	34.8	40.0
R607	Existing	364312	4889960	888	S19	1542	20.8	38.1	38.2	19.7	36.8	36.8	40.0
R608	Vacant	369253	4891943	656	S12	6044		38.8	38.8		37.7	37.7	40.0
R609	Vacant	369303	4891969	659	S12	6097		38.9	38.9		37.8	37.8	40.0
R610	Vacant	362241	4886993	637	S11	4230	9.7	37.6	37.6	8.9	36.6	36.6	40.0
R611	Vacant	363447	4891985	1460	S31	907	29.3	32.0	33.9	28.8	30.6	32.8	40.0
R612	Existing	359317	4890473	614	S29	4001	10.6	37.8	37.8	9.7	36.8	36.8	40.0
R613	Existing	358798	4888273	1332	S01	5287		31.4	31.4		30.1	30.1	40.0
R614	Vacant	366592	4889595	785	S02	3646	10.1	38.2	38.2	9.2	37.0	37.0	40.0
R615	Existing	366692	4889634	766	S02	3722	9.9	37.9	37.9	9.1	36.7	36.7	40.0
R616	Vacant	366974	4889878	693	S02	3900	9.7	37.9	37.9	7.4	36.7	36.7	40.0
R619	Existing	364846	4890591	986	S37	1655	21.3	37.3	37.4	20.2	36.0	36.1	40.0
R620	Existing	362854	4891844	962	S31	856	34.7	34.0	37.4	32.8	32.7	35.7	40.0
R622	Vacant	366374	4893149	698	S30	3722	11.7	36.9	36.9	10.7	35.8	35.8	40.0
R623	Vacant	361623	4891448	811	S22	1683	26.7	37.0	37.3	24.2	35.8	36.1	40.0
R625	Existing	362841	4891878	984	S31	892	34.3	33.8	37.1	32.3	32.5	35.4	40.0
R626	Existing	362457	4891736	716	S31	1034	32.2	35.9	37.5	30.0	34.8	36.1	40.0
R627	Vacant	362715	4887724	1158	S05	3416	12.7	36.0	36.0	11.9	34.6	34.6	40.0
R632	Existing	367413	4893773	913	S30	4934	11.6	35.5	35.5	8.7	34.2	34.2	40.0
R633	Existing	362614	4891873	887	S31	1017	27.9	34.0	35.0	27.9	32.5	33.8	40.0
R636	Existing	360541	4891112	1014	S22	2728	16.0	35.6	35.6	15.1	34.1	34.1	40.0
R637	Existing	361463	4886045	1174	S11	5363		33.7	33.7		32.5	32.5	40.0
R638	Vacant	367596	4893832	1051	S30	5119		35.0	35.0		33.6	33.6	40.0
R641	Existing	361144	4891459	858	S22	2156	19.1	35.2	35.3	18.2	34.0	34.2	40.0
R643	Existing	361178	4891489	875	S22	2127	19.3	35.0	35.2	18.4	33.9	34.0	40.0
R670	Existing	361834	4891347	600	S31	1457	28.4	38.5	38.9	26.0	37.5	37.8	40.0
R673	Existing	366974	4890051	582	S02	3849	9.6	39.0	39.0	6.7	37.9	37.9	40.0

Noise Receptor ID	Description	UTM NAD 83, Zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]						
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m			
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total	Limit
R693	Existing	361775	4886598	622	S11	4739	8.0	38.1	38.1	7.2	37.1	37.1	40.0
R694	Existing	358435	4889082	874	S01	5237		33.9	33.9		32.8	32.8	40.0
R695	Existing	359183	4890360	589	S29	4152	10.0	38.3	38.3	9.2	37.3	37.3	40.0
R696	Existing	359353	4890487	615	S29	3963	10.8	37.8	37.8	9.9	36.8	36.8	40.0
R697	Existing	359774	4890703	822	S29	3517	12.5	36.8	36.8	11.6	35.5	35.6	40.0
R698	Existing	360402	4890935	859	S04	2872	15.3	36.4	36.5	14.4	35.1	35.2	40.0
R699	Existing	362107	4891706	717	S31	1313	25.1	35.9	36.2	24.2	34.6	35.0	40.0
R700	Existing	362391	4892427	1399	S31	1595	27.3	31.2	32.7	24.9	29.9	31.1	40.0
R708	Existing	365565	4893159	1491	S30	3087	18.7	32.3	32.5	13.5	30.9	31.0	40.0
R709	Vacant	364932	4890605	942	S37	1734	20.8	37.6	37.7	19.7	36.3	36.4	40.0
R710	Existing	364665	4890379	928	S19	1568	21.4	37.7	37.8	20.3	36.3	36.4	40.0
R711	Vacant	362959	4888080	853	S05	3032	14.2	37.2	37.3	13.4	35.9	35.9	40.0
R712	Existing	362837	4886350	1471	S11	4765	7.9	31.7	31.7	7.1	30.3	30.4	40.0
R723	Existing	366870	4893610	690	S30	4392	13.4	36.7	36.7	8.3	35.6	35.6	40.0
R724	Existing	367973	4891218	643	S13	4705	4.7	38.7	38.7	1.5	37.6	37.6	40.0
R725	Vacant	369414	4893893	831	S28	6751		36.1	36.1		34.9	34.9	40.0
R726	Existing	368834	4894356	1255	S28	6450		32.8	32.8		31.5	31.5	40.0
R727	Existing	366503	4892626	622	S30	3578	12.0	39.1	39.1	11.0	38.0	38.0	40.0
R728	Existing	367118	4890143	669	S02	3964	7.2	38.2	38.2	6.4	37.1	37.1	40.0
R730	Existing	366481	4889550	821	S27	3564	10.1	38.5	38.5	6.1	37.2	37.3	40.0
R731	Existing	366491	4889566	807	S02	3566	10.2	38.5	38.5	9.2	37.3	37.3	40.0

Table C.2 Noise Impact Summary – Participating Project Noise Receptors (44 receptors)

The table is sorted by noise receptors ID; "Vacant" = vacant lot noise receptor, "Existing" = existing dwelling; "Total" = combined contribution from all sources (substation and WTGs); blank cells in "Sound pressure" columns = POR at more than 5000 m from source.

