ARMOW WIND FARM

NOISE IMPACT ASSESSMENT

September 2013

GL Garrad Hassan

GL Garrad Hassan

ARMOW WIND FARM,
ONTARIO
NOISE IMPACT ASSESSMENT

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1 INTRODUCTION

GL Garrad Hassan Canada, Inc. ("GL GH") was retained by SP Armow Wind Ontario GP Inc. in its capacity as General Partner and on behalf of SP Armow Wind Ontario LP Inc. ("Proponent") to prepare a Noise Impact Assessment ("NIA") of the Armow Wind Farm ("Project") in accordance with the *Ontario Regulation 359/09* (Renewable Energy Approvals (REA) under Part V.0.1 of the Ontario Environmental Protection Act (EPA)) [1]. This NIA also follows the Ontario Ministry of the Environment (MOE) 2008 NPC Noise Interpretation Guidelines [2].

The proposed Project is located in Southwestern Ontario, approximately 6 km east of Lake Huron.

The layout being evaluated is comprised of 98 wind turbine locations, although only 92 turbines will be installed for a total nameplate capacity of 180 MW. The substation transformer locations have been determined and have been included in this assessment.

The objective of this assessment is twofold:

1. Confirm the sound level limit requirements for the Project by providing an assessment of the existing baseline environmental noise conditions in the vicinity of the wind farm; and

2. Predict the noise levels generated by the Project at all Points of Reception (POR), Vacant Lot Receptors (VLR) and Participating receptors within 1,500 m of the turbines.

2 GENERAL DESCRIPTION OF PROJECT SITE

2.1 General Characteristics

The Project is located in southwestern Ontario, in the municipality of Kincardine in Bruce County, near the Town of Kincardine, Ontario, as shown in Figure 2-1. Project components will be installed on privately-owned agricultural lots within this area.

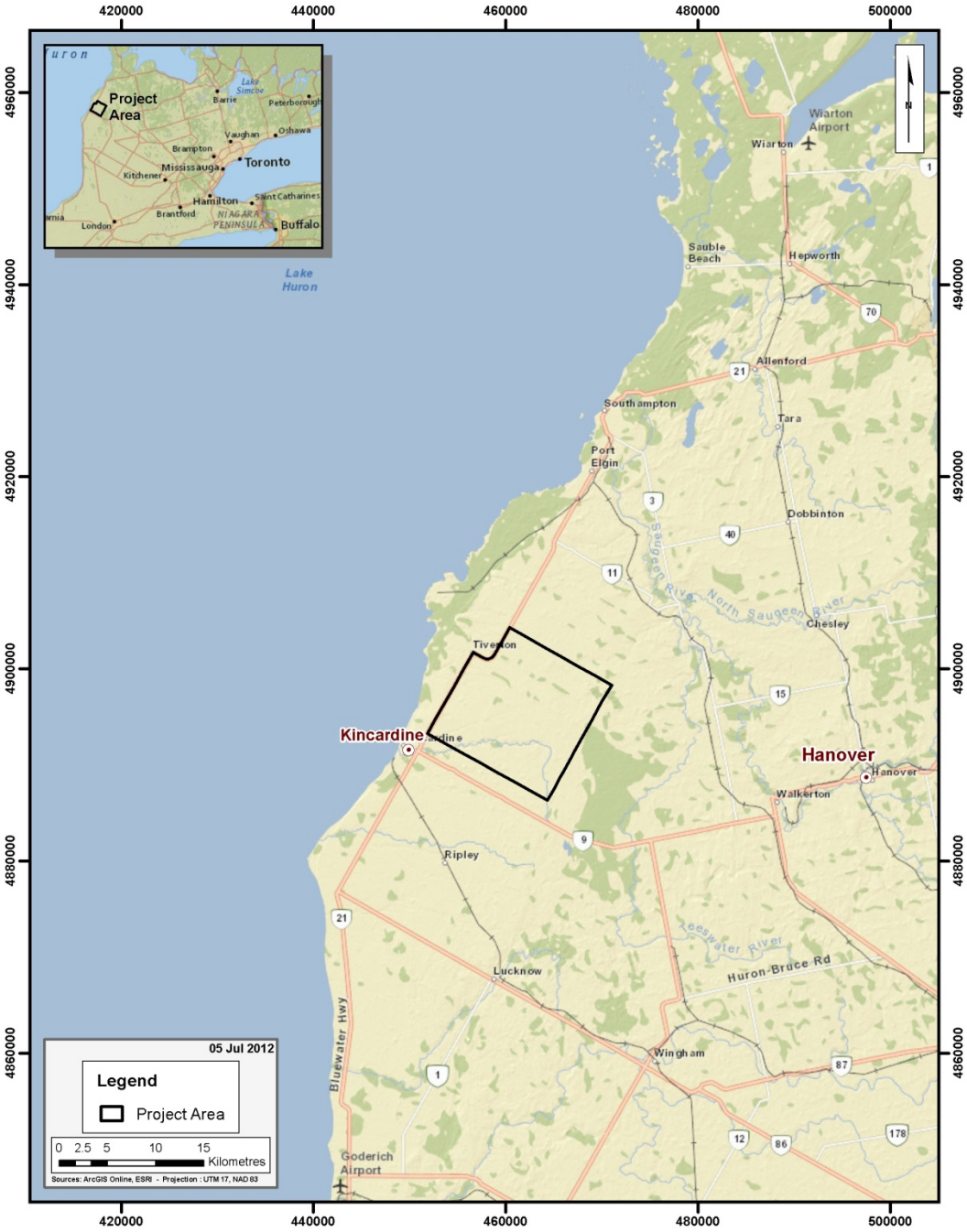

Figure 2-1: Approximate location of the Armow Wind Farm

The Proponent has supplied the layout for the proposed Armow Wind Farm [3]. The layout being evaluated is comprised of 98 wind turbine locations, although only 92 turbines will be installed for a total nameplate capacity of 180 MW. The proposed layout contains eight (8) different wind turbine models, as described in Section 4.1.

The wind turbines have been strategically sited on lands that the Proponent holds under lease options. It is anticipated that the Project collector system may be partially located on public right of ways.

2.2 Land Use Description

The Project lies on predominantly flat, open, agricultural lands that include various natural features such as waterbodies, wetlands and woodlands, as well as built features. The development pattern is typical of most rural areas in southern Ontario with dwellings built near the roadways. The Project Area is dotted with residential farm houses and related buildings. A few small urban centers exist in proximity to the Project, the two largest being Kincardine and Tiverton. The Kincardine zoning key map with the turbine layout overlaid can be found in Appendix A and the individual zoning subdivisions can be found on the Bruce County website [4]. Figure 2-2 presents typical views of the land and features of the study area, including existing wind farms.

Figure 2-2: Land features of the Armow Wind Farm Project Area

2.3 Points of Reception

All PoR, or "receptors", as defined by MOE Noise Guidelines [2], were considered in this NIA. The guidelines generally define a PoR as a house, campground, church, school or other sensitive building that is not located on the same premises as the wind farm, including its turbines and ancillary structures.

Receptor locations for the Project were identified using base data from the Ministry of Natural Resources Land Information Warehouse and Directory, recent aerial photos provided by the Proponent and field reconnaissance to verify locations and building types. Field reconnaissance was performed by GL GH and took place during April 2012. The height of each PoR (taken to be 1.5 m, 4.5 m and 7.5 m for 1-storey, 2-storey and 3-storey houses respectively) was also noted.

PoRs can also include locations on vacant lots that have residences as a permitted use; in this case GL GH has placed a VLR on such lots in a location consistent with the building pattern in the area, as per the *O. Reg. 359/09* and the Ontario MOE Noise Guidelines. The default height of a VLR is 4.5 m.

A residence located on the same premises as a wind turbine or other Project infrastructure is not a PoR as defined by the MOE Noise Guidelines, and considered a "Participating Receptor".

The coordinates of all PoRs, including VLRs and Participating Receptors are listed in Appendix C and Appendix D, respectively.

3 DESCRIPTION OF POINTS OF RECEPTION

There are a total of 391 PoRs located within a radius 1,500 m of a wind turbine or the substation, among which 143 are VLRs and 248 are dwellings or other sensitive receptors such as churches, cemeteries and schools. There are 36 dwellings and 46 VLRs considered as Participating Receptors.

3.1 Receptor Classes

The MOE categorizes PoR into three (3) classes: 1, 2, and 3. Class 1 refers to an acoustic environment typical of a major population centre where the background noise is dominated by the urban hum. These areas are highly urbanized and have moderate to high noise levels throughout the day and night. Class 2 areas have an acoustic environment characterized by low ambient sound levels between 19:00 and 07:00, whereby the evening and night time levels are defined by natural sounds, infrequent human activity and no clearly audible sounds from stationary sources (e.g. industrial and commercial facilities). Class 3 areas are typical of rural and/or small communities (i.e. with populations of less than 1,000) and an acoustic environment that is dominated by natural sounds with little or no road traffic.

Within the study area the main sources of ambient sound that currently exist include:

- Vehicular traffic on the local concession and side roads, some of which are gravel roads;
- Occasional sounds due to agricultural activities;
- Occasional sounds due to anthropogenic domestic activities; and
- Natural sounds.

Based on these conditions, all PoR are considered as having a Class 3 acoustic environment.

3.2 Determination of Applicable Noise Limits

As stated in the MOE guidelines, the noise limits for a wind farm are set according to the existing MOE noise guidelines in NPC-205/NPC-232 while taking into account the wind-generated background noise.

For a Class 3 area, the sound level limits as defined by the MOE Interpretation are described in the sections below.

3.2.1 Wind Turbine Installations in Class 3 Areas (Rural), Wind Speeds Below 6 m/s

The lowest sound level limit expressed in terms of L_{eq} is: i) 40 dBA; or ii) the minimum hourly background sound level established in accordance with Publications NPC-232/NPC-233, whichever is higher.

3.2.2 Class 3 Areas, Wind Speeds Above 6 m/s

The lowest sound level limit expressed in terms of L_{eq} is: i) the wind-induced background sound level, expressed in terms of ninetieth percentile sound level (L_{A90}) plus 7 dB; or ii) the minimum hourly background sound level established in accordance with Publications NPC-205/NPC-232/NPC-233, whichever is higher.

The applicable noise limits should be those defined by the MOE as summarized below in Table 3-1. A sample calculation of how noise modeling was determined for each PoR appears in Appendix B where intermediate and cumulative A-weighted sound pressure levels from each turbine are provided.

Table 3-1: Summary of noise limits for points of reception (Class 3)

Wind Turbine Noise Criterion (NPC-232 and Guideline) [dBA]	Wind Speed [m/s]				
	6	**7**	**8**	**9**	**10**
	40	43	45	49	51

4 DESCRIPTION OF SOURCES

4.1 Turbines

The proposed Siemens wind turbine models are all 3-bladed, upwind, horizontal-axis turbines. The rotor diameter of each wind turbine model is 101 m. At each wind turbine, the rotor and nacelle are mounted on top of a tubular tower which is manufactured in sections from steel plate. Each turbine is mounted on a steel reinforced concrete foundation.

Eight turbine models are under consideration, as described in Table 4-1.

Table 4-1: Summary of turbine models used at the Armow site

Turbine Model Nameplate	Maximum Rated Power [MW]	Hub Height [m]	Peak Sound Power Level [dBA]	Number of turbines
SWT-2.3-101, Rev. 4, Max. Power 1824 kW, 99.5 m	1.824	99.5	101	19
SWT-2.3-101, Rev. 4, Max. Power 1903 kW, 99.5 m	1.903	99.5	102	53
SWT-2.3-101, Rev. 4, Max. Power 2030 kW, 99.5 m	2.030	99.5	103	4
SWT-2.3-101, Rev. 4, Max. Power 2126 kW, 99.5 m	2.126	99.5	104	7
SWT-2.3-101, Rev. 4, Max. Power 2221 kW, 99.5 m	2.221	99.5	105	6
SWT-2.3-101, Rev. 4, Max. Power 2300 kW, 99.5 m	2.300	99.5	106	7
SWT-2.3-101, Rev. 4, Max. Power 2030 kW, 80 m	2.030	80	103	1
SWT-2.3-101, Rev. 4, Max. Power 2126 kW, 80 m	2.126	80	104	1
			Total	**98**

Table 4-2 presents the general specifications for the wind turbine models considered at the Armow site. It is noted that other than rated power and hub height (presented in Table 4-1), all wind turbines share common general specifications, as presented in Table 4-2.

Table 4-2: General specifications for turbine models used at the Armow site

Design	Steel, tubular, white; 3 sections
Rotor diameter	101 m
Operational interval	6 - 16 rpm
Number of blades	3
Cut-in wind speed	3 m/s
Cut-out wind speed	25 m/s
Nominal wind speed	12 m/s

Full noise specifications as provided by the manufacturer to the Propenent can be found in Appendix E. Coordinates of all turbines are listed in Appendix F, including a description of which turbine model is used at each wind turbine location for the Project.

4.2 Substation

The Project comprises one substation located in the Project Area and in close proximity to the wind turbines. The substation includes two (2) identical 105 MVA transformers, which will elevate the Project's collector system voltage from 34.5 kV to 240 kV. The noise specifications of the Armow transformer are described in Section 5.3.

The transformer coordinates, as provided by the Proponent, are included in Appendix F.

4.3 Other Wind Farms

Another proponent, Enbridge Ontario Wind Power LP ("Enbridge"), has submitted to the MOE an NIA Report for the Underwood Wind Farm [7], which is now operational. As-built coordinates were supplied by Enbridge [8]. The wind farm consists of 110 Vestas V82 wind turbines, also referred to as NEG Micon NM 82/1650 wind turbines, many of which are within 5 km of the proposed Armow Wind Farm site. These wind turbines have been considered in this NIA. The Vestas V82 wind turbines are reported to have a hub height of 80 m.

Enbridge has also developed the Cruickshank Wind Farm, which consists of 5 Vestas V82 wind turbines, located within 5 km of the proposed Armow Wind Farm site [9]. These wind turbines have been considered in this NIA. The Vestas V82 wind turbines are reported to have a hub height of 80 m. Coordinates of the wind turbines have been supplied by the Proponent.

Suncor Energy Products Inc. ("Suncor") has submitted to the MOE an NIA Report for the substation for the Ripley Wind Farm [10]. The substation is located within 5 km of the proposed Armow Wind Farm site and has been considered in this NIA. The Ripley Wind Farm is located significantly further than 5 km from the Armow Site and is not expected to contribute to the cumulative noise impacts, thus is has not been considered in this NIA. Coordinates of the substation were taken from the Ripley Wind Power Project noise report that Suncor presented to the MOE in October 2006.

4.4 Sound Barrier

In order to achieve compliance with the noise limits described in Section 3, each of the two (2) Armow transformers will require a noise barrier. The type of barrier used in this noise study is one that can be

described as of absorptive type with an Absorptive Coefficient of 0.85. The acoustic barriers should have a surface density of at least 20 kg/m^2 and have a closed surface free of gaps and cracks, such as Armtec's Durisol. A 7 m tall barrier was modeled on all four (4) sides of each transformer, several meters away from its surface on each side, with an opening on the north side to allow for equipment access. The two (2) barriers are illustrated in Figure 4-1. The corner coordinates of the Armow substation barriers are shown in Table 4-3.