Noise Receptor ID	Description	UTM NAD 83, zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]					
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m		
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total
R015	Existing	365758	4889070	816	S19	3208	7.0	39.1	39.1	5.8	37.9	37.9
R039	Vacant	359608	4888818	853	S01	4312	9.4	35.8	35.8	8.6	34.5	34.5
R044	Vacant	362910	4890438	679	S34	749	28.4	38.7	39.1	27.1	37.4	37.8
R048	Vacant	362789	4890459	724	S31	797	28.3	38.7	39.1	27.4	37.2	37.7
R076	Vacant	361163	4889513	869	S16	2635	15.8	38.0	38.0	14.9	36.5	36.6
R115	Vacant	365282	4888463	696	S36	3314	9.5	39.1	39.1	8.7	38.0	38.0
R134	Existing	367322	4890451	836	S02	4104	6.2	37.9	37.9	4.7	36.7	36.7
R140	Existing	363261	4892098	1410	S31	1002	28.0	31.8	33.3	28.1	30.5	32.5
R156	Vacant	358969	4890147	630	S01	4403	9.2	38.6	38.6	8.3	37.7	37.7
R177	Existing	366495	4889660	712	S02	3531	10.3	39.2	39.2	9.4	38.0	38.0
R179	Vacant	366131	4889365	798	S37	3345	8.7	39.0	39.1	6.5	37.9	37.9
R211	Vacant	362482	4890207	834	S31	1187	23.3	38.7	38.8	22.4	37.2	37.4
R224	Vacant	365458	4888627	710	S21	3300	9.6	38.6	38.6	8.8	37.4	37.4
R248	Vacant	363980	4889192	913	S21	2032	18.2	38.8	38.8	17.2	37.3	37.3
R250	Vacant	361864	4886650	599	S11	4662	8.3	38.2	38.2	7.5	37.2	37.2
R254	Existing	360129	4890712	694	S04	3163	14.0	37.7	37.7	13.1	36.5	36.6
R255	Vacant	360406	4889168	908	S04	3452	12.5	36.8	36.8	11.6	35.4	35.4
R297	Existing	365371	4888610	651	S21	3255	9.6	39.2	39.2	8.8	38.0	38.0
R310	Existing	363457	4892030	1498	S31	953	28.8	31.8	33.6	28.3	30.5	32.5
R328	Vacant	363066	4891848	1093	S31	779	35.7	33.3	37.7	30.8	32.0	34.5
R337	Existing	368133	4891327	605	S13	4869	4.7	38.9	38.9	2.9	37.8	37.8
R373	Existing	369538	4892176	661	S33	6361		39.5	39.5		38.5	38.5
R376	Existing	362412	4889866	783	S20	1499	21.6	39.5	39.6	20.6	38.2	38.2
R383	Existing	367296	4890391	807	S02	4088	6.5	37.9	37.9	4.3	36.6	36.6
R399	Vacant	369451	4892050	690	S12	6255		38.9	38.9		37.8	37.8
R427	Vacant	361304	4891372	730	S22	1984	24.6	36.9	37.2	22.0	35.8	35.9

Noise Receptor ID	Description	UTM NAD 83, zone 18		Nearest Source Distance [m]			Sound Pressure [dBA]					
				WTG		Sub-station	POR at 4.5 m			POR at 1.5 within 30 m		
		X	Y	Distance	ID	Distance	Substation	WTGs	Total	Substation	WTGs	Total
R435	Vacant	363314	4888993	492	S20	2103	18.1	41.6	41.7	17.2	40.7	40.7
R441	Existing	361668	4886460	746	S11	4904	7.5	37.0	37.0	6.7	35.9	35.9
R457	Existing	365771	4889428	504	S37	3006	14.4	41.9	41.9	13.5	40.9	40.9
R463	Vacant	361867	4889920	848	S22	1830	19.5	38.8	38.8	18.4	37.3	37.4
R503	Vacant	363155	4888902	434	S20	2197	17.8	43.0	43.1	16.9	42.3	42.3
R505	Existing	367415	4890605	834	S14	4175	9.9	38.0	38.0	4.9	36.7	36.7
R537	Vacant	366953	4893452	519	S30	4374	13.5	38.9	38.9	10.6	38.0	38.1
R556	Existing	366391	4889653	684	S27	3439	10.4	39.7	39.7	9.5	38.6	38.6
R573	Vacant	363517	4891934	1483	S31	875	29.7	32.0	34.0	29.2	30.7	33.0
R577	Vacant	359041	4890166	581	S29	4329	9.4	39.1	39.1	8.6	38.2	38.2
R578	Vacant	365567	4888834	716	S21	3224	13.3	38.9	38.9	9.0	37.7	37.7
R598	Existing	360680	4889284	838	S04	3160	13.6	37.2	37.2	12.7	35.9	35.9
R600	Existing	362831	4891653	793	S31	709	36.7	35.3	39.0	34.4	34.1	37.2
R618	Existing	363401	4892017	1448	S31	931	29.1	31.9	33.7	28.5	30.6	32.7
R667	Vacant	361446	4889693	781	S16	2300	17.3	38.5	38.6	16.3	37.1	37.2
R678	Vacant	364467	4889566	640	S19	1943	18.7	40.2	40.2	17.6	39.0	39.0
R701	Existing	363294	4892136	1460	S31	1041	27.6	31.7	33.1	27.0	30.3	32.0
R720	Vacant	363943	4889237	907	S34	1977	18.5	38.8	38.8	17.6	37.3	37.3

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Appendix D

CADNA-A Sample Calculation and Verification

Calculation of Sound Pressure Levels from Wind Turbine using ISO 9613-2

Amherst Island Wind Project

Background

As requested by the Ministry of Environment in the Noise Guidelines for Wind Farms in Section 6.7 – Appendices (October 2008), a sample calculation should be included in the Noise Assessment Report. The sample calculation must include at least one detailed calculation for a source to point of reception “pair,” preferably addressing the closest wind turbine unit, and it must represent all other “pairs".

For this project, a POR representing non-participating Noise Receptor R080 along with S11 turbine were chosen as a "pair".

The calculations are based on ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – General Method of Calculation. The ground attenuation coefficient was assumed as 0.7, as suggested by the MOE Guidelines (Section 6.4.10 – Specific Parameters). Ambient temperature and relative humidity were assumed at 10°C and 70%, respectively. The octave band data for the Siemens SWT-2.3-113 wind turbine generator were provided by the manufacturer and adjusted for wind shear. The octave band data used in this calculation is identical to that used in CADNA-A model.

Input parameters

POR height $h_r := 4.5m$

Noise source height $h_s := 99.5m$

Coordinates and elevation of R080 POR, Zr below included ground elevation and receptor height

$X_r := 362200.34m$ $Y_r := 4887074.70m$ $Z_r := 84.5m$

Coordinates and elevation of S11 noise source, Zr below included ground elevation and receptor height

$X_s := 361640.50m$ $Y_s := 4887205.50m$ $Z_s := 182.57m$

Ground absorption coefficient $G_a := 0.7$

Wind turbine (noise source) sound power emission

at 63 Hz	$L_{w\_63} := 91.5dBA$
at 125 Hz	$L_{w\_125} := 93.7dBA$
at 250 Hz	$L_{w\_250} := 95.2dBA$
at 500 Hz	$L_{w\_500} := 96.2dBA$
at 1000 Hz	$L_{w\_1000} := 97.4dBA$
at 2000 Hz	$L_{w\_2000} := 96.9dBA$
at 4000 Hz	$L_{w\_4000} := 95.0dBA$
at 8000 Hz	$L_{w\_8000} := 84.6dBA$

Distance from POR to source

$$d := \sqrt{(X_r - X_s)^2 + (Y_r - Y_s)^2 + (Z_r - Z_s)^2} = 583.2 \cdot m$$ 3D distance between the source and POR

$$d_p := \sqrt{(X_r - X_s)^2 + (Y_r - Y_s)^2} = 574.9\,m$$ Projected distance between the source and POR