Table 4-3: Armow substation barrier coordinates

Description	Easting [m]	Northing [m]
Western Barrier, point 1	465612.1	4899635.7
Western Barrier, point 2	465622.6	4899629.9
Western Barrier, point 3	465612.9	4899612.4
Western Barrier, point 4	465595.4	4899622.1
Western Barrier, point 5	465610.0	4899648.3
Eastern Barrier, point 1	465638.1	4899621.7
Eastern Barrier, point 2	465648.6	4899615.9
Eastern Barrier, point 3	465638.9	4899598.4
Eastern Barrier, point 4	465621.4	4899608.1
Eastern Barrier, point 5	465636.0	4899634.3

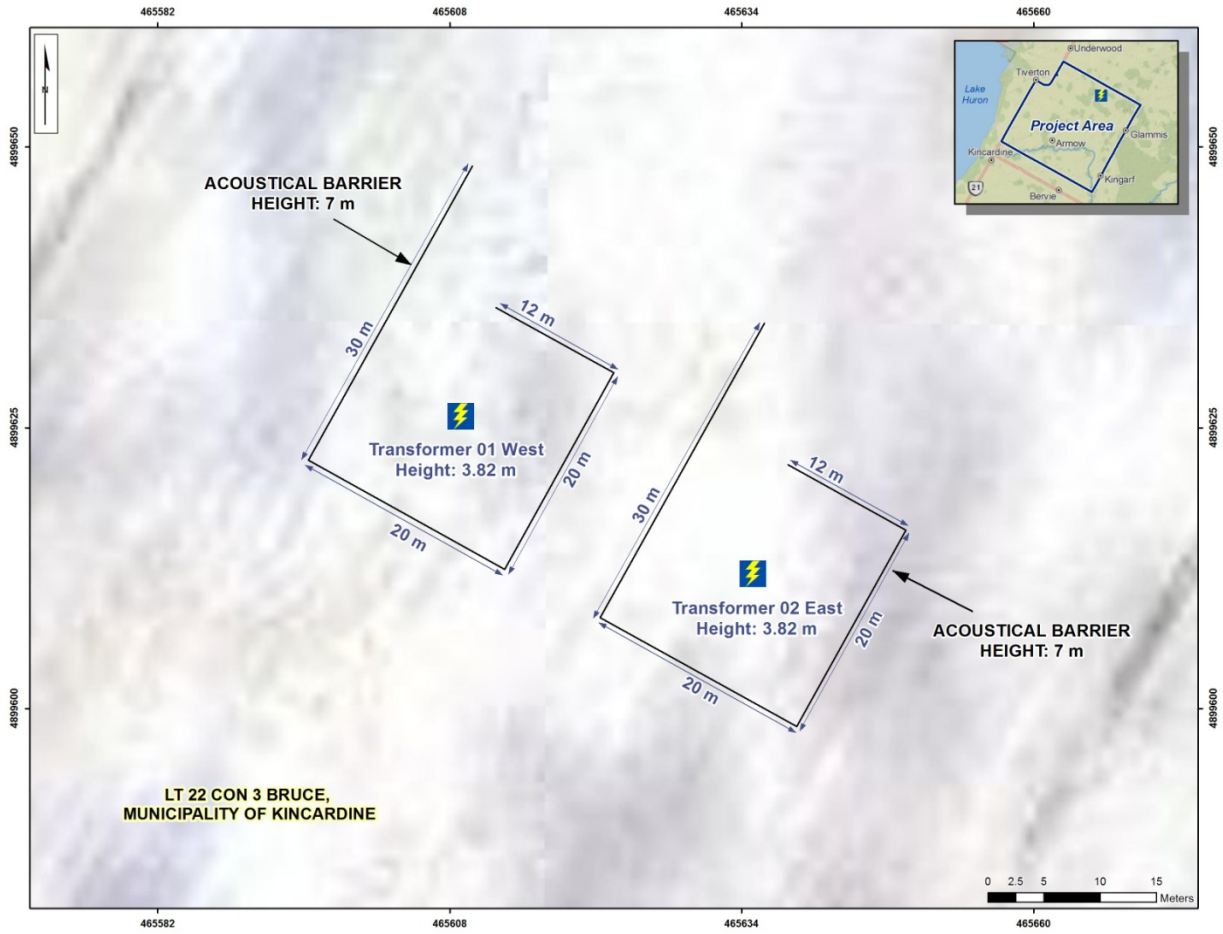

Figure 4-1: Armow Wind Farm Substation Barriers

5 NOISE EMISSION RATINGS

5.1 Armow Wind Turbines

Broadband sound power levels and octave band sound power levels were provided by Siemens [5] for each of the eight (8) wind turbine models under consideration and are shown in Appendix E. Measurements were made in accordance with the IEC 61400 – 11 Ed. 2.1 method [6] using standardized wind speeds at 10 m height. IEC 61400-11 (edition 2:2002 consolidated with amendment 1:2006) was adopted without modification as CAN/CSA-C61400-11-07 (R2012).

For each of the eight (8) wind turbine models, Siemens has provided octave band sound power levels corresponding to 10 m height wind speeds of 6, 7, 8, 9, and 10 m/s, as shown in Appendix E. Siemens has also provided a letter [11], included as Appendix G, which guarantees the maximum broadband sound power level of each turbine model.

GL GH has determined that for all Siemens wind turbine models, the octave band sound power levels corresponding to a 10 m wind speed of 7 m/s result in the greatest sound pressure level at all receptors. Therefore, the Siemens turbine octave band sound power levels used for the simulation in this NIA are those stated for each octave band centre frequency, for a 10 m height wind speed of 7 m/s. The acoustic emissions of the eight turbine models under consideration are shown in Table 5-1 to Table 5-8.

Table 5-1: Siemens SWT-2.3-101, Rev.4, Max. Power 1824 kW, 99.5 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 1824 kW, 99.5 m										
Electrical Rating : 1.824 MW										
Hub Height (m) : 99.5 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	111.5	111.1	110.2	110.2	110.0	111.1	111.1	111.1	111.1	111.1
125	104.7	105.6	105.7	105.6	105.2	105.6	105.6	105.6	105.6	105.6
250	103.8	103.5	102.6	102.4	101.8	103.5	103.5	103.5	103.5	103.5
500	97.0	96.7	95.8	95.6	95.2	96.7	96.7	96.7	96.7	96.7
1000	92.8	94.4	95.0	94.9	95.1	94.4	94.4	94.4	94.4	94.4
2000	90.3	92.5	93.5	93.7	94.1	92.5	92.5	92.5	92.5	92.5
4000	88.2	88.7	88.6	89.4	89.7	88.7	88.7	88.7	88.7	88.7
8000	77.3	78.6	79.1	79.3	79.2	78.6	78.6	78.6	78.6	78.6
A-weighted	100.4	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0	101.0

Table 5-2: Siemens SWT-2.3-101, Rev.4, Max. Power 1903 kW, 99.5 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 1903 kW, 99.5 m										
Electrical Rating : 1.903 MW										
Hub Height (m) : 99.5 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	111.7	111.3	110.4	110.5	110.2	111.3	111.3	111.3	111.3	111.3
125	105.1	105.9	106.1	106.0	105.6	105.9	105.9	105.9	105.9	105.9
250	104.2	103.9	103.0	102.8	102.2	103.9	103.9	103.9	103.9	103.9
500	98.4	98.0	97.0	96.8	96.4	98.0	98.0	98.0	98.0	98.0
1000	94.5	95.9	96.4	96.3	96.4	95.9	95.9	95.9	95.9	95.9
2000	91.4	93.6	94.6	94.7	95.2	93.6	93.6	93.6	93.6	93.6
4000	89.1	89.7	89.6	90.5	90.7	89.7	89.7	89.7	89.7	89.7
8000	77.6	79.1	79.7	79.9	79.9	79.1	79.1	79.1	79.1	79.1
A-weighted	101.4	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0

Table 5-3: Siemens SWT-2.3-101, Rev.4, Max. Power 2030 kW, 99.5 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 2030 kW, 99.5 m										
Electrical Rating : 2.030 MW										
Hub Height (m) : 99.5 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	112.0	111.6	110.6	110.7	110.4	111.6	111.6	111.6	111.6	111.6
125	105.6	106.3	106.5	106.4	105.9	106.3	106.3	106.3	106.3	106.3
250	104.6	104.3	103.5	103.3	102.6	104.3	104.3	104.3	104.3	104.3
500	99.7	99.2	98.2	98.0	97.6	99.2	99.2	99.2	99.2	99.2
1000	96.2	97.3	97.8	97.6	97.8	97.3	97.3	97.3	97.3	97.3
2000	92.4	94.7	95.7	95.8	96.2	94.7	94.7	94.7	94.7	94.7
4000	89.9	90.6	90.6	91.5	91.6	90.6	90.6	90.6	90.6	90.6
8000	77.8	79.6	80.3	80.5	80.4	79.6	79.6	79.6	79.6	79.6
A-weighted	102.4	103.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0

Table 5-4: Siemens SWT-2.3-101, Rev.4, Max. Power 2126 kW, 99.5 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 2126 kW, 99.5 m										
Electrical Rating : 2.126 MW										
Hub Height (m) : 99.5 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	112.2	111.8	110.8	110.8	110.4	111.8	111.8	111.8	111.8	111.8
125	105.9	107.1	106.8	106.2	105.3	107.1	107.1	107.1	107.1	107.1
250	105.0	105.8	103.3	102.6	101.7	105.8	105.8	105.8	105.8	105.8
500	100.3	100.8	99.5	99.2	98.8	100.8	100.8	100.8	100.8	100.8
1000	97.7	98.3	99.3	99.2	99.3	98.3	98.3	98.3	98.3	98.3
2000	93.9	94.5	96.6	96.7	97.2	94.5	94.5	94.5	94.5	94.5
4000	90.6	91.8	91.5	93.3	93.4	91.8	91.8	91.8	91.8	91.8
8000	78.1	78.8	80.4	80.3	80.1	78.8	78.8	78.8	78.8	78.8
A-weighted	103.3	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0

Table 5-5: Siemens SWT-2.3-101, Rev.4, Max. Power 2221 kW, 99.5 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 2221 kW, 99.5 m										
Electrical Rating : 2.221 MW										
Hub Height (m) : 99.5 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	112.5	112.2	111.0	111.1	110.7	112.2	112.2	112.2	112.2	112.2
125	106.4	107.7	107.2	106.6	105.7	107.7	107.7	107.7	107.7	107.7
250	105.1	106.1	105.0	104.3	103.5	106.1	106.1	106.1	106.1	106.1
500	100.9	101.5	100.4	100.2	99.8	101.5	101.5	101.5	101.5	101.5
1000	99.2	99.9	100.1	100.0	100.2	99.9	99.9	99.9	99.9	99.9
2000	95.3	96.0	97.7	97.8	98.2	96.0	96.0	96.0	96.0	96.0
4000	91.2	92.5	92.6	94.4	94.5	92.5	92.5	92.5	92.5	92.5
8000	78.2	79.0	81.9	81.8	81.6	79.0	79.0	79.0	79.0	79.0
A-weighted	104.2	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0

Table 5-6: Siemens SWT-2.3-101, Rev.4, Max. Power 2300 kW, 99.5 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 2300 kW, 99.5 m										
Electrical Rating : 2.3 MW										
Hub Height (m) : 99.5 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	112.9	112.4	111.2	110.0	109.4	112.4	112.4	112.4	112.4	112.4
125	106.9	107.8	107.6	105.6	105.4	107.8	107.8	107.8	107.8	107.8
250	104.1	105.1	104.7	102.9	102.5	105.1	105.1	105.1	105.1	105.1
500	101.1	101.8	101.6	101.3	100.8	101.8	101.8	101.8	101.8	101.8
1000	100.9	101.6	101.7	101.9	101.8	101.6	101.6	101.6	101.6	101.6
2000	97.1	98.4	98.6	99.1	99.5	98.4	98.4	98.4	98.4	98.4
4000	91.8	93.2	93.4	94.0	94.3	93.2	93.2	93.2	93.2	93.2
8000	80.0	81.5	81.9	82.5	83.1	81.5	81.5	81.5	81.5	81.5
A-weighted	105.1	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0	106.0

Table 5-7: Siemens SWT-2.3-101, Rev.4, Max. Power 2126 kW, 80 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 2126 kW, 80 m										
Electrical Rating : 2.126 MW										
Hub Height (m) : 80 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	111.8	111.9	110.8	110.6	110.5	111.9	111.9	111.9	111.9	111.9
125	105.6	107.0	106.9	106.5	105.5	107.0	107.0	107.0	107.0	107.0
250	104.6	105.8	103.3	102.9	101.9	105.8	105.8	105.8	105.8	105.8
500	99.9	100.9	99.5	99.3	98.9	100.9	100.9	100.9	100.9	100.9
1000	97.3	98.4	99.3	99.2	99.3	98.4	98.4	98.4	98.4	98.4
2000	93.5	94.6	96.6	96.7	97.0	94.6	94.6	94.6	94.6	94.6
4000	90.2	91.7	91.5	92.4	93.4	91.7	91.7	91.7	91.7	91.7
8000	77.7	78.8	80.4	80.3	80.2	78.8	78.8	78.8	78.8	78.8
A-weighted	102.9	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0

Table 5-8: Siemens SWT-2.3-101, Rev.4, Max. Power 2030 kW, 80 m wind turbine acoustic emission summary

Make and Model : SWT-2.3-101, Rev.4, Max. Power 2030 kW, 80 m										
Electrical Rating : 2.030 MW										
Hub Height (m) : 80 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	111.6	111.7	110.6	110.5	110.5	111.7	111.7	111.7	111.7	111.7
125	105.1	106.3	106.4	106.4	106.0	106.3	106.3	106.3	106.3	106.3
250	104.2	104.6	103.5	103.4	102.8	104.6	104.6	104.6	104.6	104.6
500	99.3	99.5	98.2	98.1	97.7	99.5	99.5	99.5	99.5	99.5
1000	95.8	97.2	97.8	97.7	97.8	97.2	97.2	97.2	97.2	97.2
2000	92.0	94.3	95.7	95.8	96.1	94.3	94.3	94.3	94.3	94.3
4000	89.5	90.6	90.6	91.1	91.6	90.6	90.6	90.6	90.6	90.6
8000	77.4	79.3	80.3	80.4	80.5	79.3	79.3	79.3	79.3	79.3
A-weighted	102.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0

Siemens has provided a noise measurement report to the Proponent, which describes the measurement and analysis of the sound power level and tonality of the SWT-2.3-101 [13], included here as Appendix H. Siemens has stated that the Siemens turbines to be supplied for the Armow Wind Project are not tonal since all of these turbines produce no tonal audibility above 3 dB as stated in the acoustic emission documents and calculated using the criteria specified in accordance with IEC 61400-11:2002 [11]. Therefore a tonality penalty has not been applied to noise from the Siemens turbines. A summary of the tonal and tonal audibility results from [13] is shown in Table 5-9.

Table 5-9: Summary of SWT-2.3-101, Max. Power 2300 kW tonality and tonal audibility

Wind Speed [m/s]	6	7	8	9	10
Max Tonality ΔL_k [dB]	-6.7	-5.2	-2.9	-1.5	-0.2
Max Tonality Audibility $\Delta L_{a,k}$ [dB]	-4.7	-3.2	-0.6	0.8	2.1

5.2 Underwood and Cruickshank Wind Turbines

As described in Section 4.3, there are two (2) neighbouring wind farms, the Underwood Wind Farm and the Cruickshank Wind Farm, which must be considered as noise sources in this assessment.

Broadband sound power levels and octave band sound power levels of the Vestas V82 wind turbine were obtained from the Underwood Wind Farm noise report [7], as shown in Appendix I, corresponding to

10 m height wind speeds of 6, 7, 8, 9, and 10 m/s. Measurements were made in accordance with the IEC 61400 – 11 Ed. 2.1 method [6].

GL GH has determined that for the V82 wind turbines, the octave band sound power levels corresponding to a 10 m wind speed of 10 m/s result in the greatest sound pressure level at all receptors. Therefore, the Vestas V82 octave band sound power levels used for the simulation in this NIA are those stated for each octave band centre frequency, for a 10 m height wind speed of 10 m/s, in Table 5-10. This turbine was used for modeling both the Underwood and Cruickshank wind farms.

Table 5-10: Vestas V82 wind turbine acoustic emission summary

Make and Model : Vestas V82/NEG Micon NM82										
Electrical Rating : 1.65 MW										
Hub Height (m) : 80 m										
Wind Shear Coefficient : 0.42, worst case summer night time shear of the region [12]										
	Octave Band Sound Power Level [dB]									
	Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed [m/s]	6	7	8	9	10	6	7	8	9	10
Frequency [Hz]										
63	108	111.4	114.7	117	114.3	114.3	114.3	114.3	114.3	114.3
125	105.9	108.5	111.6	113.7	113.5	113.5	113.5	113.5	113.5	113.5
250	104.5	106.4	108.7	110.0	112.8	112.8	112.8	112.8	112.8	112.8
500	99.2	100.9	103.4	104.9	108.7	108.7	108.7	108.7	108.7	108.7
1000	96.0	97.5	101.1	103.7	103.6	103.6	103.6	103.6	103.6	103.6
2000	92.7	94.0	96.9	98.8	96.5	96.5	96.5	96.5	96.5	96.5
4000	91.7	92.1	95.2	97.3	87.2	87.2	87.2	87.2	87.2	87.2
8000	80.0	82.5	87.8	92.1	78.0	78.0	78.0	78.0	78.0	78.0
A-weighted	102.4	104.0	106.9	108.9	109.9	109.9	109.9	109.9	109.9	109.9

As noted in Section 4, the V82 wind turbine is also known as the NM82. A noise measurement test made in accordance with the IEC 61400 – 11 Ed. 2.1 method concluded that no audible tones are present in the noise emitted from the NM82 turbine [14]. Therefore a tonality penalty has not been applied to noise from the V82 wind turbines. The noise measurement report summary is included in Appendix I.