Combined sound power level for the source

$$Total\_L_w := 10 \cdot \log\left(10^{\frac{L_{w\_63}}{10}} + 10^{\frac{L_{w\_125}}{10}} + 10^{\frac{L_{w\_250}}{10}} + 10^{\frac{L_{w\_500}}{10}} + 10^{\frac{L_{w\_1000}}{10}} \ldots + 10^{\frac{L_{w\_2000}}{10}} + 10^{\frac{L_{w\_4000}}{10}} + 10^{\frac{L_{w\_8000}}{10}}\right)$$

$$Total\_L_w = 104 \cdot dBA$$

Attenuation

Attenuation due to geometrical divergence

$$Att\_div := 20 \cdot \log\left(\frac{d}{1m}\right) + 11 = 66.3 \cdot dB$$

Attenuation due to atmospheric absorption at ambient temperature and relative humidity of 10°C and 70%

at 63 Hz $Att\_atm\_63 := 0.1 \frac{dB}{km} \cdot d = 0.058 \cdot dB$

at 125 Hz $Att\_atm\_125 := 0.4 \frac{dB}{km} \cdot d = 0.233 \cdot dB$

at 250 Hz $Att\_atm\_250 := 1.0 \frac{dB}{km} \cdot d = 0.583 \cdot dB$

at 500 Hz $Att\_atm\_500 := 1.9 \frac{dB}{km} \cdot d = 1.108 \cdot dB$

at 1000 Hz $Att\_atm\_1000 := 3.7 \frac{dB}{km} \cdot d = 2.158 \cdot dB$

at 2000 Hz $Att\_atm\_2000 := 9.7 \frac{dB}{km} \cdot d = 5.657 \cdot dB$

at 4000 Hz $Att\_atm\_4000 := 32.8 \frac{dB}{km} \cdot d = 19.13 \cdot dB$

at 8000 Hz $Att\_atm\_8000 := 117.0 \frac{dB}{km} \cdot d = 68.237 \cdot dB$

Attenuation coefficients

$$a_1(h) := 1.5 + 3.0 \cdot e^{-0.12\left(\frac{h}{m}-5\right)^2} \cdot \left(1 - e^{\frac{-d_p}{50 \cdot m}}\right) + 5.7 \cdot e^{-0.09 \cdot \frac{h^2}{m^2}} \cdot \left(1 - e^{-2.8 \cdot 10^{-6} \cdot \frac{d_p^2}{m^2}}\right)$$

$$b_1(h) := 1.5 + 8.6 \cdot e^{-0.09 \cdot \frac{h^2}{m^2}} \cdot \left(1 - e^{\frac{-d_p}{50 \cdot m}}\right)$$

$$c_1(h) := 1.5 + 14.0 \cdot e^{-0.46 \cdot \frac{h^2}{m^2}} \cdot \left(1 - e^{\frac{-d_p}{50 \cdot m}}\right)$$

$$d_1(h) := 1.5 + 5.0 \cdot e^{-0.9 \cdot \frac{h^2}{m^2}} \cdot \left(1 - e^{\frac{-d_p}{50 \cdot m}}\right)$$

$$q := \begin{cases} 0 & \text{if } d_p \le 30 \cdot (h_r + h_s) \\ 1 - \frac{30 \cdot (h_r + h_s)}{d_p} & \text{otherwise} \end{cases}$$

Attenuation due to ground absorption - source

$a_1(h_s) = 1.5$ $b_1(h_s) = 1.5$ $c_1(h_s) = 1.5$ $d_1(h_s) = 1.5$

at 63 Hz $Att\_gr\_s\_63 := -1.5dB$

at 125 Hz $Att\_gr\_s\_125 := -1.5 + G_a \cdot a_1(h_s) = -0.45 \cdot dB$

at 250 Hz $Att\_gr\_s\_250 := -1.5 + G_a \cdot b_1(h_s) = -0.45 \cdot dB$

at 500 Hz $Att\_gr\_s\_500 := -1.5 + G_a \cdot c_1(h_s) = -0.45 \cdot dB$

at 1000 Hz $Att\_gr\_s\_1000 := -1.5 + G_a \cdot d_1(h_s) = -0.45 \cdot dB$

at 2000 Hz $Att\_gr\_s\_2000 := -1.5 \cdot (1 - G_a) = -0.45 \cdot dB$

at 4000 Hz $Att\_gr\_s\_4000 := -1.5 \cdot (1 - G_a) = -0.45 \cdot dB$

at 8000 Hz $Att\_gr\_s\_8000 := -1.5 \cdot (1 - G_a) = -0.45 \cdot dB$

Attenuation due to ground absorption - middle

$q = 0$

at 63 Hz $Att\_gr\_m\_63 := -3 \cdot q^2 = 0 \cdot dB$

at 125 Hz $Att\_gr\_m\_125 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

at 250 Hz $Att\_gr\_m\_250 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

at 500 Hz $Att\_gr\_m\_500 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

at 1000 Hz $Att\_gr\_m\_1000 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

at 2000 Hz $Att\_gr\_m\_2000 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

at 4000 Hz $Att\_gr\_m\_4000 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

at 8000 Hz $Att\_gr\_m\_8000 := -3 \cdot q \cdot (1 - G_a) = 0 \cdot dB$

Attenuation due to ground absorption - POR

$a_1(h_r) = 4.967$ $b_1(h_r) = 2.89$ $c_1(h_r) = 1.501$ $d_1(h_r) = 1.5$

at 63 Hz $Att\_gr\_r\_63 := -1.5dB$

at 125 Hz $Att\_gr\_r\_125 := -1.5 + G_a \cdot a_1(h_r) = 1.977 \cdot dB$

at 250 Hz $Att\_gr\_r\_250 := -1.5 + G_a \cdot b_1(h_r) = 0.523 \cdot dB$

at 500 Hz $Att\_gr\_r\_500 := -1.5 + G_a \cdot c_1(h_r) = -0.449 \cdot dB$

at 1000 Hz $Att\_gr\_r\_1000 := -1.5 + G_a \cdot d_1(h_r) = -0.45 \cdot dB$

at 2000 Hz $Att\_gr\_r\_2000 := -1.5 \cdot (1 - G_a) = -0.45 \cdot dB$

at 4000 Hz $Att\_gr\_r\_4000 := -1.5 \cdot (1 - G_a) = -0.45 \cdot dB$

at 8000 Hz $Att\_gr\_r\_8000 := -1.5 \cdot (1 - G_a) = -0.45 \cdot dB$

Total ground attenuation for each frequency

at 63 Hz $Att\_gr\_63 := Att\_gr\_s\_63 + Att\_gr\_m\_63 + Att\_gr\_r\_63 = -3 \cdot dB$

at 125 Hz $Att\_gr\_125 := Att\_gr\_s\_125 + Att\_gr\_m\_125 + Att\_gr\_r\_125 = 1.5 \cdot dB$

at 250 Hz $Att\_gr\_250 := Att\_gr\_s\_250 + Att\_gr\_m\_250 + Att\_gr\_r\_250 = 0.073 \cdot dB$

at 500 Hz $Att\_gr\_500 := Att\_gr\_s\_500 + Att\_gr\_m\_500 + Att\_gr\_r\_500 = -0.9 \cdot dB$

at 1000 Hz $Att\_gr\_1000 := Att\_gr\_s\_1000 + Att\_gr\_m\_1000 + Att\_gr\_r\_1000 = -0.9 \cdot dB$

at 2000 Hz $Att\_gr\_2000 := Att\_gr\_s\_2000 + Att\_gr\_m\_2000 + Att\_gr\_r\_2000 = -0.9 \cdot dB$

at 4000 Hz $Att\_gr\_4000 := Att\_gr\_s\_4000 + Att\_gr\_m\_4000 + Att\_gr\_r\_4000 = -0.9 \cdot dB$

at 8000 Hz $Att\_gr\_8000 := Att\_gr\_s\_8000 + Att\_gr\_m\_8000 + Att\_gr\_r\_8000 = -0.9 \cdot dB$