5.3 Armow Substation Transformers

The cumulative effect that the Armow substation would have on nearby residents has been considered in this analysis. Noise emission from the Armow substation mainly originates from two (2) identical high-voltage 105 MVA, 240 kV transformers. The choice of transformer has not yet been finalized but will be sourced in accordance with permitted specifications. The Proponent has supplied specifications and drawings of an example transformer model, similar to what will be constructed [15]. These drawings are included here as Appendix J. The transformer sound power level used in the noise modeling has been

calculated based on these specifications and drawings, as described below. The Proponent has specified that the final transformer sound power level will not exceed what has been modeled in this report.

The broadband sound power level of each Armow transformer has been calculated to be 105.5 dBA, based on an audible noise level of 77 dBA, as sourced and guaranteed by the Proponent, in accordance with the application of standard IEEE C57.12.90. The 105.5 dBA includes a 5 dBA tonal penalty, as prescribed in Publication NPC-104.

The substation transformer drawings used to calculate the transformer's measurement surface area, as defined in standard IEEE C57.12.90, are included in Appendix J. The calculated measurement surface area *S* was found to be 223.1 m². This calculation is based on an 8-sided polygon perimeter that includes a 2 m offset from both fan cooled surfaces and a 0.3 m offset from the other surfaces, as well as the top area of the measurement surface, in accordance with standard IEEE C57.12.90. A sketch of the plan view of the transformer, showing the approximate perimeter of the measurement surface area, is included in Appendix J.

The measurement surface area excludes the reservoir above the main transformer tank since that height is not considered when determining the height of the IEEE C57.12.90 microphone placement, and therefore not part of the measurement surface area. The substation coordinates, as provided by the Proponent, are included in Appendix F.

The transformer's broadband sound power level L_W has been estimated as a function of its sound pressure level and measurement surface area using the following equation, as defined by IEEE C57.12.90 [18]

$$L_W = L_P + 10 * logS$$

A broadband sound power level of 105.5 dBA was used for the transformer for all noise modeling. The calculation is summarized in Table 5-11.

Table 5-11: Armow Transformer sound power level calculation summary

Transformer Power Rating [MVA]	105
Transformer Voltage Rating [kV]	240
Sound Pressure Level L_P [dBA]	77.0
Sound measurement area S (m^2)	223.1
Sound Power Level [dBA] (without penalty)	100.5
Sound Power Level L_W [dBA] (with penalty)	**105.5**

Table 5-12 provides the octave band sound power levels of the Armow substation transformers using a typical transformer octave band sound distribution for a large transformer [16]. Table 5-13 details the octave band calculation.

As seen in Appendix J, the top height of the main tank and fans of the transformer is 3.82 m. The transformers have been conservatively modeled as point sources at this top height.

Table 5-12: Armow Wind Farm substation transformer sound power level

	Octave Band Sound Power Level* (dB)									
Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000	Broadband (dBA)
PWL (dB)	102.1	108.1	110.1	105.1	105.1	99.1	94.1	89.1	82.1	105.5

* Includes 5 dB penalty to account for tonality

Table 5-13: Armow Transformer Octave Band Calculation Details

31.5	63	125	250	500	1000	2000	4000	8000	Frequency [Hz]
-1	5	7	2	2	-4	-9	-14	-21	**Typical Outdoor Transformer Octave band relative distribution [17] [dB Lin]**
-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	**dB Lin to dBA Conversion Scale**
-40.4	-21.2	-9.1	-6.6	-1.2	-4.0	-7.8	-13.0	-22.1	**Typical Outdoor Transformer Octave band relative distribution [dBA]**
62.7	81.9	94.0	96.5	101.9	99.1	95.3	90.1	81.0	**Scaled to 105.5 dBA Transformer**

5.4 Ripley and Underwood Wind Farm Substation Transformers

The substation associated with the Ripley Wind Farm is located within 5 km of the Project and the cumulative noise effects from its two (2) high-voltage transformers have also been considered in this analysis. The substation associated with the neighbouring Underwood Wind Farm, which consists of two (2) high-voltage transformers, is located greater than 5 km from the Armow project. Noise emissions from the Underwood substation have therefore not been considered in this assessment. For reference, the coordinates of the two (2) Underwood high-voltage transformers are included in Appendix F.

Noise emission from the Ripley substation mainly originates from two (2) identical 42 MVA, 240 kV transformers. The maximum broadband sound power level of each transformer is reported to be 102.0 dBA in the Ripley Wind Power Project NIA report [10], which does not include a penalty for tonality. Since the substations are considered to be a tonal noise source, it is necessary to apply a 5 dBA penalty as prescribed in Publication NPC-104. The resulting transformer sound power level is therefore 107.0 dBA.

Based on the available information, GL GH has independently calculated the sound power level of the Ripley transformer to be 107.0 dBA, including tonality penalty, as described below. This is consistent with the transformer sound power level in the Ripley noise report, as described above.

The Ripley transformer specifications sheet is shown in Appendix K. The transformer's audible noise level is reported to be 78 dBA during second stage ONAF operation. The transformer has fans on one (1) side as seen in the diagram on the transformer's nameplate as well as in photographs of the transformer, shown in Appendix K. Based on this diagram, and the transformer's width, depth, and height over cover described in the specifications, the measurement surface area was calculated to be 253.7 m^2. This calculation is based on a 6-sided polygon perimeter that includes a 2 m offset from the fan cooled surface and a 0.3 m offset from the other surfaces, as well as the top area of the measurement surface, in accordance with standard IEEE C57.12.90.

The measurement surface area excludes the reservoir above the main transformer tank since that height is not considered when determining the height of the IEEE C57.12.90 microphone placement, and therefore not part of the measurement surface area. The substation coordinates, as provided by the Proponent, are included in Appendix F.

The transformer's broadband sound power level L_W has been estimated as a function of its sound pressure level and measurement surface area using the following equation, as defined by IEEE C57.12.90 [18]

$$L_W = L_P + 10 * logS$$

A broadband sound power level of 107.0 dBA was used for the Ripley transformer for all noise modeling. The calculation is summarized in Table 5-14.

Table 5-14: Ripley Transformer sound power level calculation summary

Transformer Power Rating [MVA]	42
Transformer Voltage Rating [kV]	240
Sound Pressure Level L_P [dBA]	78.0
Sound measurement area S (m^2)	253.7
Sound Power Level [dBA] (without penalty)	102.0
Sound Power Level L_W [dBA] (with penalty)	**107.0**

Table 5-15 provides the octave band sound power levels of the Ripley substation transformers using a typical transformer octave band sound distribution for a large transformer [16]. Table 5-16 details the octave band calculation. It is noted that the transformer octave band sound power levels reported in the Ripley NIA correspond well with those estimated by GL GH, once the tonality penalty is applied. The only exception to this is the 32 Hz band, which was not considered in the Ripley NIA but has been considered in this assessment.

As seen in Appendix K, the height of the transformer is 4.0 m. The transformers have been conservatively modeled as point sources at this height.

Table 5-15: Ripley substation transformer sound power level

	Octave Band Sound Power Level* (dB)									
Frequency (Hz)	32	63	125	250	500	1000	2000	4000	8000	Broadband (dBA)
PWL (dB)	103.6	109.6	111.6	106.6	106.6	100.6	95.6	90.6	83.6	107.0

* Includes 5 dB penalty to account for tonality

Table 5-16: Ripley Transformer Octave Band Calculation Details

31.5	63	125	250	500	1000	2000	4000	8000	Frequency [Hz]
-1	5	7	2	2	-4	-9	-14	-21	**Typical Outdoor Transformer Octave band relative distribution [17] [dB Lin]**
-39.4	-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1	**dB Lin to dBA Conversion Scale**
-40.4	-21.2	-9.1	-6.6	-1.2	-4.0	-7.8	-13.0	-22.1	**Typical Outdoor Transformer Octave band relative distribution [dBA]**
64.2	83.4	95.5	98.0	103.4	100.6	96.8	91.6	82.5	**Scaled to 107.0 dBA Transformer**

6 NOISE IMPACT ASSESSMENT

The sound pressure level at each PoR and Participating Receptor for the aggregate of all wind turbines and substations associated with the Armow Project and adjacent projects were calculated based on the ISO 9613-2 method.

The ISO 9613 standard [19] [20] provides a prediction of the equivalent continuous A-weighted sound pressure level at a distance from one or more point sources under meteorological conditions favourable to propagation from sources of sound emission. These conditions are for downwind propagation or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, commonly occurring at night.

The method consists of octave-band algorithms (i.e., with nominal mid-band frequencies from 63 Hz to 8 kHz) for calculating the attenuation of the emitted sound. The algorithm takes into account the following physical effects:

- Geometrical divergence – attenuation due to spherical spreading from the sound source;
- Atmospheric absorption – attenuation due to absorption by the atmosphere; and
- Ground effect – attenuation due to the acoustical properties of the ground.

ISO-9613-2 parameters were set as follows:

- Ambient air temperature: 10ºC;
- Ambient barometric pressure: 101.32 kPa;
- Humidity: 70%;
- Source ground factor: 0.7;
- Middle ground factor: 0.7; and
- Receptor ground factor: 0.7;

The effect of topography was included. Justification for the use of a global ground factor of 0.7 is presented in Section 6.1.

Additional calculations concerning propagation through foliage were not performed in this NIA, implying that the values calculated for sound attenuation are likely to be conservative in areas where there is foliage present in the line of sight between any turbine and a PoR. The estimated accuracy of the ISO 9613 method, as stated in ISO 9613-2, is ± 3 dB.

The noise emission ratings used for each source were those specified in Section 5. The noise impact was calculated for each PoR and Participating Receptor located within 1,500 m of at least one (1) wind turbine or the substation, and the calculated noise level was then compared with the applicable noise limit for each receptor as stated in Table 3-1.

Noise levels were calculated at 4.5 m a.g.l for 2-storey Points of Reception/Participating Receptors and at 7.5 m a.g.l for 3-storey PoR/Participating Receptors. For all noise modeling, including the sample calculations shown in Appendix B, it has been assumed that the shear profile is representative of night time during the summer, as described by the MOE [2].

6.1 Justification of global ground factor G

In order to evaluate the suitability of using a global ground factor of 0.7, GL GH has undertaken a refined estimate of the noise propagation around the project substation. Specifically, ground attenuation from the substation to R_268 has been investigated. This part of the site is expected to be most sensitive to ground factor assumptions; it will have the largest area of hard ground, as well as the shortest source-receiver distance.

The Proponent has supplied site plans indicating that an area around the substation of approximately 12,000 m^2 will be covered with gravel, as seen in Figure 6-1. For the purpose of this analysis, the gravel area has been assumed to have a ground factor of 0. Based on aerial photography, there is an additional area of hard ground near R_268, as seen in Figure 6-1.The remaining area between the substation and R_268 can be categorized as soft ground, with a ground factor of 1.0, as defined by ISO 9613-2 [20].

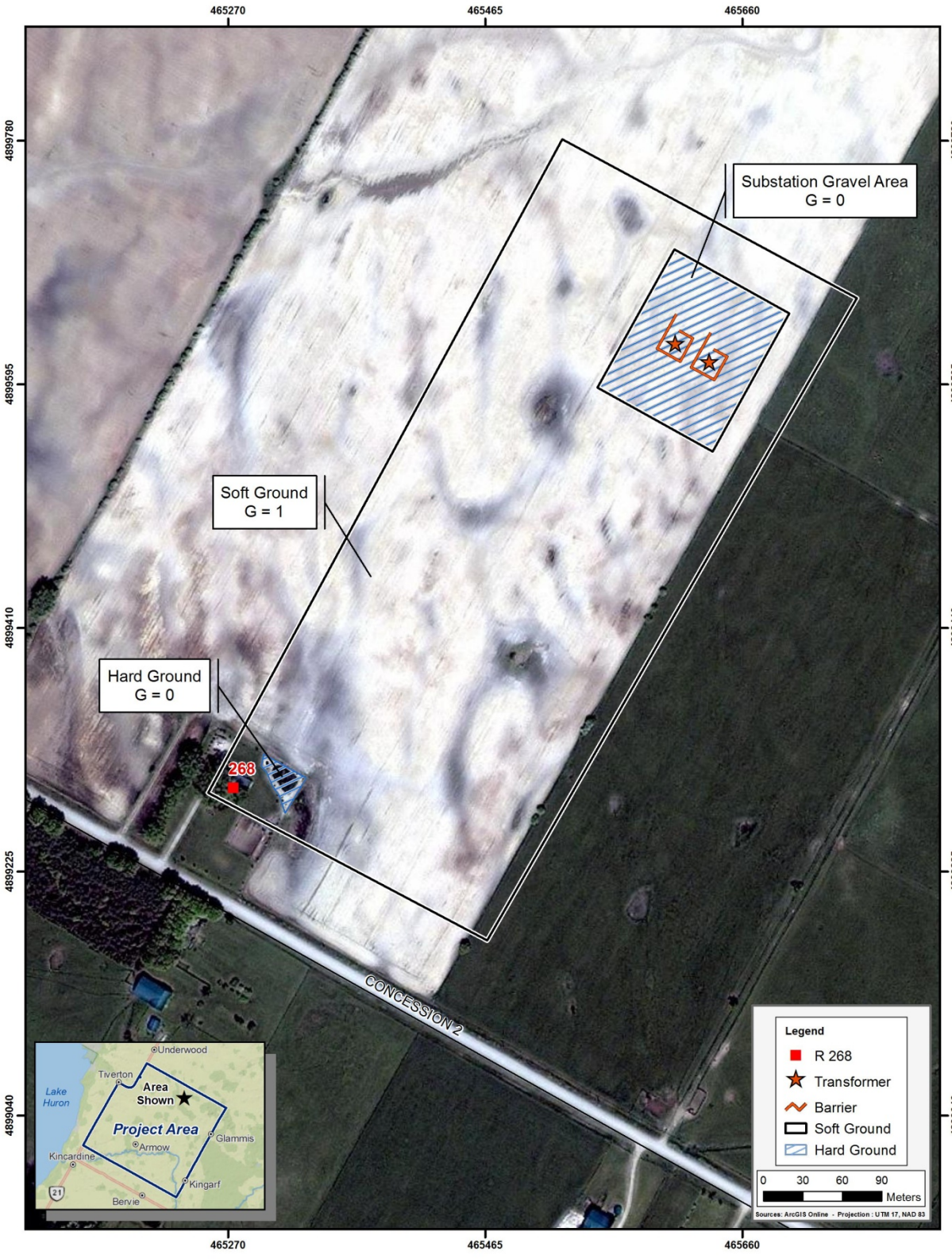

Figure 6-1: Ground factor near the Armow Wind Farm substation

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Based on these ground factor areas, CadnaA calculates the source, middle, and receiver region ground factors for the transformer to R_268 case, as defined in ISO 9613-2, for each of the two (2) transformers [21].

Two (2) sets of CadnaA calculations have been carried out. The first uses the site specific ground factor areas as defined above. The second CadnaA calculation uses a global ground factor of 0.7 for the entire region. The estimated sound pressure level at R_268 is shown below for each case.

Case	**Case 1, Global G = 0.7**	**Case 2, Site-Specific G values for each region**
Sound Pressure Level at R_268 [dBA]	39.1	38.9

As seen in the table, Case 1 produces a sound pressure level of 39.1 dBA at R_268, which is higher and therefore a more conservative assumption than Case 2. Because a global value of 0.7 has been shown to be more conservative for the most sensitive source-receiver case in the vicinity of the transformer, GL GH considers this to be further support that this value can be considered appropriate for use across the rest of the Armow site, based on ISO 9613-2. Therefore the opinion of GL GH is that based on ISO 9613-2, a global ground factor of 0.7 is suitable for use when modeling noise propagation at the Armow site.

7 NOISE IMPACT ASSESSMENT SUMMARY TABLE

7.1 Results

The noise level at each PoR within 1,500 m of any turbine or substation of the Armow Wind Farm, for wind speeds between 6 m/s and 10 m/s, is tabulated in Table 7-1. For each PoR, the following information is provided:

- The distance to the closest wind turbine or substation
- For PoRs at 1.5 m a.g.l., the sound pressure level presented for wind speeds from 6 m/s to 10 m/s is the maximum noise level on the circumference of a 30-m radius circle centered on the PoR;
- For PoRs at 4.5 m or 7.5 m a.g.l., the sound pressure level presented for wind speeds from 6 m/s to 10 m/s is the noise level at the PoR location at its respective height;
- The sound level limit for that PoR according to the MOE noise guidelines at each wind speed from 6 m/s to 10 m/s;
- The applicable background sound level; and
- Whether or not the noise levels at the PoR comply with the MOE guidelines (for continued reference, compliance is confirmed for all PoR).

The closest distance between a wind turbine and a non-VLR PoR for this project is 554 m between Turbine 59 and R_801. The closest distance between a wind turbine and a VLR is 552 m between Turbine 106 and V_601. The closest PoR to the substation is R_268 at 476 m, while the closest VLR to the substation is V_759 at 516 m.

The highest calculated noise level for a PoR is 39.96 dBA, shown as 40.0 dBA in Table 7-1, for R_152. The highest calculated noise level for a VLR is 39.91 dBA, shown as 39.9 dBA in Table 7-1, for V_556.

Similarly, the maximum noise level at each Participating receptor within 1,500 m of any wind turbine or substation is tabulated in Table 7-2.

It is noted that there are no shared receptors between Armow and the adjacent Underwood, Cruickshank and Ripley Wind Farms. Therefore no concordance tables are required in this report.

The results show that the Armow Wind Farm complies with the applicable MOE environmental noise guidelines at all wind speeds modeled (i.e., 6, 7, 8, 9 and 10 m/s). Noise iso-contour maps illustrating the maximum noise contribution of the Armow Wind Farm are shown in Appendix A.

Table 7-1: Wind turbine noise impact assessment summary

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_64	4.5	1446	T79	30.4	30.4	30.4	30.4	30.4	40	43	45	49	51	40	Yes
R_65	4.5	1031	T79	33.2	33.2	33.2	33.2	33.2	40	43	45	49	51	40	Yes
R_68	4.5	630	T68	39.3	39.3	39.3	39.3	39.3	40	43	45	49	51	40	Yes
R_69	4.5	621	T68	38.7	38.7	38.7	38.7	38.7	40	43	45	49	51	40	Yes
R_70	4.5	833	T68	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	40	Yes
R_71	4.5	831	T68	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_72	1.5	1060	T68	31.6	31.6	31.6	31.6	31.6	40	43	45	49	51	40	Yes
R_73	4.5	1040	T68	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	40	Yes
R_74	4.5	1396	T80	31.2	31.2	31.2	31.2	31.2	40	43	45	49	51	40	Yes
R_75	4.5	1307	T80	31.8	31.8	31.8	31.8	31.8	40	43	45	49	51	40	Yes
R_90	4.5	1433	T103	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	40	Yes
R_91	1.5	1492	T103	31.0	31.0	31.0	31.0	31.0	40	43	45	49	51	40	Yes
R_92	4.5	1398	T103	33.7	33.7	33.7	33.7	33.7	40	43	45	49	51	40	Yes
R_93	4.5	1388	T103	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	40	Yes
R_94	4.5	1330	T103	34.1	34.1	34.1	34.1	34.1	40	43	45	49	51	40	Yes
R_95	4.5	1381	T103	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	40	Yes
R_96	4.5	1385	T103	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	40	Yes
R_97	4.5	1426	T103	33.2	33.2	33.2	33.2	33.2	40	43	45	49	51	40	Yes
R_98	1.5	1473	T103	30.9	30.9	30.9	30.9	30.9	40	43	45	49	51	40	Yes
R_100	4.5	1324	T103	33.7	33.7	33.7	33.7	33.7	40	43	45	49	51	40	Yes
R_101	1.5	1381	T103	31.4	31.4	31.4	31.4	31.4	40	43	45	49	51	40	Yes
R_102	4.5	1268	T103	34.1	34.1	34.1	34.1	34.1	40	43	45	49	51	40	Yes
R_103	4.5	1296	T103	33.8	33.8	33.8	33.8	33.8	40	43	45	49	51	40	Yes
R_104	1.5	1256	T103	32.0	32.0	32.0	32.0	32.0	40	43	45	49	51	40	Yes
R_105	1.5	1241	T103	32.1	32.1	32.1	32.1	32.1	40	43	45	49	51	40	Yes
R_106	4.5	988	T32	35.4	35.4	35.4	35.4	35.4	40	43	45	49	51	40	Yes
R_107	1.5	1114	T32	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	40	Yes
R_108	4.5	1122	T32	35.4	35.4	35.4	35.4	35.4	40	43	45	49	51	40	Yes
R_109	4.5	798	T35	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
R_110	4.5	1084	T90	35.2	35.2	35.2	35.2	35.2	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_111	4.5	1187	T90	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes
R_119	4.5	1075	T110	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	40	Yes
R_122	4.5	730	T115	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes
R_123	4.5	636	T115	39.6	39.6	39.6	39.6	39.6	40	43	45	49	51	40	Yes
R_124	4.5	827	T114	39.7	39.7	39.7	39.7	39.7	40	43	45	49	51	40	Yes
R_125	4.5	758	T50	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_126	4.5	763	T49	39.6	39.6	39.6	39.6	39.6	40	43	45	49	51	40	Yes
R_127	4.5	845	T49	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes
R_128	4.5	730	T82	39.5	39.5	39.5	39.5	39.5	40	43	45	49	51	40	Yes
R_130	1.5	671	T100	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
R_131	4.5	695	T104	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	40	Yes
R_132	4.5	677	T104	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_133	4.5	816	T104	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
R_134	7.5	767	T48	39.0	39.0	39.0	39.0	39.0	40	43	45	49	51	40	Yes
R_135	4.5	708	T67	38.2	38.2	38.2	38.2	38.2	40	43	45	49	51	40	Yes
R_136	4.5	799	T64	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
R_137	4.5	561	T64	39.3	39.3	39.3	39.3	39.3	40	43	45	49	51	40	Yes
R_138	4.5	742	T64	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	40	Yes
R_139	4.5	555	T111	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_140	7.5	732	T111	38.7	38.7	38.7	38.7	38.7	40	43	45	49	51	40	Yes
R_141	1.5	690	T98	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes
R_142	1.5	599	T98	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_146	4.5	888	T116	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	40	Yes
R_147	4.5	726	T43	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_148	4.5	789	T42	39.3	39.3	39.3	39.3	39.3	40	43	45	49	51	40	Yes
R_149	4.5	814	T84	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_151	1.5	680	T96	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	40	Yes
R_152	4.5	655	T96	40.0	40.0	40.0	40.0	40.0	40	43	45	49	51	40	Yes
R_153	4.5	936	T96	39.3	39.3	39.3	39.3	39.3	40	43	45	49	51	40	Yes
R_154	4.5	763	T95	39.5	39.5	39.5	39.5	39.5	40	43	45	49	51	40	Yes
R_156	4.5	881	T92	38.8	38.8	38.8	38.8	38.8	40	43	45	49	51	40	Yes
R_157	4.5	1022	T69	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_158	4.5	820	T69	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_159	4.5	816	T69	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_160	1.5	855	T69	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
R_161	4.5	969	T69	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	40	Yes
R_162	4.5	1073	T69	36.6	36.6	36.6	36.6	36.6	40	43	45	49	51	40	Yes
R_163	4.5	973	T61	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
R_164	4.5	800	T61	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
R_165	4.5	707	T61	39.5	39.5	39.5	39.5	39.5	40	43	45	49	51	40	Yes
R_167	1.5	574	T63	38.2	38.2	38.2	38.2	38.2	40	43	45	49	51	40	Yes
R_168	7.5	744	T63	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
R_169	4.5	1082	T63	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	40	Yes
R_170	4.5	1109	T63	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	40	Yes
R_171	4.5	1235	T63	34.9	34.9	34.9	34.9	34.9	40	43	45	49	51	40	Yes
R_172	4.5	1224	T63	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
R_173	4.5	1258	T73	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
R_174	4.5	1315	T73	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes
R_175	4.5	1091	T74	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
R_176	4.5	957	T74	35.2	35.2	35.2	35.2	35.2	40	43	45	49	51	40	Yes
R_177	4.5	1110	T74	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
R_179	4.5	893	T81	36.5	36.5	36.5	36.5	36.5	40	43	45	49	51	40	Yes
R_180	4.5	1154	T81	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	40	Yes
R_181	4.5	1328	T81	36.6	36.6	36.6	36.6	36.6	40	43	45	49	51	40	Yes
R_182	4.5	1297	T81	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
R_188	4.5	701	T97	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_189	4.5	788	T29	39.5	39.5	39.5	39.5	39.5	40	43	45	49	51	40	Yes
R_190	4.5	846	T29	39.0	39.0	39.0	39.0	39.0	40	43	45	49	51	40	Yes
R_191	4.5	976	T107	38.4	38.4	38.4	38.4	38.4	40	43	45	49	51	40	Yes
R_192	4.5	767	T60	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	40	Yes
R_193	4.5	706	T103	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_199	4.5	1309	T103	34.3	34.3	34.3	34.3	34.3	40	43	45	49	51	40	Yes
R_200	4.5	1302	T103	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes
R_201	4.5	1333	T103	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_202	4.5	1259	T103	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
R_203	4.5	1254	T103	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	40	Yes
R_204	4.5	1239	T103	35.2	35.2	35.2	35.2	35.2	40	43	45	49	51	40	Yes
R_205	4.5	1301	T103	34.9	34.9	34.9	34.9	34.9	40	43	45	49	51	40	Yes
R_206	4.5	1278	T103	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_207	4.5	1251	T102	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	40	Yes
R_208	4.5	958	T102	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	40	Yes
R_209	7.5	1083	T102	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_210	4.5	786	T102	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	40	Yes
R_211	4.5	926	T102	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
R_212	4.5	913	T102	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes
R_214	4.5	695	T102	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes
R_215	4.5	666	T102	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_217	4.5	746	T105	39.6	39.6	39.6	39.6	39.6	40	43	45	49	51	40	Yes
R_218	4.5	759	T14	39.8	39.8	39.8	39.8	39.8	40	43	45	49	51	40	Yes
R_221	4.5	745	T14	39.8	39.8	39.8	39.8	39.8	40	43	45	49	51	40	Yes
R_222	1.5	770	T7	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
R_223	4.5	694	T57	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_227	1.5	645	T94	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	40	Yes
R_228	4.5	841	T12	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
R_229	4.5	1103	T4	37.1	37.1	37.1	37.1	37.1	40	43	45	49	51	40	Yes
R_230	4.5	1092	T4	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_231	1.5	818	T91	35.2	35.2	35.2	35.2	35.2	40	43	45	49	51	40	Yes
R_232	4.5	723	T91	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	40	Yes
R_234	4.5	887	T11	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	40	Yes
R_235	1.5	1273	T11	33.0	33.0	33.0	33.0	33.0	40	43	45	49	51	40	Yes
R_236	1.5	1419	T10	32.8	32.8	32.8	32.8	32.8	40	43	45	49	51	40	Yes
R_238	4.5	1371	T10	35.2	35.2	35.2	35.2	35.2	40	43	45	49	51	40	Yes
R_239	1.5	1385	T10	33.2	33.2	33.2	33.2	33.2	40	43	45	49	51	40	Yes
R_240	4.5	1213	T10	35.9	35.9	35.9	35.9	35.9	40	43	45	49	51	40	Yes
R_241	1.5	1323	T73	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	40	Yes
R_242	7.5	1045	T73	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_243	4.5	627	T73	38.8	38.8	38.8	38.8	38.8	40	43	45	49	51	40	Yes
R_244	4.5	832	T73	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
R_245	7.5	966	T73	37.1	37.1	37.1	37.1	37.1	40	43	45	49	51	40	Yes
R_246	4.5	1253	T73	36.0	36.0	36.0	36.0	36.0	40	43	45	49	51	40	Yes
R_247	4.5	1151	T73	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	40	Yes
R_248	7.5	1490	T73	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	40	Yes
R_264	4.5	1416	Armow Transformer West	38.4	38.4	38.4	38.4	38.4	40	43	45	49	51	40	Yes
R_266	4.5	838	Armow Transformer West	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_267	4.5	753	T4	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_268	4.5	476	Armow Transformer West	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes
R_269	4.5	603	Armow Transformer West	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	40	Yes
R_270	4.5	695	Armow Transformer East	38.6	38.6	38.6	38.6	38.6	40	43	45	49	51	40	Yes
R_271	4.5	883	T56	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
R_272	1.5	639	T5	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes
R_273	1.5	659	T51	38.2	38.2	38.2	38.2	38.2	40	43	45	49	51	40	Yes
R_274	4.5	612	T52	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_275	4.5	723	T52	38.6	38.6	38.6	38.6	38.6	40	43	45	49	51	40	Yes
R_276	7.5	1130	T106	33.7	33.7	33.7	33.7	33.7	40	43	45	49	51	40	Yes
R_277	1.5	1485	T106	28.7	28.7	28.7	28.7	28.7	40	43	45	49	51	40	Yes
R_285	4.5	1493	T51	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	40	Yes
R_287	4.5	1402	T51	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	40	Yes
R_288	4.5	1481	T101	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	40	Yes
R_293	4.5	1472	Armow Transformer	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
			East												
R_316	1.5	936	T32	34.9	34.9	34.9	34.9	34.9	40	43	45	49	51	40	Yes
R_317	4.5	826	T35	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_318	4.5	943	T35	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
R_319	4.5	1068	T35	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes
R_320	4.5	1066	T30	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	40	Yes
R_322	4.5	916	T30	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
R_323	1.5	813	T30	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_325	4.5	857	T27	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_328	4.5	696	T83	38.8	38.8	38.8	38.8	38.8	40	43	45	49	51	40	Yes
R_330	4.5	950	T83	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
R_331	4.5	994	T21	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes
R_333	1.5	1406	T19	33.0	33.0	33.0	33.0	33.0	40	43	45	49	51	40	Yes
R_334	4.5	1296	T19	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_335	4.5	934	T19	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_336	1.5	905	T108	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	40	Yes
R_337	4.5	808	T108	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	40	Yes
R_339	1.5	845	T108	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	40	Yes
R_340	4.5	938	T108	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_341	4.5	1077	T108	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	40	Yes
R_342	4.5	1196	T108	35.4	35.4	35.4	35.4	35.4	40	43	45	49	51	40	Yes
R_343	4.5	1375	T108	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	40	Yes
R_346	4.5	1247	T75	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	40	Yes
R_347	4.5	1084	T75	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_348	4.5	1069	T75	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_349	4.5	711	T75	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_350	4.5	819	T75	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
R_351	4.5	657	T75	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_352	7.5	966	T75	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
R_353	4.5	1402	T75	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	40	Yes
R_356	7.5	745	T108	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
R_357	4.5	628	T87	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_358	1.5	753	T87	35.6	35.6	35.6	35.6	35.6	40	43	45	49	51	40	Yes
R_359	4.5	732	T87	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
R_360	4.5	758	T87	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
R_361	4.5	782	T87	37.2	37.2	37.2	37.2	37.2	40	43	45	49	51	40	Yes
R_362	4.5	815	T87	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_363	4.5	839	T87	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes
R_364	1.5	856	T87	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
R_365	1.5	680	T87	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	40	Yes
R_366	4.5	752	T87	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
R_367	4.5	842	T87	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_368	4.5	892	T87	36.6	36.6	36.6	36.6	36.6	40	43	45	49	51	40	Yes
R_369	4.5	969	T37	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	40	Yes
R_370	4.5	723	T33	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	40	Yes
R_372	4.5	1488	T33	32.7	32.7	32.7	32.7	32.7	40	43	45	49	51	40	Yes
R_381	1.5	1101	T87	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	40	Yes
R_382	4.5	1178	T87	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	40	Yes
R_383	1.5	1192	T87	32.9	32.9	32.9	32.9	32.9	40	43	45	49	51	40	Yes
R_384	4.5	1338	T87	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	40	Yes
R_388	4.5	1360	T100	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	40	Yes
R_389	4.5	1136	T41	35.9	35.9	35.9	35.9	35.9	40	43	45	49	51	40	Yes
R_390	4.5	1090	T41	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	40	Yes
R_391	4.5	816	T41	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
R_392	4.5	845	T42	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
R_400	1.5	740	T77	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	40	Yes
R_401	4.5	635	T77	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
R_402	4.5	618	T76	39.0	39.0	39.0	39.0	39.0	40	43	45	49	51	40	Yes
R_403	4.5	678	T78	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
R_404	4.5	566	T78	39.0	39.0	39.0	39.0	39.0	40	43	45	49	51	40	Yes
R_405	4.5	652	T78	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
R_406	4.5	792	T66	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	40	Yes
R_407	7.5	574	T66	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
R_410	4.5	848	T50	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_411	4.5	985	T113	36.1	36.1	36.1	36.1	36.1	40	43	45	49	51	40	Yes
R_414	4.5	863	T115	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	40	Yes
R_415	4.5	828	T115	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	40	Yes
R_416	4.5	1284	T115	32.0	32.0	32.0	32.0	32.0	40	43	45	49	51	40	Yes
R_418	4.5	831	T21	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes
R_419	4.5	1318	T21	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_420	4.5	1386	T70	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
R_421	4.5	1493	T70	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
R_425	4.5	782	T79	35.4	35.4	35.4	35.4	35.4	40	43	45	49	51	40	Yes
R_426	1.5	711	T104	36.6	36.6	36.6	36.6	36.6	40	43	45	49	51	40	Yes
R_427	1.5	623	T104	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_428	1.5	732	T115	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
R_434	4.5	1355	T35	32.3	32.3	32.3	32.3	32.3	40	43	45	49	51	40	Yes
R_435	4.5	1318	T35	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	40	Yes
R_442	7.5	1245	T37	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	40	Yes
R_444	1.5	650	T37	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	40	Yes
R_445	1.5	879	T87	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	40	Yes
R_446	1.5	1107	T87	33.2	33.2	33.2	33.2	33.2	40	43	45	49	51	40	Yes
R_447	1.5	713	T64	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	40	Yes
R_452	4.5	1271	T68	32.1	32.1	32.1	32.1	32.1	40	43	45	49	51	40	Yes
R_453	1.5	821	T68	33.7	33.7	33.7	33.7	33.7	40	43	45	49	51	40	Yes
R_455	4.5	977	T103	37.3	37.3	37.3	37.3	37.3	40	43	45	49	51	40	Yes
R_458	1.5	1372	Armow Transformer West	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
R_462	1.5	637	Armow Transformer East	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
R_469	1.5	1498	T103	30.7	30.7	30.7	30.7	30.7	40	43	45	49	51	40	Yes
R_470	1.5	1486	T103	30.8	30.8	30.8	30.8	30.8	40	43	45	49	51	40	Yes
R_471	4.5	1223	T103	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
R_472	4.5	962	T99	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
R_473	1.5	1128	T11	33.3	33.3	33.3	33.3	33.3	40	43	45	49	51	40	Yes
R_474	1.5	702	T73	36.5	36.5	36.5	36.5	36.5	40	43	45	49	51	40	Yes
R_476	4.5	1023	T80	33.9	33.9	33.9	33.9	33.9	40	43	45	49	51	40	Yes
R_497	1.5	906	T87	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
R_499	4.5	1156	T64	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes
R_501	4.5	637	T110	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	40	Yes
R_503	1.5	1460	T75	31.3	31.3	31.3	31.3	31.3	40	43	45	49	51	40	Yes
V_507	4.5	1447	T32	32.4	32.4	32.4	32.4	32.4	40	43	45	49	51	40	Yes
V_510	4.5	1405	T103	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	40	Yes
V_511	4.5	1443	T103	33.1	33.1	33.1	33.1	33.1	40	43	45	49	51	40	Yes
V_512	4.5	1236	T103	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	40	Yes
V_514	4.5	1471	T103	33.2	33.2	33.2	33.2	33.2	40	43	45	49	51	40	Yes
V_520	4.5	979	T102	37.2	37.2	37.2	37.2	37.2	40	43	45	49	51	40	Yes
V_521	4.5	1464	T103	33.3	33.3	33.3	33.3	33.3	40	43	45	49	51	40	Yes
V_522	4.5	1423	T103	33.5	33.5	33.5	33.5	33.5	40	43	45	49	51	40	Yes
V_523	4.5	1270	T102	35.6	35.6	35.6	35.6	35.6	40	43	45	49	51	40	Yes
V_524	4.5	1279	T103	35.4	35.4	35.4	35.4	35.4	40	43	45	49	51	40	Yes
V_525	4.5	1305	T103	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	40	Yes
V_526	4.5	1388	T103	34.0	34.0	34.0	34.0	34.0	40	43	45	49	51	40	Yes
V_528	4.5	1359	T106	31.2	31.2	31.2	31.2	31.2	40	43	45	49	51	40	Yes
V_529	4.5	1271	T103	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
V_530	4.5	1296	T103	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes
V_531	4.5	1308	T103	34.3	34.3	34.3	34.3	34.3	40	43	45	49	51	40	Yes
V_532	4.5	1226	T103	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	40	Yes
V_533	4.5	557	T91	38.6	38.6	38.6	38.6	38.6	40	43	45	49	51	40	Yes
V_538	4.5	1182	T81	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes
V_541	4.5	707	T87	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	40	Yes
V_542	4.5	723	T87	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	40	Yes
V_543	4.5	783	T87	37.2	37.2	37.2	37.2	37.2	40	43	45	49	51	40	Yes
V_544	4.5	803	T87	37.2	37.2	37.2	37.2	37.2	40	43	45	49	51	40	Yes
V_545	4.5	663	T87	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
V_546	4.5	680	T87	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
V_549	4.5	855	T87	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	40	Yes
V_550	4.5	854	T87	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	40	Yes
V_551	4.5	834	T87	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
V_552	4.5	854	T87	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes
V_553	4.5	931	T87	36.2	36.2	36.2	36.2	36.2	40	43	45	49	51	40	Yes
V_554	4.5	1115	T87	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
V_555	4.5	614	T77	38.4	38.4	38.4	38.4	38.4	40	43	45	49	51	40	Yes
V_556	4.5	802	T50	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
V_557	4.5	906	T42	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	40	Yes
V_558	4.5	660	T114	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	40	Yes
V_580	4.5	1461	T101	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
V_596	4.5	1165	T103	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	40	Yes
V_597	4.5	789	T14	39.8	39.8	39.8	39.8	39.8	40	43	45	49	51	40	Yes
V_598	4.5	1076	T106	33.7	33.7	33.7	33.7	33.7	40	43	45	49	51	40	Yes
V_599	4.5	996	T106	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes
V_600	4.5	1128	T106	33.4	33.4	33.4	33.4	33.4	40	43	45	49	51	40	Yes
V_601	4.5	552	T106	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	40	Yes
V_602	4.5	572	T52	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
V_603	4.5	594	T52	38.6	38.6	38.6	38.6	38.6	40	43	45	49	51	40	Yes
V_604	4.5	964	T52	33.9	33.9	33.9	33.9	33.9	40	43	45	49	51	40	Yes
V_605	4.5	1189	T52	33.1	33.1	33.1	33.1	33.1	40	43	45	49	51	40	Yes
V_606	4.5	610	T52	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	40	Yes
V_607	4.5	628	T51	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
V_609	4.5	660	T101	39.1	39.1	39.1	39.1	39.1	40	43	45	49	51	40	Yes
V_610	4.5	670	T101	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	40	Yes
V_611	4.5	921	Armow Transformer West	39.4	39.4	39.4	39.4	39.4	40	43	45	49	51	40	Yes
V_612	4.5	1000	Armow Transformer West	39.5	39.5	39.5	39.5	39.5	40	43	45	49	51	40	Yes
V_629	4.5	871	T73	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
V_630	4.5	729	T73	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
V_631	4.5	1017	T81	35.7	35.7	35.7	35.7	35.7	40	43	45	49	51	40	Yes
V_633	4.5	1347	T74	34.4	34.4	34.4	34.4	34.4	40	43	45	49	51	40	Yes
V_634	4.5	1151	T75	34.9	34.9	34.9	34.9	34.9	40	43	45	49	51	40	Yes
V_635	4.5	779	T75	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
V_636	4.5	709	T75	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
V_637	4.5	916	T81	36.3	36.3	36.3	36.3	36.3	40	43	45	49	51	40	Yes
V_656	4.5	816	T91	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes
V_657	4.5	1030	T11	35.9	35.9	35.9	35.9	35.9	40	43	45	49	51	40	Yes
V_658	4.5	1489	T11	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	40	Yes
V_659	4.5	1357	T10	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	40	Yes
V_660	4.5	1313	T10	35.2	35.2	35.2	35.2	35.2	40	43	45	49	51	40	Yes
V_661	4.5	1427	T11	35.1	35.1	35.1	35.1	35.1	40	43	45	49	51	40	Yes
V_662	4.5	709	T91	37.6	37.6	37.6	37.6	37.6	40	43	45	49	51	40	Yes
V_663	4.5	1094	T4	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
V_664	4.5	813	T94	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
V_665	4.5	589	T57	39.6	39.6	39.6	39.6	39.6	40	43	45	49	51	40	Yes
V_666	4.5	1066	T103	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	40	Yes
V_667	4.5	1154	T103	35.3	35.3	35.3	35.3	35.3	40	43	45	49	51	40	Yes
V_668	4.5	1497	T32	32.0	32.0	32.0	32.0	32.0	40	43	45	49	51	40	Yes
V_669	4.5	1421	T32	33.0	33.0	33.0	33.0	33.0	40	43	45	49	51	40	Yes
V_670	4.5	1135	T35	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	40	Yes
V_671	4.5	1048	T35	35.9	35.9	35.9	35.9	35.9	40	43	45	49	51	40	Yes
V_672	4.5	864	T35	38.2	38.2	38.2	38.2	38.2	40	43	45	49	51	40	Yes
V_673	4.5	1146	T32	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
V_674	4.5	986	T31	37.9	37.9	37.9	37.9	37.9	40	43	45	49	51	40	Yes
V_675	4.5	902	T107	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	40	Yes
V_676	4.5	859	T107	38.8	38.8	38.8	38.8	38.8	40	43	45	49	51	40	Yes
V_677	4.5	812	T107	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
V_678	4.5	846	T29	39.3	39.3	39.3	39.3	39.3	40	43	45	49	51	40	Yes
V_679	4.5	716	T97	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
V_680	4.5	716	T97	39.6	39.6	39.6	39.6	39.6	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
V_681	4.5	823	T69	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
V_682	4.5	1200	T10	35.6	35.6	35.6	35.6	35.6	40	43	45	49	51	40	Yes
V_683	4.5	1227	T10	35.4	35.4	35.4	35.4	35.4	40	43	45	49	51	40	Yes
V_684	4.5	943	T23	38.3	38.3	38.3	38.3	38.3	40	43	45	49	51	40	Yes
V_685	4.5	653	T63	37.8	37.8	37.8	37.8	37.8	40	43	45	49	51	40	Yes
V_686	4.5	1061	T108	36.6	36.6	36.6	36.6	36.6	40	43	45	49	51	40	Yes
V_687	4.5	1021	T19	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
V_689	4.5	902	T61	37.7	37.7	37.7	37.7	37.7	40	43	45	49	51	40	Yes
V_690	4.5	1026	T69	36.5	36.5	36.5	36.5	36.5	40	43	45	49	51	40	Yes
V_691	4.5	910	T69	36.5	36.5	36.5	36.5	36.5	40	43	45	49	51	40	Yes
V_692	4.5	680	T83	39.6	39.6	39.6	39.6	39.6	40	43	45	49	51	40	Yes
V_693	4.5	702	T26	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
V_695	4.5	794	T30	39.3	39.3	39.3	39.3	39.3	40	43	45	49	51	40	Yes
V_696	4.5	741	T98	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes
V_697	4.5	759	T111	38.1	38.1	38.1	38.1	38.1	40	43	45	49	51	40	Yes
V_698	4.5	633	T64	38.5	38.5	38.5	38.5	38.5	40	43	45	49	51	40	Yes
V_699	4.5	866	T64	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
V_703	4.5	1434	T70	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
V_704	4.5	1396	T100	34.9	34.9	34.9	34.9	34.9	40	43	45	49	51	40	Yes
V_705	4.5	1489	T100	34.2	34.2	34.2	34.2	34.2	40	43	45	49	51	40	Yes
V_706	4.5	1495	T19	35.0	35.0	35.0	35.0	35.0	40	43	45	49	51	40	Yes
V_707	4.5	1331	T19	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	40	Yes
V_708	4.5	565	T87	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes
V_709	4.5	1266	T37	33.7	33.7	33.7	33.7	33.7	40	43	45	49	51	40	Yes
V_711	4.5	865	T79	34.9	34.9	34.9	34.9	34.9	40	43	45	49	51	40	Yes
V_712	4.5	879	T79	34.5	34.5	34.5	34.5	34.5	40	43	45	49	51	40	Yes
V_713	4.5	939	T79	34.2	34.2	34.2	34.2	34.2	40	43	45	49	51	40	Yes
V_718	4.5	1054	T75	36.9	36.9	36.9	36.9	36.9	40	43	45	49	51	40	Yes
V_734	4.5	789	T68	35.5	35.5	35.5	35.5	35.5	40	43	45	49	51	40	Yes
V_735	4.5	902	T68	35.8	35.8	35.8	35.8	35.8	40	43	45	49	51	40	Yes
V_736	4.5	873	T77	36.0	36.0	36.0	36.0	36.0	40	43	45	49	51	40	Yes
V_737	4.5	776	T77	36.8	36.8	36.8	36.8	36.8	40	43	45	49	51	40	Yes