Total attenuation for each frequency

at 63 Hz $Att\_63 := Att\_div + Att\_atm\_63 + Att\_gr\_63 = 63.375 \cdot dB$

at 125 Hz $Att\_125 := Att\_div + Att\_atm\_125 + Att\_gr\_125 = 68.077 \cdot dB$

at 250 Hz $Att\_250 := Att\_div + Att\_atm\_250 + Att\_gr\_250 = 66.973 \cdot dB$

at 500 Hz $Att\_500 := Att\_div + Att\_atm\_500 + Att\_gr\_500 = 66.526 \cdot dB$

at 1000 Hz $Att\_1000 := Att\_div + Att\_atm\_1000 + Att\_gr\_1000 = 67.575 \cdot dB$

at 2000 Hz $Att\_2000 := Att\_div + Att\_atm\_2000 + Att\_gr\_2000 = 71.074 \cdot dB$

at 4000 Hz $Att\_4000 := Att\_div + Att\_atm\_4000 + Att\_gr\_4000 = 84.546 \cdot dB$

at 8000 Hz $Att\_8000 := Att\_div + Att\_atm\_8000 + Att\_gr\_8000 = 133.654 \cdot dB$

Sound pressure levels at the POR

at 63 Hz $L_{p\_63} := L_{w\_63} - Att\_63 = 28.1 \cdot dBA$

at 125 Hz $L_{p\_125} := L_{w\_125} - Att\_125 = 25.6 \cdot dBA$

at 250 Hz $L_{p\_250} := L_{w\_250} - Att\_250 = 28.2 \cdot dBA$

at 500 Hz $L_{p\_500} := L_{w\_500} - Att\_500 = 29.7 \cdot dBA$

at 1000 Hz $L_{p\_1000} := L_{w\_1000} - Att\_1000 = 29.8 \cdot dBA$

at 2000 Hz $L_{p\_2000} := L_{w\_2000} - Att\_2000 = 25.8 \cdot dBA$

at 4000 Hz $L_{p\_4000} := L_{w\_4000} - Att\_4000 = 10.5 \cdot dBA$

at 8000 Hz $L_{p\_8000} := L_{w\_8000} - Att\_8000 = -49.1 \cdot dBA$

$$Total\_L_p := 10 \cdot \log\left(10^{\frac{L_{p\_63}}{10}} + 10^{\frac{L_{p\_125}}{10}} + 10^{\frac{L_{p\_250}}{10}} + 10^{\frac{L_{p\_500}}{10}} + 10^{\frac{L_{p\_1000}}{10}} \dots + 10^{\frac{L_{p\_2000}}{10}} + 10^{\frac{L_{p\_4000}}{10}} + 10^{\frac{L_{p\_8000}}{10}}\right)$$

$Total\_L_p = 36.0 \cdot dBA$

Impact of S11 on R080 POR as calculated by CADNA-A

Frequency [Hz]	31.5	63	125	250	500	1000	2000	4000	8000	Total
Sound pressure [dBA]		28.1	25.6	28.2	29.7	29.9	25.8	10.5	-49.0	36.0

Conclusion

Based on the calculation procedure provided in ISO 9613-2 and the parameters suggested by the Ministry of Environment in the Noise Guidelines for Wind Farms, Section 6.4.10 (October 2008), the estimated sound pressure level at the point of reception R080 produced by the noise source (wind turbine generator) S11 is 36.0 dBA, which is equal to the prediction of CADNA-A for the same POR (36.0 dBA).

It is important to note that POR R080 receives sound contributions from several sources, and the level shown above (36.0 dBA) corresponds only to the contribution from S11. The total sound pressure level at this POR was estimated by CADNA-A at 38.4 dBA.

Both the air and ground attenuation components were included and calculated based on ISO 9613-2 assuming 10°C ambient temperature and 70% relative humidity.

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	5000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	0.00
Night-time Penalty (dB)	0.00
DTM	
Standard Height (m)	0.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	1
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	0.70
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03)	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Receiver
Name: Existing
ID: R080
X: 362200.34
Y: 4887074.70
Z: 84.50

Point Source, ISO 9613, Name: "Substation", ID: "Subs"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	363269.13	4891095.48	94.00	0	32	60.6	60.6	0.0	0.0	83.4	0.1	-5.8	0.0	0.0	4.8	0.0	-0.0	-21.9	-21.9
2	363269.13	4891095.48	94.00	0	63	77.8	77.8	0.0	0.0	83.4	0.5	-5.8	0.0	0.0	4.8	0.0	-0.0	-5.0	-5.0
3	363269.13	4891095.48	94.00	0	125	90.9	90.9	0.0	0.0	83.4	1.7	3.8	0.0	0.0	1.0	0.0	-0.0	1.0	1.0
4	363269.13	4891095.48	94.00	0	250	96.4	96.4	0.0	0.0	83.4	4.3	0.7	0.0	0.0	4.1	0.0	-0.0	3.9	3.9
5	363269.13	4891095.48	94.00	0	500	101.8	101.8	0.0	0.0	83.4	8.0	-1.7	0.0	0.0	4.8	0.0	-0.0	7.3	7.3
6	363269.13	4891095.48	94.00	0	1000	99.0	99.0	0.0	0.0	83.4	15.2	-1.7	0.0	0.0	4.9	0.0	-0.0	-2.7	-2.7
7	363269.13	4891095.48	94.00	0	2000	95.2	95.2	0.0	0.0	83.4	40.2	-1.7	0.0	0.0	5.0	0.0	-0.0	-31.7	-31.7
8	363269.13	4891095.48	94.00	0	4000	90.0	90.0	0.0	0.0	83.4	136.3	-1.7	0.0	0.0	5.2	0.0	-0.0	-133.2	-133.2
9	363269.13	4891095.48	94.00	0	8000	79.9	79.9	0.0	0.0	83.4	486.3	-1.7	0.0	0.0	5.6	0.0	-0.0	-493.7	-493.7

Point Source, ISO 9613, Name: "(untitled)", ID: "S01"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	359172.10	4889551.06	184.50	0	63	91.5	91.5	0.0	0.0	82.8	0.5	-3.6	0.0	0.0	0.0	0.0	-0.0	11.8	11.8
2	359172.10	4889551.06	184.50	0	125	93.7	93.7	0.0	0.0	82.8	1.6	1.6	0.0	0.0	0.0	0.0	-0.0	7.6	7.6
3	359172.10	4889551.06	184.50	0	250	95.2	95.2	0.0	0.0	82.8	4.1	-0.1	0.0	0.0	0.0	0.0	-0.0	8.4	8.4
4	359172.10	4889551.06	184.50	0	500	96.2	96.2	0.0	0.0	82.8	7.5	-1.1	0.0	0.0	0.0	0.0	-0.0	6.9	6.9
5	359172.10	4889551.06	184.50	0	1000	97.4	97.4	0.0	0.0	82.8	14.3	-1.1	0.0	0.0	0.0	0.0	-0.0	1.3	1.3
6	359172.10	4889551.06	184.50	0	2000	96.9	96.9	0.0	0.0	82.8	37.8	-1.1	0.0	0.0	0.0	0.0	-0.0	-22.7	-22.7
7	359172.10	4889551.06	184.50	0	4000	95.0	95.0	0.0	0.0	82.8	128.2	-1.1	0.0	0.0	0.0	0.0	-0.0	-115.0	-115.0
8	359172.10	4889551.06	184.50	0	8000	84.6	84.6	0.0	0.0	82.8	457.4	-1.1	0.0	0.0	0.0	0.0	-0.0	-454.5	-454.5

Point Source, ISO 9613, Name: "(untitled)", ID: "S03"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	361257.04	4887433.92	183.20	0	63	91.2	91.2	0.0	0.0	71.1	0.1	-3.0	0.0	0.0	0.0	0.0	-0.0	22.9	22.9
2	361257.04	4887433.92	183.20	0	125	93.7	93.7	0.0	0.0	71.1	0.4	1.8	0.0	0.0	0.0	0.0	-0.0	20.4	20.4
3	361257.04	4887433.92	183.20	0	250	96.1	96.1	0.0	0.0	71.1	1.1	0.1	0.0	0.0	0.0	0.0	-0.0	23.9	23.9
4	361257.04	4887433.92	183.20	0	500	97.3	97.3	0.0	0.0	71.1	2.0	-0.9	0.0	0.0	0.0	0.0	-0.0	25.1	25.1
5	361257.04	4887433.92	183.20	0	1000	98.9	98.9	0.0	0.0	71.1	3.7	-0.9	0.0	0.0	0.0	0.0	-0.0	25.0	25.0
6	361257.04	4887433.92	183.20	0	2000	98.5	98.5	0.0	0.0	71.1	9.8	-0.9	0.0	0.0	0.0	0.0	-0.0	18.5	18.5
7	361257.04	4887433.92	183.20	0	4000	95.8	95.8	0.0	0.0	71.1	33.2	-0.9	0.0	0.0	0.0	0.0	-0.0	-7.7	-7.7
8	361257.04	4887433.92	183.20	0	8000	82.0	82.0	0.0	0.0	71.1	118.5	-0.9	0.0	0.0	0.0	0.0	-0.0	-106.8	-106.8

Point Source, ISO 9613, Name: "(untitled)", ID: "S04"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	360408.29	4890076.32	184.50	0	63	91.2	91.2	0.0	0.0	81.9	0.4	-3.3	0.0	0.0	0.0	0.0	-0.0	12.2	12.2
2	360408.29	4890076.32	184.50	0	125	93.7	93.7	0.0	0.0	81.9	1.4	1.7	0.0	0.0	0.0	0.0	-0.0	8.7	8.7
3	360408.29	4890076.32	184.50	0	250	96.1	96.1	0.0	0.0	81.9	3.6	-0.0	0.0	0.0	0.0	0.0	-0.0	10.6	10.6
4	360408.29	4890076.32	184.50	0	500	97.3	97.3	0.0	0.0	81.9	6.7	-1.0	0.0	0.0	0.0	0.0	-0.0	9.7	9.7
5	360408.29	4890076.32	184.50	0	1000	98.9	98.9	0.0	0.0	81.9	12.8	-1.0	0.0	0.0	0.0	0.0	-0.0	5.2	5.2
6	360408.29	4890076.32	184.50	0	2000	98.5	98.5	0.0	0.0	81.9	33.8	-1.0	0.0	0.0	0.0	0.0	-0.0	-16.2	-16.2
7	360408.29	4890076.32	184.50	0	4000	95.8	95.8	0.0	0.0	81.9	114.6	-1.0	0.0	0.0	0.0	0.0	-0.0	-99.7	-99.7
8	360408.29	4890076.32	184.50	0	8000	82.0	82.0	0.0	0.0	81.9	408.8	-1.0	0.0	0.0	0.0	0.0	-0.0	-407.7	-407.7

Point Source, ISO 9613, Name: "(untitled)", ID: "S05"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	362668.00	4888881.21	179.50	0	63	91.2	91.2	0.0	0.0	76.4	0.2	-3.0	0.0	0.0	0.0	0.0	-0.0	17.5	17.5
2	362668.00	4888881.21	179.50	0	125	93.7	93.7	0.0	0.0	76.4	0.8	1.8	0.0	0.0	0.0	0.0	-0.0	14.7	14.7
3	362668.00	4888881.21	179.50	0	250	96.1	96.1	0.0	0.0	76.4	2.0	0.1	0.0	0.0	0.0	0.0	-0.0	17.7	17.7
4	362668.00	4888881.21	179.50	0	500	97.3	97.3	0.0	0.0	76.4	3.6	-0.9	0.0	0.0	0.0	0.0	-0.0	18.2	18.2

Point Source, ISO 9613, Name: "(untitled)", ID: "S05"

Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
5	362668.00	4888881.21	179.50	0	1000	98.9	98.9	0.0	0.0	76.4	6.8	-0.9	0.0	0.0	0.0	0.0	-0.0	16.5	16.5
6	362668.00	4888881.21	179.50	0	2000	98.5	98.5	0.0	0.0	76.4	18.1	-0.9	0.0	0.0	0.0	0.0	-0.0	4.9	4.9
7	362668.00	4888881.21	179.50	0	4000	95.8	95.8	0.0	0.0	76.4	61.2	-0.9	0.0	0.0	0.0	0.0	-0.0	-41.0	-41.0
8	362668.00	4888881.21	179.50	0	8000	82.0	82.0	0.0	0.0	76.4	218.4	-0.9	0.0	0.0	0.0	0.0	-0.0	-211.9	-211.9

Point Source, ISO 9613, Name: "(untitled)", ID: "S09"

Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	360950.66	4887103.68	179.50	0	63	91.5	91.5	0.0	0.0	73.0	0.2	-3.0	0.0	0.0	0.0	0.0	-0.0	21.4	21.4
2	360950.66	4887103.68	179.50	0	125	93.7	93.7	0.0	0.0	73.0	0.5	1.8	0.0	0.0	0.0	0.0	-0.0	18.4	18.4
3	360950.66	4887103.68	179.50	0	250	95.2	95.2	0.0	0.0	73.0	1.3	0.1	0.0	0.0	0.0	0.0	-0.0	20.9	20.9
4	360950.66	4887103.68	179.50	0	500	96.2	96.2	0.0	0.0	73.0	2.4	-0.9	0.0	0.0	0.0	0.0	-0.0	21.7	21.7
5	360950.66	4887103.68	179.50	0	1000	97.4	97.4	0.0	0.0	73.0	4.6	-0.9	0.0	0.0	0.0	0.0	-0.0	20.8	20.8
6	360950.66	4887103.68	179.50	0	2000	96.9	96.9	0.0	0.0	73.0	12.1	-0.9	0.0	0.0	0.0	0.0	-0.0	12.7	12.7
7	360950.66	4887103.68	179.50	0	4000	95.0	95.0	0.0	0.0	73.0	41.1	-0.9	0.0	0.0	0.0	0.0	-0.0	-18.1	-18.1
8	360950.66	4887103.68	179.50	0	8000	84.6	84.6	0.0	0.0	73.0	146.5	-0.9	0.0	0.0	0.0	0.0	-0.0	-134.0	-134.0

Point Source, ISO 9613, Name: "(untitled)", ID: "S11"

Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	361640.50	4887205.50	182.57	0	63	91.5	91.5	0.0	0.0	66.3	0.1	-3.0	0.0	0.0	0.0	0.0	-0.0	28.1	28.1
2	361640.50	4887205.50	182.57	0	125	93.7	93.7	0.0	0.0	66.3	0.2	1.5	0.0	0.0	0.0	0.0	-0.0	25.6	25.6
3	361640.50	4887205.50	182.57	0	250	95.2	95.2	0.0	0.0	66.3	0.6	0.1	0.0	0.0	0.0	0.0	-0.0	28.2	28.2
4	361640.50	4887205.50	182.57	0	500	96.2	96.2	0.0	0.0	66.3	1.1	-0.9	0.0	0.0	0.0	0.0	-0.0	29.7	29.7
5	361640.50	4887205.50	182.57	0	1000	97.4	97.4	0.0	0.0	66.3	2.1	-0.9	0.0	0.0	0.0	0.0	-0.0	29.9	29.9
6	361640.50	4887205.50	182.57	0	2000	96.9	96.9	0.0	0.0	66.3	5.6	-0.9	0.0	0.0	0.0	0.0	-0.0	25.9	25.9
7	361640.50	4887205.50	182.57	0	4000	95.0	95.0	0.0	0.0	66.3	19.1	-0.9	0.0	0.0	0.0	0.0	-0.0	10.5	10.5
8	361640.50	4887205.50	182.57	0	8000	84.6	84.6	0.0	0.0	66.3	68.2	-0.9	0.0	0.0	0.0	0.0	-0.0	-49.0	-49.0

Point Source, ISO 9613, Name: "(untitled)", ID: "S16"

Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	361904.00	4889060.00	181.21	0	63	91.2	91.2	0.0	0.0	77.1	0.2	-3.0	0.0	0.0	0.0	0.0	-0.0	16.9	16.9
2	361904.00	4889060.00	181.21	0	125	93.7	93.7	0.0	0.0	77.1	0.8	1.8	0.0	0.0	0.0	0.0	-0.0	14.0	14.0
3	361904.00	4889060.00	181.21	0	250	96.1	96.1	0.0	0.0	77.1	2.1	0.1	0.0	0.0	0.0	0.0	-0.0	16.9	16.9
4	361904.00	4889060.00	181.21	0	500	97.3	97.3	0.0	0.0	77.1	3.9	-0.9	0.0	0.0	0.0	0.0	-0.0	17.3	17.3
5	361904.00	4889060.00	181.21	0	1000	98.9	98.9	0.0	0.0	77.1	7.3	-0.9	0.0	0.0	0.0	0.0	-0.0	15.4	15.4
6	361904.00	4889060.00	181.21	0	2000	98.5	98.5	0.0	0.0	77.1	19.4	-0.9	0.0	0.0	0.0	0.0	-0.0	2.9	2.9
7	361904.00	4889060.00	181.21	0	4000	95.8	95.8	0.0	0.0	77.1	65.9	-0.9	0.0	0.0	0.0	0.0	-0.0	-46.2	-46.2
8	361904.00	4889060.00	181.21	0	8000	82.0	82.0	0.0	0.0	77.1	234.9	-0.9	0.0	0.0	0.0	0.0	-0.0	-229.1	-229.1

Point Source, ISO 9613, Name: "(untitled)", ID: "S19"

Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	365107.18	4889563.44	184.50	0	63	91.5	91.5	0.0	0.0	82.7	0.5	-3.5	0.0	0.0	0.0	0.0	-0.0	11.9	11.9
2	365107.18	4889563.44	184.50	0	125	93.7	93.7	0.0	0.0	82.7	1.6	1.6	0.0	0.0	0.0	0.0	-0.0	7.8	7.8
3	365107.18	4889563.44	184.50	0	250	95.2	95.2	0.0	0.0	82.7	4.0	-0.1	0.0	0.0	0.0	0.0	-0.0	8.6	8.6
4	365107.18	4889563.44	184.50	0	500	96.2	96.2	0.0	0.0	82.7	7.4	-1.1	0.0	0.0	0.0	0.0	-0.0	7.2	7.2
5	365107.18	4889563.44	184.50	0	1000	97.4	97.4	0.0	0.0	82.7	14.0	-1.1	0.0	0.0	0.0	0.0	-0.0	1.8	1.8
6	365107.18	4889563.44	184.50	0	2000	96.9	96.9	0.0	0.0	82.7	37.0	-1.1	0.0	0.0	0.0	0.0	-0.0	-21.7	-21.7
7	365107.18	4889563.44	184.50	0	4000	95.0	95.0	0.0	0.0	82.7	125.4	-1.1	0.0	0.0	0.0	0.0	-0.0	-112.0	-112.0
8	365107.18	4889563.44	184.50	0	8000	84.6	84.6	0.0	0.0	82.7	447.4	-1.1	0.0	0.0	0.0	0.0	-0.0	-444.4	-444.4

Point Source, ISO 9613, Name: "(untitled)", ID: "S20"

Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	362894.06	4889249.14	183.86	0	63	91.2	91.2	0.0	0.0	78.2	0.3	-3.0	0.0	0.0	0.0	0.0	-0.0	15.8	15.8
2	362894.06	4889249.14	183.86	0	125	93.7	93.7	0.0	0.0	78.2	0.9	1.8	0.0	0.0	0.0	0.0	-0.0	12.8	12.8
3	362894.06	4889249.14	183.86	0	250	96.1	96.1	0.0	0.0	78.2	2.4	0.1	0.0	0.0	0.0	0.0	-0.0	15.5	15.5
4	362894.06	4889249.14	183.86	0	500	97.3	97.3	0.0	0.0	78.2	4.4	-0.9	0.0	0.0	0.0	0.0	-0.0	15.6	15.6
5	362894.06	4889249.14	183.86	0	1000	98.9	98.9	0.0	0.0	78.2	8.4	-0.9	0.0	0.0	0.0	0.0	-0.0	13.3	13.3
6	362894.06	4889249.14	183.86	0	2000	98.5	98.5	0.0	0.0	78.2	22.1	-0.9	0.0	0.0	0.0	0.0	-0.0	-0.9	-0.9
7	362894.06	4889249.14	183.86	0	4000	95.8	95.8	0.0	0.0	78.2	74.9	-0.9	0.0	0.0	0.0	0.0	-0.0	-56.3	-56.3
8	362894.06	4889249.14	183.86	0	8000	82.0	82.0	0.0	0.0	78.2	267.0	-0.9	0.0	0.0	0.0	0.0	-0.0	-262.3	-262.3