Point of Reception ID	PoR height [m]	Distance to Noise Source [m]	Nearest Noise Source [ID]	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Sound Level Limit [dBA] at selected Wind Speed in m/s					Applicable Background Sound Level	Compliance With Limit (Yes/No)
				6 or <	7	8	9	10	6 or <	7	8	9	10	NPC 232 (C 3)	
V_738	4.5	655	T77	37.5	37.5	37.5	37.5	37.5	40	43	45	49	51	40	Yes
V_739	4.5	744	T77	37.0	37.0	37.0	37.0	37.0	40	43	45	49	51	40	Yes
V_740	4.5	777	T77	37.4	37.4	37.4	37.4	37.4	40	43	45	49	51	40	Yes
V_741	4.5	700	T76	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
V_742	4.5	874	T66	36.6	36.6	36.6	36.6	36.6	40	43	45	49	51	40	Yes
V_743	4.5	766	T104	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
V_744	4.5	616	T66	38.7	38.7	38.7	38.7	38.7	40	43	45	49	51	40	Yes
V_745	4.5	752	T66	37.2	37.2	37.2	37.2	37.2	40	43	45	49	51	40	Yes
V_746	4.5	828	T114	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	40	Yes
V_747	4.5	944	T115	34.6	34.6	34.6	34.6	34.6	40	43	45	49	51	40	Yes
V_748	4.5	1290	T115	31.9	31.9	31.9	31.9	31.9	40	43	45	49	51	40	Yes
V_749	4.5	1372	T115	31.5	31.5	31.5	31.5	31.5	40	43	45	49	51	40	Yes
V_751	4.5	688	T115	39.9	39.9	39.9	39.9	39.9	40	43	45	49	51	40	Yes
V_752	4.5	697	T49	39.7	39.7	39.7	39.7	39.7	40	43	45	49	51	40	Yes
V_755	4.5	1304	T87	34.7	34.7	34.7	34.7	34.7	40	43	45	49	51	40	Yes
V_756	4.5	1308	T87	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
V_758	4.5	838	Armow Transformer West	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
V_759	4.5	516	Armow Transformer East	38.9	38.9	38.9	38.9	38.9	40	43	45	49	51	40	Yes
V_760	4.5	1218	T103	34.8	34.8	34.8	34.8	34.8	40	43	45	49	51	40	Yes
V_761	4.5	1387	T103	32.4	32.4	32.4	32.4	32.4	40	43	45	49	51	40	Yes
V_762	4.5	1047	T32	35.8	35.8	35.8	35.8	35.8	40	43	45	49	51	40	Yes
V_763	4.5	1285	T90	33.6	33.6	33.6	33.6	33.6	40	43	45	49	51	40	Yes
V_764	4.5	888	T64	36.4	36.4	36.4	36.4	36.4	40	43	45	49	51	40	Yes
V_772	4.5	888	T56	38.0	38.0	38.0	38.0	38.0	40	43	45	49	51	40	Yes
V_774	4.5	1183	T40	35.8	35.8	35.8	35.8	35.8	40	43	45	49	51	40	Yes
V_775	4.5	794	T100	36.7	36.7	36.7	36.7	36.7	40	43	45	49	51	40	Yes
R_801	1.5	554	T59	39.2	39.2	39.2	39.2	39.2	40	43	45	49	51	40	Yes

Table 7-2: Wind turbine noise impact assessment summary – Participating receptors

Participating receptor ID	Height [m]	Distance to Nearest Source [m]	Nearest Source [ID]	Calculated Sound Pressure Level at Selected 10 m Wind Speeds [dBA]				
				6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
R_66	4.5	605	T79	37.2	37.2	37.2	37.2	37.2
R_67	4.5	397	T80	41.9	41.9	41.9	41.9	41.9
R_120	4.5	863	T115	38.0	38.0	38.0	38.0	38.0
R_121	4.5	841	T115	38.1	38.1	38.1	38.1	38.1
R_129	4.5	690	T100	39.0	39.0	39.0	39.0	39.0
R_143	4.5	565	T98	40.3	40.3	40.3	40.3	40.3
R_144	4.5	706	T98	39.8	39.8	39.8	39.8	39.8
R_145	4.5	714	T98	39.8	39.8	39.8	39.8	39.8
R_150	4.5	393	T83	41.9	41.9	41.9	41.9	41.9
R_155	4.5	775	T92	39.5	39.5	39.5	39.5	39.5
R_166	4.5	544	T61	41.1	41.1	41.1	41.1	41.1
R_178	4.5	879	T74	36.0	36.0	36.0	36.0	36.0
R_187	4.5	620	T97	40.0	40.0	40.0	40.0	40.0
R_213	1.5	789	T102	36.8	36.8	36.8	36.8	36.8
R_216	4.5	670	T105	39.6	39.6	39.6	39.6	39.6
R_219	1.5	676	T105	38.1	38.1	38.1	38.1	38.1
R_220	4.5	711	T14	39.9	39.9	39.9	39.9	39.9
R_224	4.5	450	T57	40.8	40.8	40.8	40.8	40.8
R_225	4.5	579	T57	40.3	40.3	40.3	40.3	40.3
R_226	4.5	548	T94	40.3	40.3	40.3	40.3	40.3
R_233	4.5	696	T91	37.5	37.5	37.5	37.5	37.5
R_321	4.5	748	T30	39.2	39.2	39.2	39.2	39.2
R_324	4.5	764	T30	40.2	40.2	40.2	40.2	40.2
R_326	4.5	781	T89	40.0	40.0	40.0	40.0	40.0
R_327	4.5	698	T83	39.9	39.9	39.9	39.9	39.9
R_329	4.5	822	T24	39.0	39.0	39.0	39.0	39.0
R_338	4.5	716	T108	38.8	38.8	38.8	38.8	38.8
R_371	4.5	865	T37	36.6	36.6	36.6	36.6	36.6
R_393	4.5	754	T42	38.6	38.6	38.6	38.6	38.6
R_408	4.5	571	T82	39.6	39.6	39.6	39.6	39.6
R_409	4.5	756	T50	38.8	38.8	38.8	38.8	38.8
R_412	4.5	660	T113	39.0	39.0	39.0	39.0	39.0
R_413	4.5	726	T114	37.7	37.7	37.7	37.7	37.7
R_437	1.5	761	T30	37.3	37.3	37.3	37.3	37.3
R_443	4.5	1221	T37	34.0	34.0	34.0	34.0	34.0
R_500	4.5	465	T110	39.8	39.8	39.8	39.8	39.8
V_608	4.5	364	T5	41.9	41.9	41.9	41.9	41.9

Participating receptor ID	Height [m]	Distance to Nearest Source [m]	Nearest Source [ID]	Calculated Sound Pressure Level at Selected 10 m Wind Speeds [dBA]				
				6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
V_694	4.5	897	T30	39.8	39.8	39.8	39.8	39.8
V_753	4.5	770	T77	38.5	38.5	38.5	38.5	38.5
V_754	4.5	670	T67	38.6	38.6	38.6	38.6	38.6
V_757	4.5	485	Armow Transformer West	39.1	39.1	39.1	39.1	39.1
V_776	4.5	801	T94	38.4	38.4	38.4	38.4	38.4
V_777	4.5	676	T68	36.6	36.6	36.6	36.6	36.6
V_778	4.5	659	T48	38.9	38.9	38.9	38.9	38.9
V_779	4.5	699	T49	38.9	38.9	38.9	38.9	38.9
V_780	4.5	684	T73	38.3	38.3	38.3	38.3	38.3
V_781	4.5	562	T67	38.8	38.8	38.8	38.8	38.8
V_782	4.5	654	T102	39.7	39.7	39.7	39.7	39.7
V_783	4.5	772	T97	39.8	39.8	39.8	39.8	39.8
V_784	4.5	853	T114	39.7	39.7	39.7	39.7	39.7
V_785	4.5	709	T42	39.3	39.3	39.3	39.3	39.3
V_786	4.5	675	T91	37.7	37.7	37.7	37.7	37.7
V_787	4.5	662	T96	39.7	39.7	39.7	39.7	39.7
V_788	4.5	724	T96	39.5	39.5	39.5	39.5	39.5
V_789	4.5	839	T44	39.9	39.9	39.9	39.9	39.9
V_790	4.5	797	T103	38.5	38.5	38.5	38.5	38.5
V_791	4.5	784	T107	38.8	38.8	38.8	38.8	38.8
V_792	4.5	629	T77	37.9	37.9	37.9	37.9	37.9
V_793	4.5	599	T75	39.4	39.4	39.4	39.4	39.4
V_794	4.5	577	T64	39.0	39.0	39.0	39.0	39.0
V_795	4.5	665	T61	40.3	40.3	40.3	40.3	40.3
V_796	4.5	656	T23	40.0	40.0	40.0	40.0	40.0
V_797	4.5	669	T42	39.2	39.2	39.2	39.2	39.2
V_798	4.5	480	T63	40.1	40.1	40.1	40.1	40.1
V_799	4.5	426	T52	39.7	39.7	39.7	39.7	39.7
V_800	4.5	249	T5	43.7	43.7	43.7	43.7	43.7
V_802	4.5	386	T5	42.6	42.6	42.6	42.6	42.6
V_803	4.5	683	T61	39.2	39.2	39.2	39.2	39.2
V_804	4.5	604	Armow Transformer West	39.1	39.1	39.1	39.1	39.1
V_805	4.5	485	T5	41.7	41.7	41.7	41.7	41.7
V_806	4.5	578	T76	39.3	39.3	39.3	39.3	39.3
V_807	4.5	660	T100	38.9	38.9	38.9	38.9	38.9
V_808	4.5	830	T60	39.0	39.0	39.0	39.0	39.0

Participating receptor ID	Height [m]	Distance to Nearest Source [m]	Nearest Source [ID]	Calculated Sound Pressure Level at Selected 10 m Wind Speeds [dBA]				
				6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
V_809	4.5	898	T35	37.3	37.3	37.3	37.3	37.3
V_810	4.5	706	T69	37.4	37.4	37.4	37.4	37.4
V_811	4.5	637	T78	38.6	38.6	38.6	38.6	38.6
V_812	4.5	658	T29	39.8	39.8	39.8	39.8	39.8
V_813	4.5	802	T88	38.2	38.2	38.2	38.2	38.2
V_814	4.5	869	T32	38.1	38.1	38.1	38.1	38.1
V_815	4.5	743	T7	39.9	39.9	39.9	39.9	39.9
V_816	4.5	875	T84	38.9	38.9	38.9	38.9	38.9
V_817	4.5	577	T87	40.1	40.1	40.1	40.1	40.1

8 CONCLUSION

Based on the approach presented in this NIA, the Armow Wind Farm is compliant with the MOE noise limits at all PoRs and VLRs within 1,500 m of the Project's noise sources, for wind speeds of 6, 7, 8, 9 and 10 m/s.

9 REFERENCES

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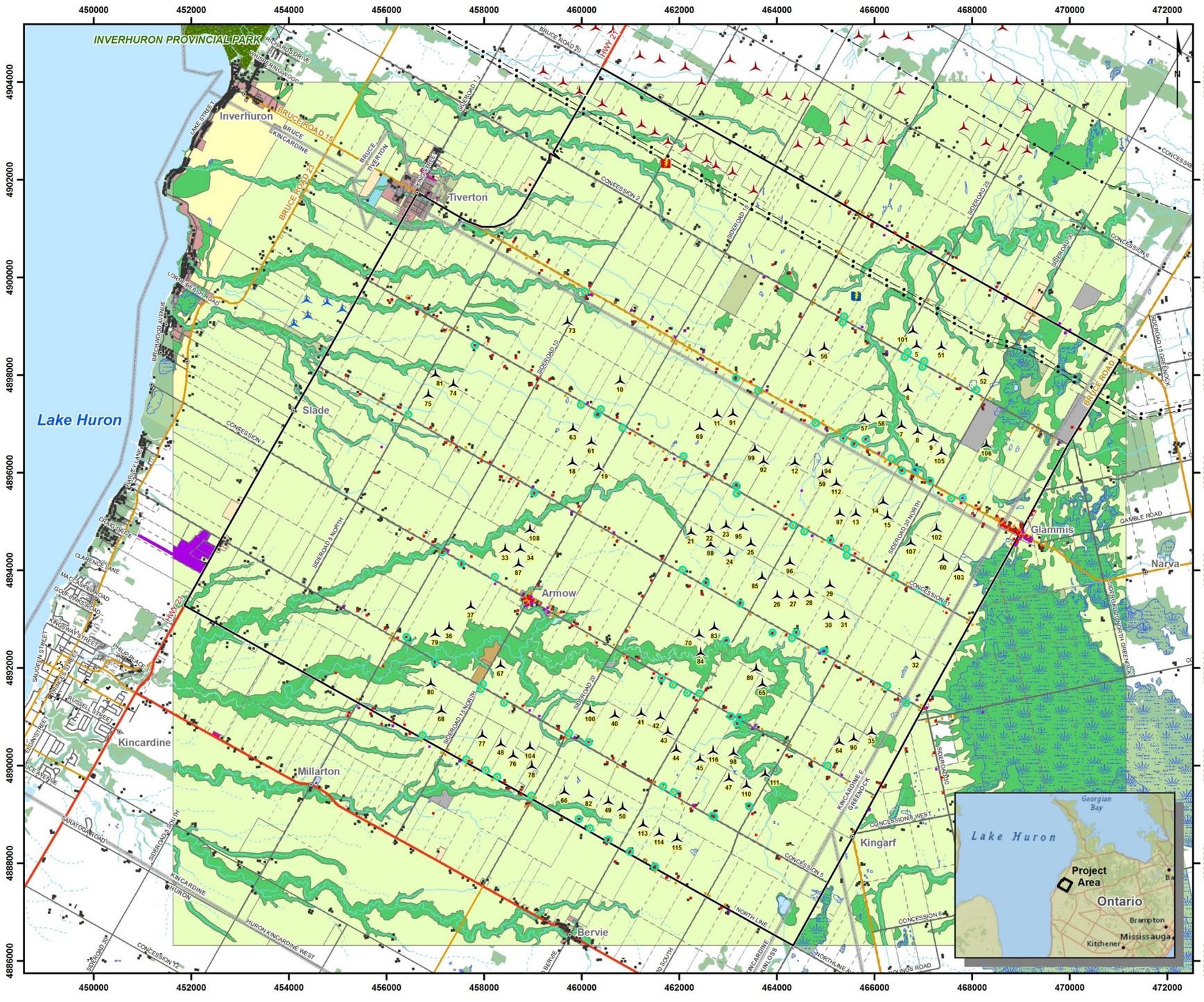
[19] International Organization for Standardization (ISO), Acoustics - Attenuation of Sound During Propagation Outdoors - Calculation of the Absorption of Sound by the Atmosphere. ISO 9613-1. 33 p., 1993.

[20] International Organization for Standardization (ISO), Acoustics - Attenuation of Sound During Propagation Outdoors - General Method of Calculation. ISO 9613-2. 25 p., 1996.

[21] DataKustik. CadnaA Reference Manual: Release 4.2. 2011.

APPENDIX A ZONING AND NOISE ISO-CONTOUR MAPS



Legend

Project Components
- Wind Turbine (98)
- Armow Transformer
- Participating Receptor
- Project Area

Zoning
- General Agriculture
- Agricultural Comm/Indus
- Airport
- General Commercial
- Neighbourhood Commercial
- Hamlet Hwy. Commercial
- Hamlet Commercial
- Travel Trailer & Campground
- Environmental Protection
- Institutional
- General Industrial
- Extractive Industrial
- Open Space
- Planned Development
- Residential
- Waste Disposal

Other Components
- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
- Permanent Watercourse
- Intermittent Watercourse
- Runway
- Waterbody
- Wetland
- Lot Line
- Municipal Boundary

0 0.5 1 2 3 4 km

Pattern ENERGY GROUP

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Armow Wind Energy Project

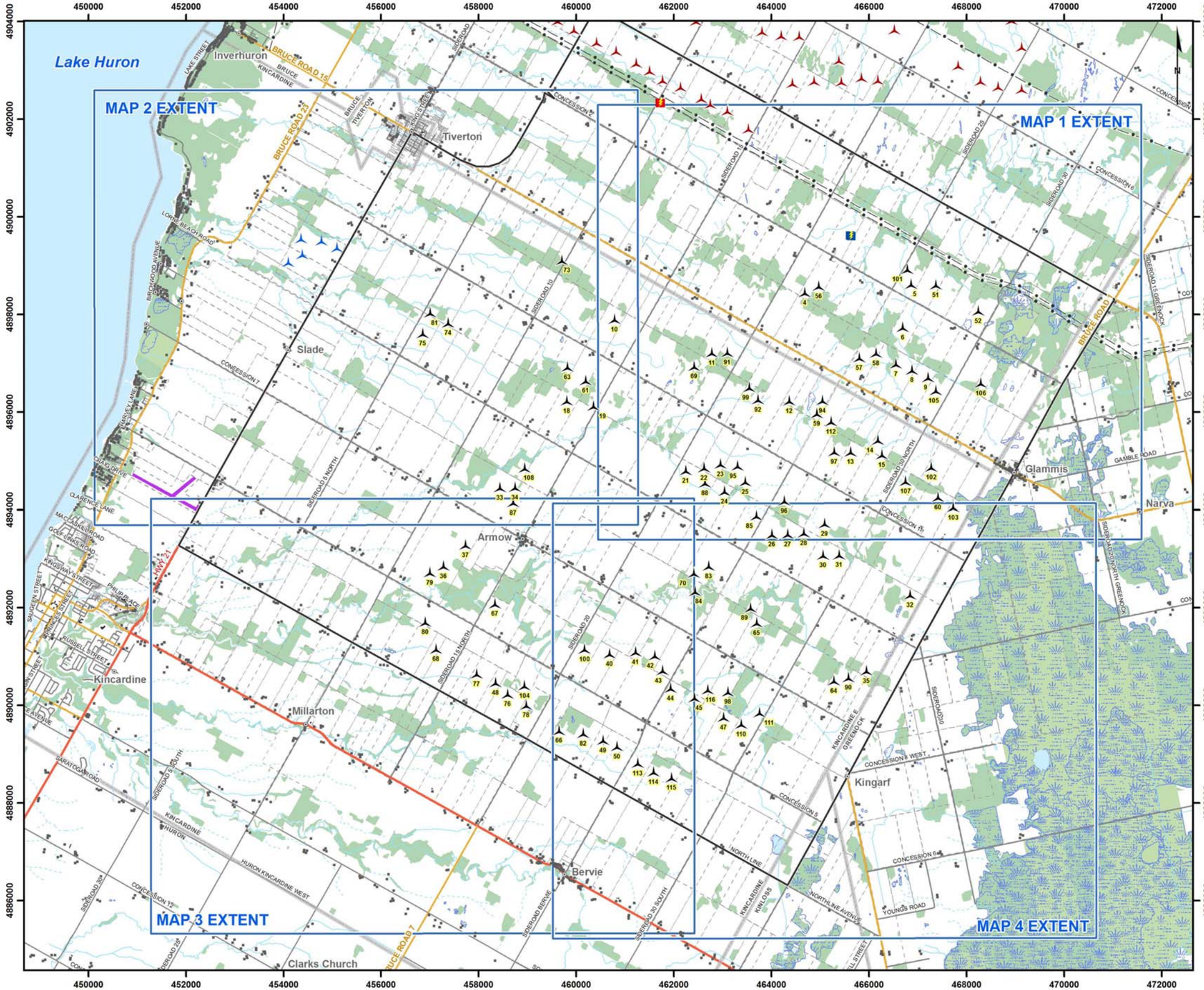
MUNICIPAL ZONING MAP
BRUCE COUNTY - KINCARDINE, ON

GL Garrad Hassan

800235-001-130807-L18-AB

August 7, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR, Bruce County.