Point Source, ISO 9613, Name: "(untitled)", ID: "S21"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	364880.81	4889038.86	180.18	0	63	91.5	91.5	0.0	0.0	81.4	0.4	-3.2	0.0	0.0	0.0	0.0	-0.0	12.8	12.8
2	364880.81	4889038.86	180.18	0	125	93.7	93.7	0.0	0.0	81.4	1.4	1.7	0.0	0.0	0.0	0.0	-0.0	9.2	9.2
3	364880.81	4889038.86	180.18	0	250	95.2	95.2	0.0	0.0	81.4	3.5	0.0	0.0	0.0	0.0	0.0	-0.0	10.3	10.3
4	364880.81	4889038.86	180.18	0	500	96.2	96.2	0.0	0.0	81.4	6.4	-1.0	0.0	0.0	0.0	0.0	-0.0	9.3	9.3
5	364880.81	4889038.86	180.18	0	1000	97.4	97.4	0.0	0.0	81.4	12.2	-1.0	0.0	0.0	0.0	0.0	-0.0	4.8	4.8
6	364880.81	4889038.86	180.18	0	2000	96.9	96.9	0.0	0.0	81.4	32.1	-1.0	0.0	0.0	0.0	0.0	-0.0	-15.7	-15.7
7	364880.81	4889038.86	180.18	0	4000	95.0	95.0	0.0	0.0	81.4	108.9	-1.0	0.0	0.0	0.0	0.0	-0.0	-94.4	-94.4
8	364880.81	4889038.86	180.18	0	8000	84.6	84.6	0.0	0.0	81.4	388.6	-1.0	0.0	0.0	0.0	0.0	-0.0	-384.4	-384.4

Point Source, ISO 9613, Name: "(untitled)", ID: "S22"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	361447.08	4890656.10	189.50	0	63	91.2	91.2	0.0	0.0	82.3	0.5	-3.4	0.0	0.0	0.0	0.0	-0.0	11.9	11.9
2	361447.08	4890656.10	189.50	0	125	93.7	93.7	0.0	0.0	82.3	1.5	1.7	0.0	0.0	0.0	0.0	-0.0	8.3	8.3
3	361447.08	4890656.10	189.50	0	250	96.1	96.1	0.0	0.0	82.3	3.8	-0.1	0.0	0.0	0.0	0.0	-0.0	10.1	10.1
4	361447.08	4890656.10	189.50	0	500	97.3	97.3	0.0	0.0	82.3	7.1	-1.0	0.0	0.0	0.0	0.0	-0.0	9.0	9.0
5	361447.08	4890656.10	189.50	0	1000	98.9	98.9	0.0	0.0	82.3	13.4	-1.0	0.0	0.0	0.0	0.0	-0.0	4.3	4.3
6	361447.08	4890656.10	189.50	0	2000	98.5	98.5	0.0	0.0	82.3	35.4	-1.0	0.0	0.0	0.0	0.0	-0.0	-18.1	-18.1
7	361447.08	4890656.10	189.50	0	4000	95.8	95.8	0.0	0.0	82.3	120.0	-1.0	0.0	0.0	0.0	0.0	-0.0	-105.4	-105.4
8	361447.08	4890656.10	189.50	0	8000	82.0	82.0	0.0	0.0	82.3	427.9	-1.0	0.0	0.0	0.0	0.0	-0.0	-427.2	-427.2

Point Source, ISO 9613, Name: "(untitled)", ID: "S27"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	365916.00	4890146.00	185.29	0	63	91.2	91.2	0.0	0.0	84.7	0.6	-4.1	0.0	0.0	0.0	0.0	-0.0	10.0	10.0
2	365916.00	4890146.00	185.29	0	125	93.7	93.7	0.0	0.0	84.7	2.0	1.5	0.0	0.0	0.0	0.0	-0.0	5.6	5.6
3	365916.00	4890146.00	185.29	0	250	96.1	96.1	0.0	0.0	84.7	5.0	-0.2	0.0	0.0	0.0	0.0	-0.0	6.6	6.6
4	365916.00	4890146.00	185.29	0	500	97.3	97.3	0.0	0.0	84.7	9.3	-1.2	0.0	0.0	0.0	0.0	-0.0	4.6	4.6
5	365916.00	4890146.00	185.29	0	1000	98.9	98.9	0.0	0.0	84.7	17.6	-1.2	0.0	0.0	0.0	0.0	-0.0	-2.2	-2.2
6	365916.00	4890146.00	185.29	0	2000	98.5	98.5	0.0	0.0	84.7	46.6	-1.2	0.0	0.0	0.0	0.0	-0.0	-31.5	-31.5
7	365916.00	4890146.00	185.29	0	4000	95.8	95.8	0.0	0.0	84.7	158.0	-1.2	0.0	0.0	0.0	0.0	-0.0	-145.7	-145.7
8	365916.00	4890146.00	185.29	0	8000	82.0	82.0	0.0	0.0	84.7	563.6	-1.2	0.0	0.0	0.0	0.0	-0.0	-565.0	-565.0

Point Source, ISO 9613, Name: "(untitled)", ID: "S29"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	359561.75	4889909.18	182.65	0	63	91.5	91.5	0.0	0.0	82.8	0.5	-3.6	0.0	0.0	0.0	0.0	-0.0	11.9	11.9
2	359561.75	4889909.18	182.65	0	125	93.7	93.7	0.0	0.0	82.8	1.6	1.6	0.0	0.0	0.0	0.0	-0.0	7.7	7.7
3	359561.75	4889909.18	182.65	0	250	95.2	95.2	0.0	0.0	82.8	4.0	-0.1	0.0	0.0	0.0	0.0	-0.0	8.5	8.5
4	359561.75	4889909.18	182.65	0	500	96.2	96.2	0.0	0.0	82.8	7.5	-1.1	0.0	0.0	0.0	0.0	-0.0	7.0	7.0
5	359561.75	4889909.18	182.65	0	1000	97.4	97.4	0.0	0.0	82.8	14.2	-1.1	0.0	0.0	0.0	0.0	-0.0	1.5	1.5
6	359561.75	4889909.18	182.65	0	2000	96.9	96.9	0.0	0.0	82.8	37.4	-1.1	0.0	0.0	0.0	0.0	-0.0	-22.2	-22.2
7	359561.75	4889909.18	182.65	0	4000	95.0	95.0	0.0	0.0	82.8	126.9	-1.1	0.0	0.0	0.0	0.0	-0.0	-113.6	-113.6
8	359561.75	4889909.18	182.65	0	8000	84.6	84.6	0.0	0.0	82.8	452.8	-1.1	0.0	0.0	0.0	0.0	-0.0	-449.9	-449.9