Legend

Project Components
- Wind Turbine (98)
- Armow Transformer
- Project Area

Other Components
- Existing Turbine (Enbridge Ontario)
- Existing Tubine (Cruickshank)
- Transformer
- Building
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
- Permanent Watercourse
- Intermittent Watercourse
- Runway
- Waterbody
- Wetland
- Lot Line
- Municipal Boundary

0 0.5 1 2 3 4 km

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NOISE MAP EXTENTS

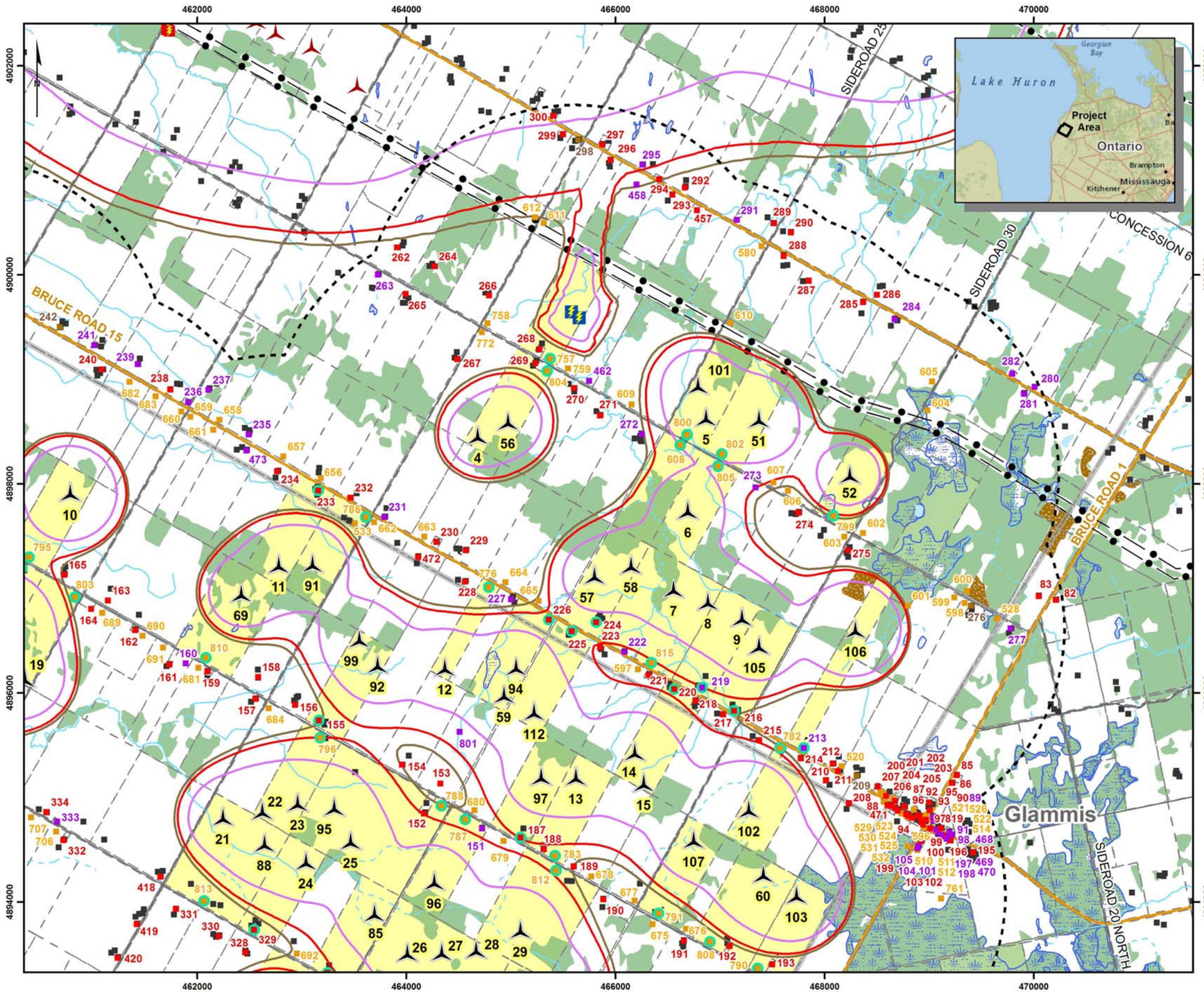
GL Garrad Hassan

800235-001-130812-L15-AB

August 12, 2013

Projection: UTM Zone 17, NAD83

Sources: Geobase®, CanVec, OMNR, Bruce County



Legend

Project Components
- Wind Turbine (98)
- Armow Transformer
- Participating Receptor
- Participating Lot
- Investigation Area (2 km)

Existing Projects
- Existing Turbine (Enbridge Ontario)
- Transformer

Predicted Sound Level at Wind Speed of 6 m/s
- 40 dB(A) at 1.5 m agl*
- 40 dB(A) at 4.5 m agl*
- 40 dB(A) at 7.5 m agl*

* agl : above ground level

Other Components
- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Cemetery
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
- Permanent Watercourse
- Intermittent Watercourse
- Residential Area
- Cemetery
- Campground
- Golf Course
- Park / Sports Field
- Pit or Quarry
- Runway
- Waterbody
- Wetland
- Wooded Area
- Provincial Park
- Conservation Area
- Lot Line
- Municipal Boundary

0 250 500 1,000 1,500 2,000 Meters

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Armow Wind Energy Project

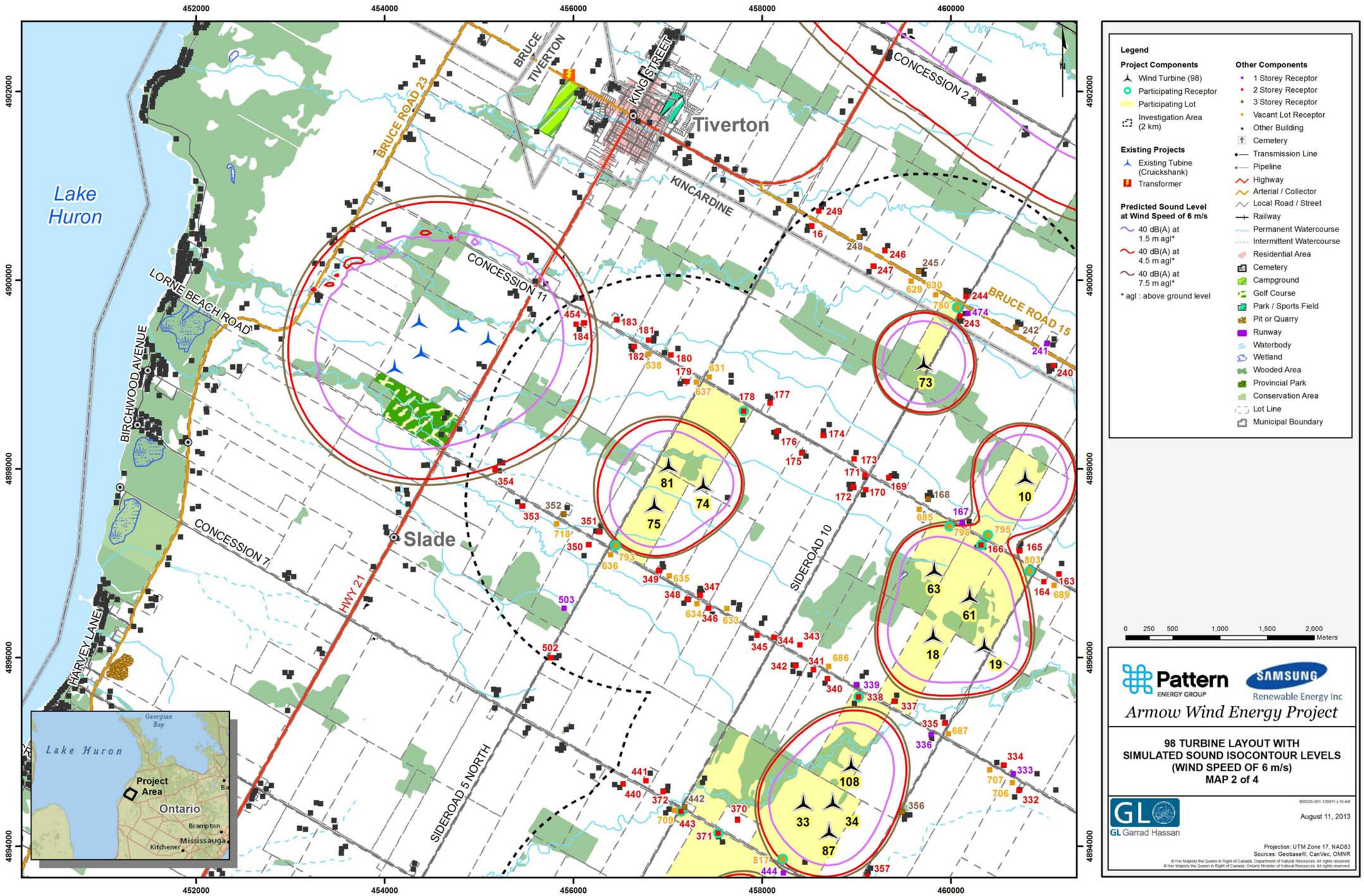
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 6 m/s) MAP 1 of 4

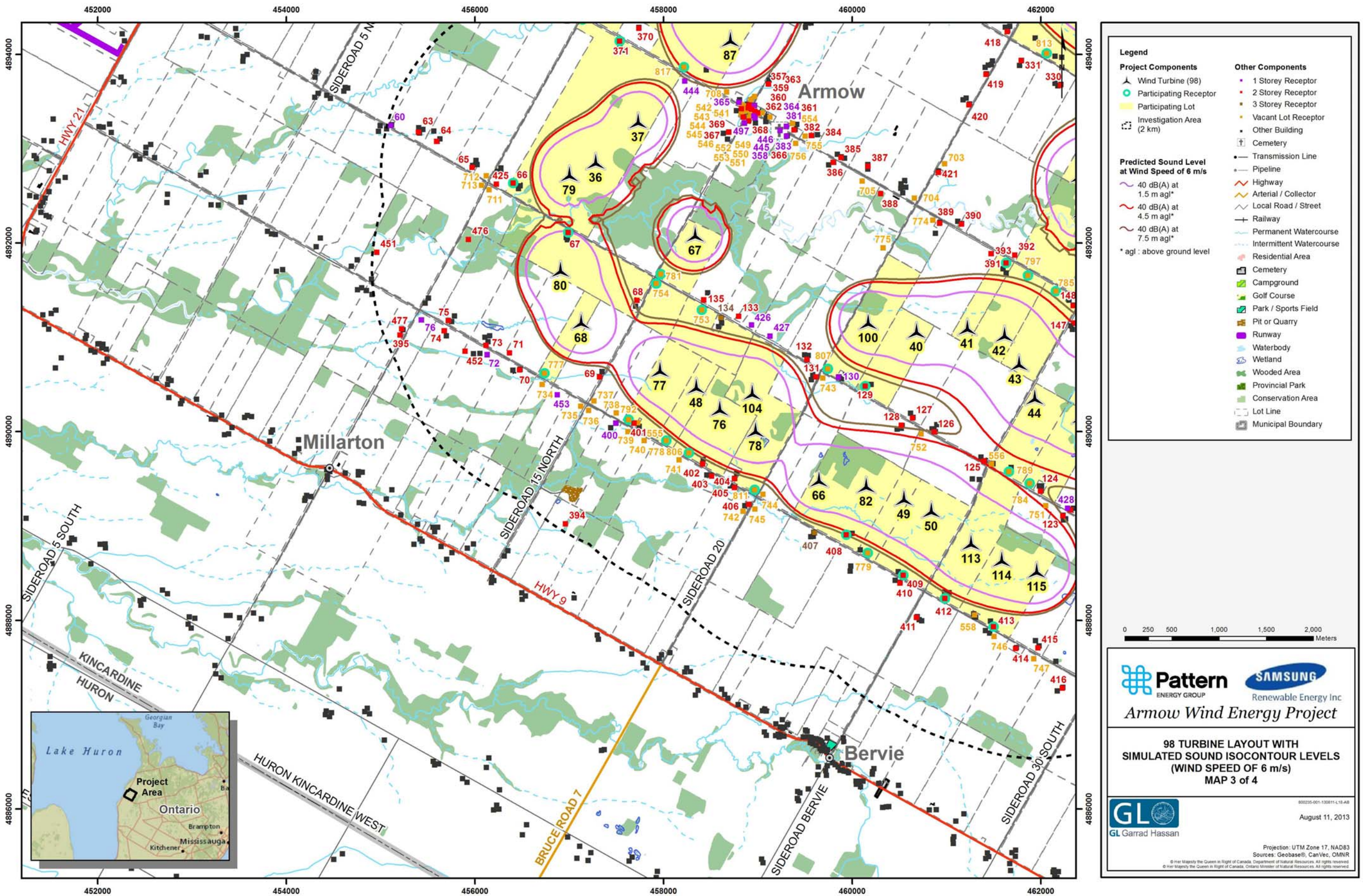
GL Garrad Hassan

800235-001-130811-L18-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR





Legend

Project Components
- Wind Turbine (98)
- Participating Receptor
- Participating Lot
- Investigation Area (2 km)

Predicted Sound Level at Wind Speed of 6 m/s
- 40 dB(A) at 1.5 m agl*
- 40 dB(A) at 4.5 m agl*
- 40 dB(A) at 7.5 m agl*

* agl : above ground level

Other Components
- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Cemetery
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
- Permanent Watercourse
- Intermittent Watercourse
- Residential Area
- Cemetery
- Campground
- Golf Course
- Park / Sports Field
- Pit or Quarry
- Runway
- Waterbody
- Wetland
- Wooded Area
- Provincial Park
- Conservation Area
- Lot Line
- Municipal Boundary

Pattern ENERGY GROUP

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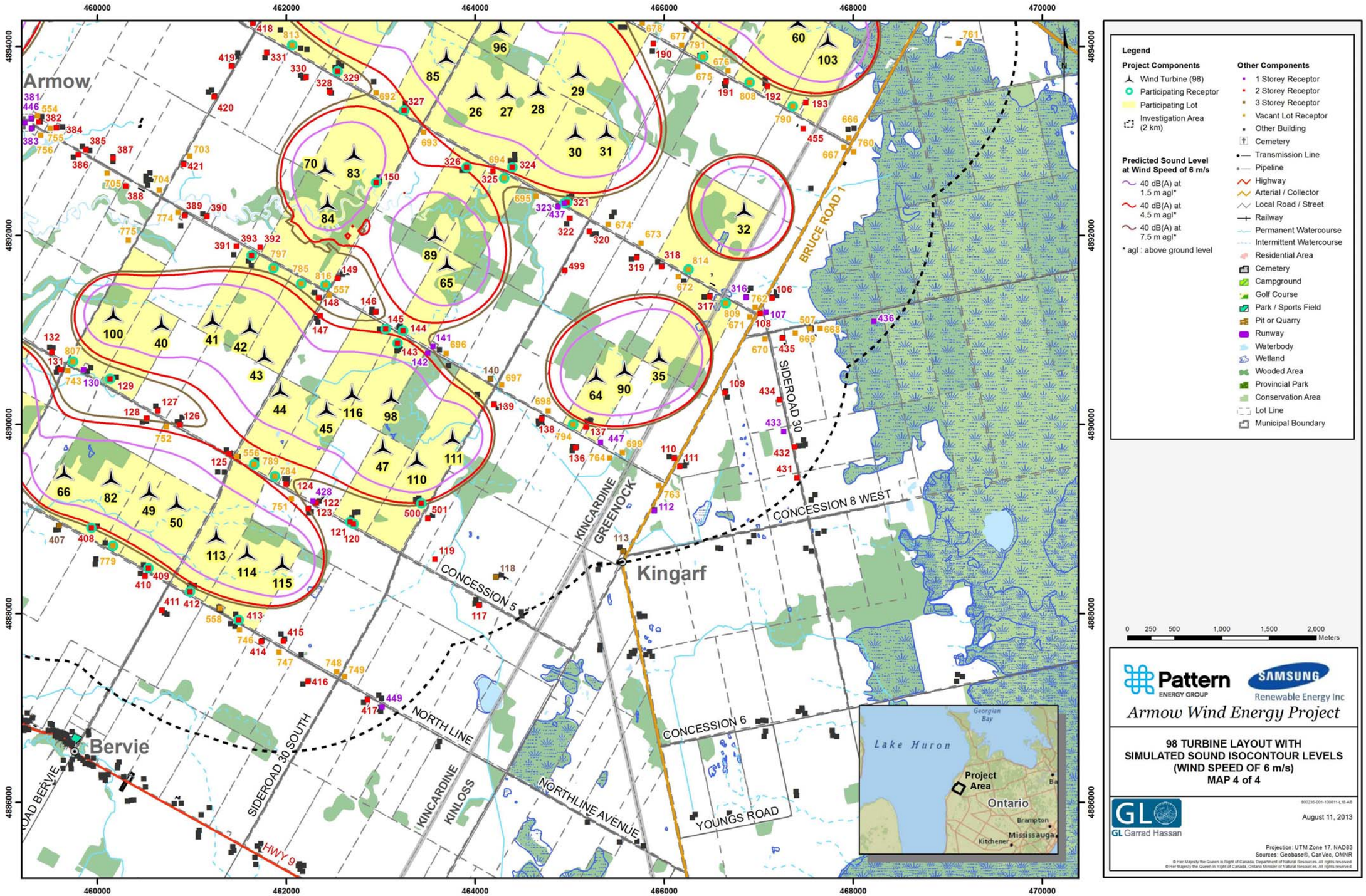
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 6 m/s) MAP 3 of 4