Point Source, ISO 9613, Name: "(untitled)", ID: "S31"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	362343.14	4891028.43	189.50	0	63	91.5	91.5	0.0	0.0	83.0	0.5	-3.6	0.0	0.0	0.0	0.0	-0.0	11.7	11.7
2	362343.14	4891028.43	189.50	0	125	93.7	93.7	0.0	0.0	83.0	1.6	1.6	0.0	0.0	0.0	0.0	-0.0	7.5	7.5
3	362343.14	4891028.43	189.50	0	250	95.2	95.2	0.0	0.0	83.0	4.1	-0.1	0.0	0.0	0.0	0.0	-0.0	8.2	8.2
4	362343.14	4891028.43	189.50	0	500	96.2	96.2	0.0	0.0	83.0	7.6	-1.1	0.0	0.0	0.0	0.0	-0.0	6.7	6.7
5	362343.14	4891028.43	189.50	0	1000	97.4	97.4	0.0	0.0	83.0	14.5	-1.1	0.0	0.0	0.0	0.0	-0.0	1.1	1.1
6	362343.14	4891028.43	189.50	0	2000	96.9	96.9	0.0	0.0	83.0	38.3	-1.1	0.0	0.0	0.0	0.0	-0.0	-23.2	-23.2
7	362343.14	4891028.43	189.50	0	4000	95.0	95.0	0.0	0.0	83.0	129.7	-1.1	0.0	0.0	0.0	0.0	-0.0	-116.6	-116.6
8	362343.14	4891028.43	189.50	0	8000	84.6	84.6	0.0	0.0	83.0	462.6	-1.1	0.0	0.0	0.0	0.0	-0.0	-459.8	-459.8

Point Source, ISO 9613, Name: "(untitled)", ID: "S34"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	363323.99	4889900.50	179.50	0	63	91.5	91.5	0.0	0.0	80.7	0.4	-3.0	0.0	0.0	0.0	0.0	-0.0	13.5	13.5
2	363323.99	4889900.50	179.50	0	125	93.7	93.7	0.0	0.0	80.7	1.3	1.8	0.0	0.0	0.0	0.0	-0.0	10.0	10.0
3	363323.99	4889900.50	179.50	0	250	95.2	95.2	0.0	0.0	80.7	3.2	0.1	0.0	0.0	0.0	0.0	-0.0	11.3	11.3
4	363323.99	4889900.50	179.50	0	500	96.2	96.2	0.0	0.0	80.7	5.9	-0.9	0.0	0.0	0.0	0.0	-0.0	10.6	10.6

Point Source, ISO 9613, Name: "(untitled)", ID: "S34"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
5	363323.99	4889900.50	179.50	0	1000	97.4	97.4	0.0	0.0	80.7	11.1	-0.9	0.0	0.0	0.0	0.0	-0.0	6.5	6.5
6	363323.99	4889900.50	179.50	0	2000	96.9	96.9	0.0	0.0	80.7	29.4	-0.9	0.0	0.0	0.0	0.0	-0.0	-12.3	-12.3
7	363323.99	4889900.50	179.50	0	4000	95.0	95.0	0.0	0.0	80.7	99.7	-0.9	0.0	0.0	0.0	0.0	-0.0	-84.5	-84.5
8	363323.99	4889900.50	179.50	0	8000	84.6	84.6	0.0	0.0	80.7	355.6	-0.9	0.0	0.0	0.0	0.0	-0.0	-350.8	-350.8

Point Source, ISO 9613, Name: "(untitled)", ID: "S36"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	364588.58	4888397.36	178.68	0	63	91.2	91.2	0.0	0.0	79.7	0.3	-3.0	0.0	0.0	0.0	0.0	-0.0	14.1	14.1
2	364588.58	4888397.36	178.68	0	125	93.7	93.7	0.0	0.0	79.7	1.1	1.8	0.0	0.0	0.0	0.0	-0.0	11.1	11.1
3	364588.58	4888397.36	178.68	0	250	96.1	96.1	0.0	0.0	79.7	2.8	0.1	0.0	0.0	0.0	0.0	-0.0	13.5	13.5
4	364588.58	4888397.36	178.68	0	500	97.3	97.3	0.0	0.0	79.7	5.3	-0.9	0.0	0.0	0.0	0.0	-0.0	13.2	13.2
5	364588.58	4888397.36	178.68	0	1000	98.9	98.9	0.0	0.0	79.7	10.0	-0.9	0.0	0.0	0.0	0.0	-0.0	10.1	10.1
6	364588.58	4888397.36	178.68	0	2000	98.5	98.5	0.0	0.0	79.7	26.4	-0.9	0.0	0.0	0.0	0.0	-0.0	-6.7	-6.7
7	364588.58	4888397.36	178.68	0	4000	95.8	95.8	0.0	0.0	79.7	89.5	-0.9	0.0	0.0	0.0	0.0	-0.0	-72.5	-72.5
8	364588.58	4888397.36	178.68	0	8000	82.0	82.0	0.0	0.0	79.7	319.3	-0.9	0.0	0.0	0.0	0.0	-0.0	-316.1	-316.1

Point Source, ISO 9613, Name: "(untitled)", ID: "S37"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	365500.96	4889854.04	185.85	0	63	91.2	91.2	0.0	0.0	83.7	0.5	-3.8	0.0	0.0	0.0	0.0	-0.0	10.8	10.8
2	365500.96	4889854.04	185.85	0	125	93.7	93.7	0.0	0.0	83.7	1.8	1.5	0.0	0.0	0.0	0.0	-0.0	6.7	6.7
3	365500.96	4889854.04	185.85	0	250	96.1	96.1	0.0	0.0	83.7	4.5	-0.2	0.0	0.0	0.0	0.0	-0.0	8.1	8.1
4	365500.96	4889854.04	185.85	0	500	97.3	97.3	0.0	0.0	83.7	8.3	-1.2	0.0	0.0	0.0	0.0	-0.0	6.4	6.4
5	365500.96	4889854.04	185.85	0	1000	98.9	98.9	0.0	0.0	83.7	15.8	-1.2	0.0	0.0	0.0	0.0	-0.0	0.6	0.6
6	365500.96	4889854.04	185.85	0	2000	98.5	98.5	0.0	0.0	83.7	41.7	-1.2	0.0	0.0	0.0	0.0	-0.0	-25.8	-25.8
7	365500.96	4889854.04	185.85	0	4000	95.8	95.8	0.0	0.0	83.7	141.4	-1.2	0.0	0.0	0.0	0.0	-0.0	-128.2	-128.2
8	365500.96	4889854.04	185.85	0	8000	82.0	82.0	0.0	0.0	83.7	504.5	-1.2	0.0	0.0	0.0	0.0	-0.0	-505.0	-505.0

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