GL Garrad Hassan

800235-001-130811-L10-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



Legend

Project Components

- Wind Turbine (98)
- Participating Receptor
- Participating Lot
- Investigation Area (2 km)

Predicted Sound Level at Wind Speed of 6 m/s

- 40 dB(A) at 1.5 m agl*
- 40 dB(A) at 4.5 m agl*
- 40 dB(A) at 7.5 m agl*

* agl : above ground level

Other Components

- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Cemetery
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
- Permanent Watercourse
- Intermittent Watercourse
- Residential Area
- Cemetery
- Campground
- Golf Course
- Park / Sports Field
- Pit or Quarry
- Runway
- Waterbody
- Wetland
- Wooded Area
- Provincial Park
- Conservation Area
- Lot Line
- Municipal Boundary

0 250 500 1,000 1,500 2,000 Meters

Pattern ENERGY GROUP

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Armow Wind Energy Project

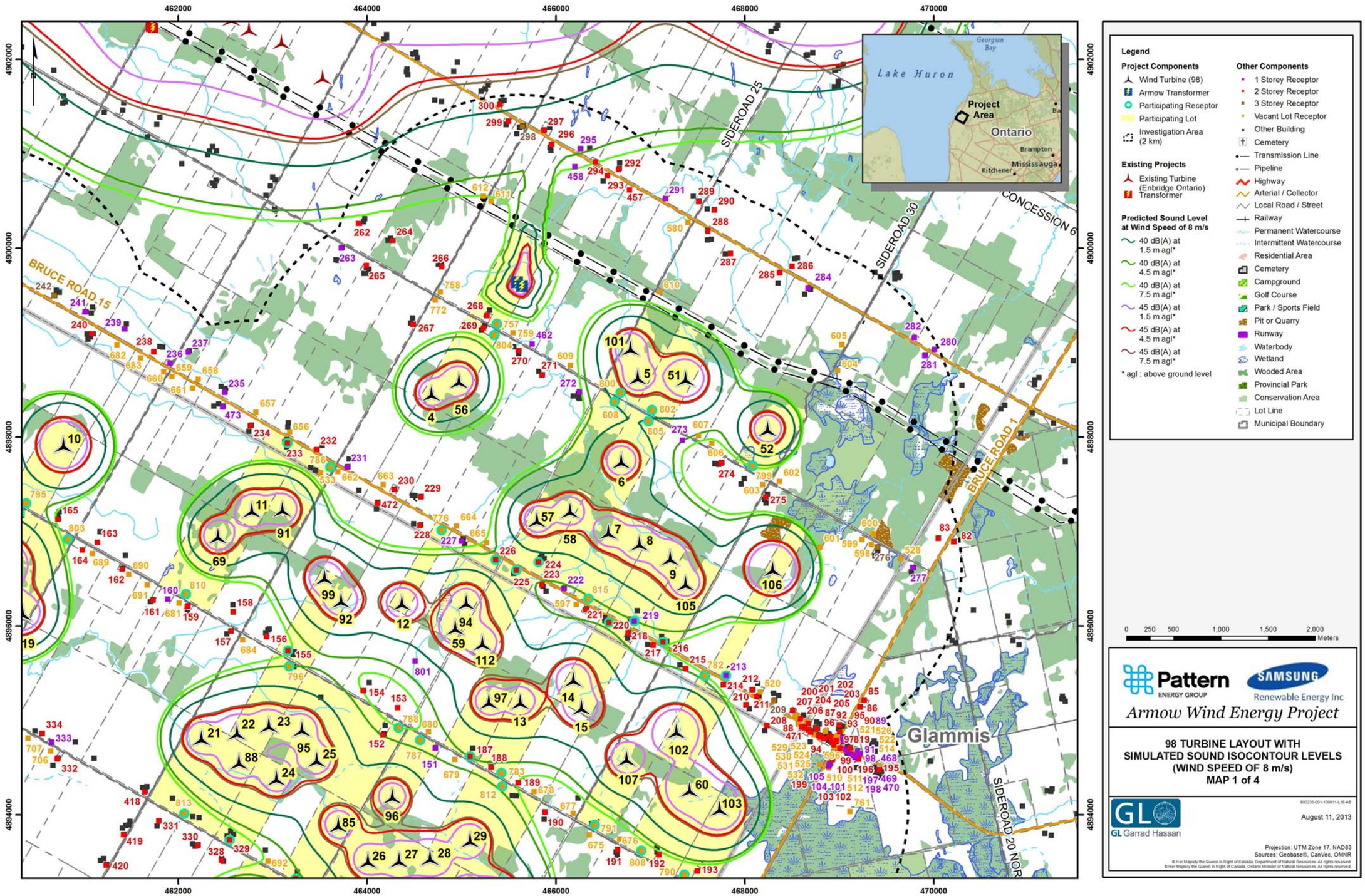
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 6 m/s) MAP 4 of 4

GL Garrad Hassan

800235-001-130811-L10-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



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Armow Wind Energy Project

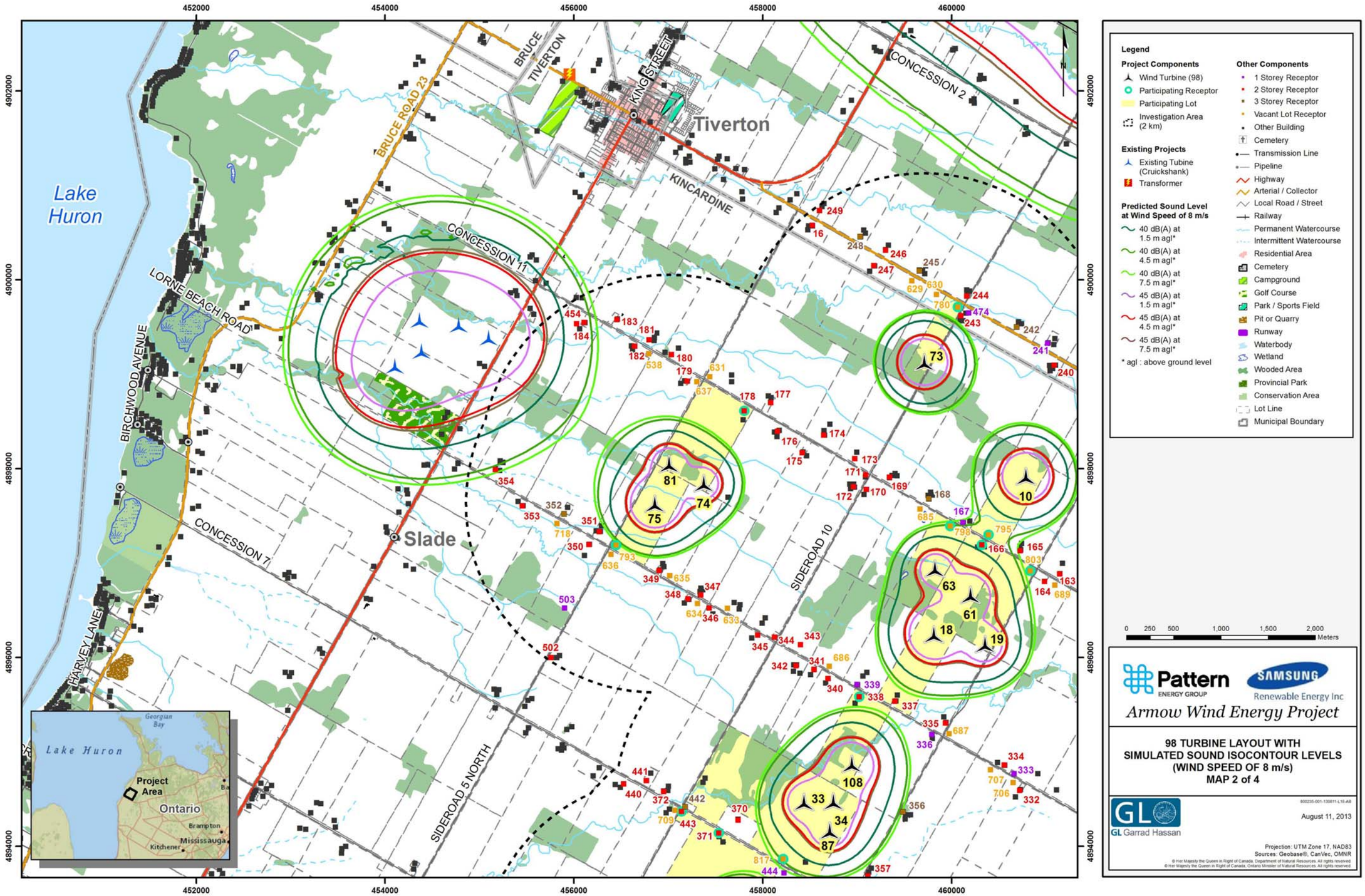
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 8 m/s) MAP 1 of 4

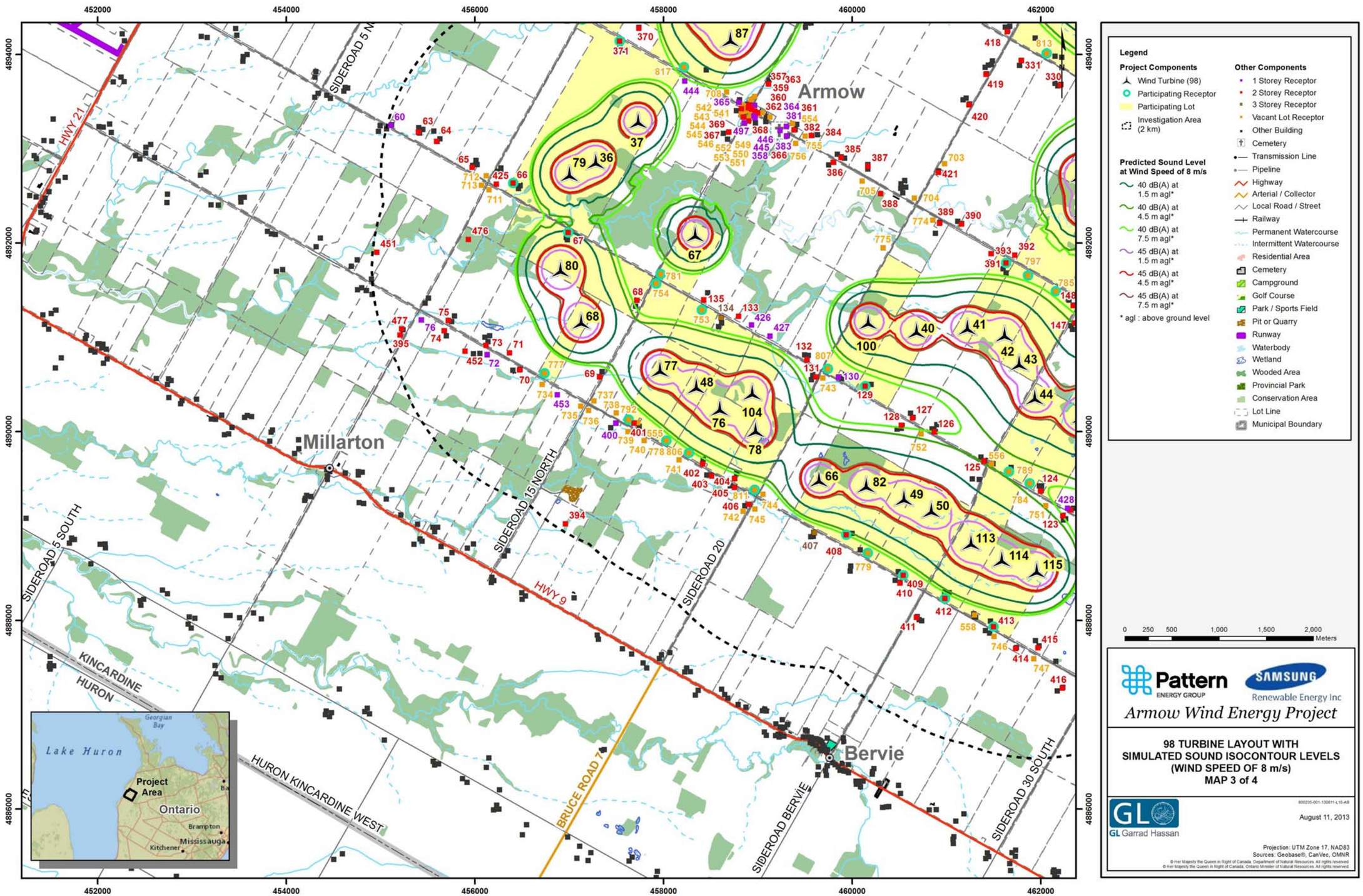
GL Garrad Hassan

800235-001-130811-L18-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR


452000
454000
456000
458000
460000
4902000
4900000
4898000
4896000
4894000
Lake Huron
BRUCE ROAD 23
BRUCE TIVERTON
KING STREET
Tiverton
KINCARDINE
CONCESSION 2
CONCESSION 11
LORNE BEACH ROAD
BIRCHWOOD AVENUE
CONCESSION 7
Slade
HARVEY LANE
SIDEROAD 10
SIDEROAD 5 NORTH
Georgian Bay
Lake Huron
Project Area
Ontario
Brampton
Mississauga
Kitchener
Legend
Project Components
Wind Turbine (98)
Participating Receptor
Participating Lot
Investigation Area (2 km)
Existing Projects
Existing Tubine (Cruickshank)
Transformer
Predicted Sound Level at Wind Speed of 8 m/s
40 dB(A) at 1.5 m agl*
40 dB(A) at 4.5 m agl*
40 dB(A) at 7.5 m agl*
45 dB(A) at 1.5 m agl*
45 dB(A) at 4.5 m agl*
45 dB(A) at 7.5 m agl*
* agl : above ground level
Other Components
1 Storey Receptor
2 Storey Receptor
3 Storey Receptor
Vacant Lot Receptor
Other Building
Cemetery
Transmission Line
Pipeline
Highway
Arterial / Collector
Local Road / Street
Railway
Permanent Watercourse
Intermittent Watercourse
Residential Area
Cemetery
Campground
Golf Course
Park / Sports Field
Pit or Quarry
Runway
Waterbody
Wetland
Wooded Area
Provincial Park
Conservation Area
Lot Line
Municipal Boundary
0 250 500 1,000 1,500 2,000
Meters
Pattern ENERGY GROUP
SAMSUNG Renewable Energy Inc
Armow Wind Energy Project
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 8 m/s)
MAP 2 of 4
GL Garrad Hassan
August 11, 2013
Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



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SAMSUNG Renewable Energy Inc

Armow Wind Energy Project

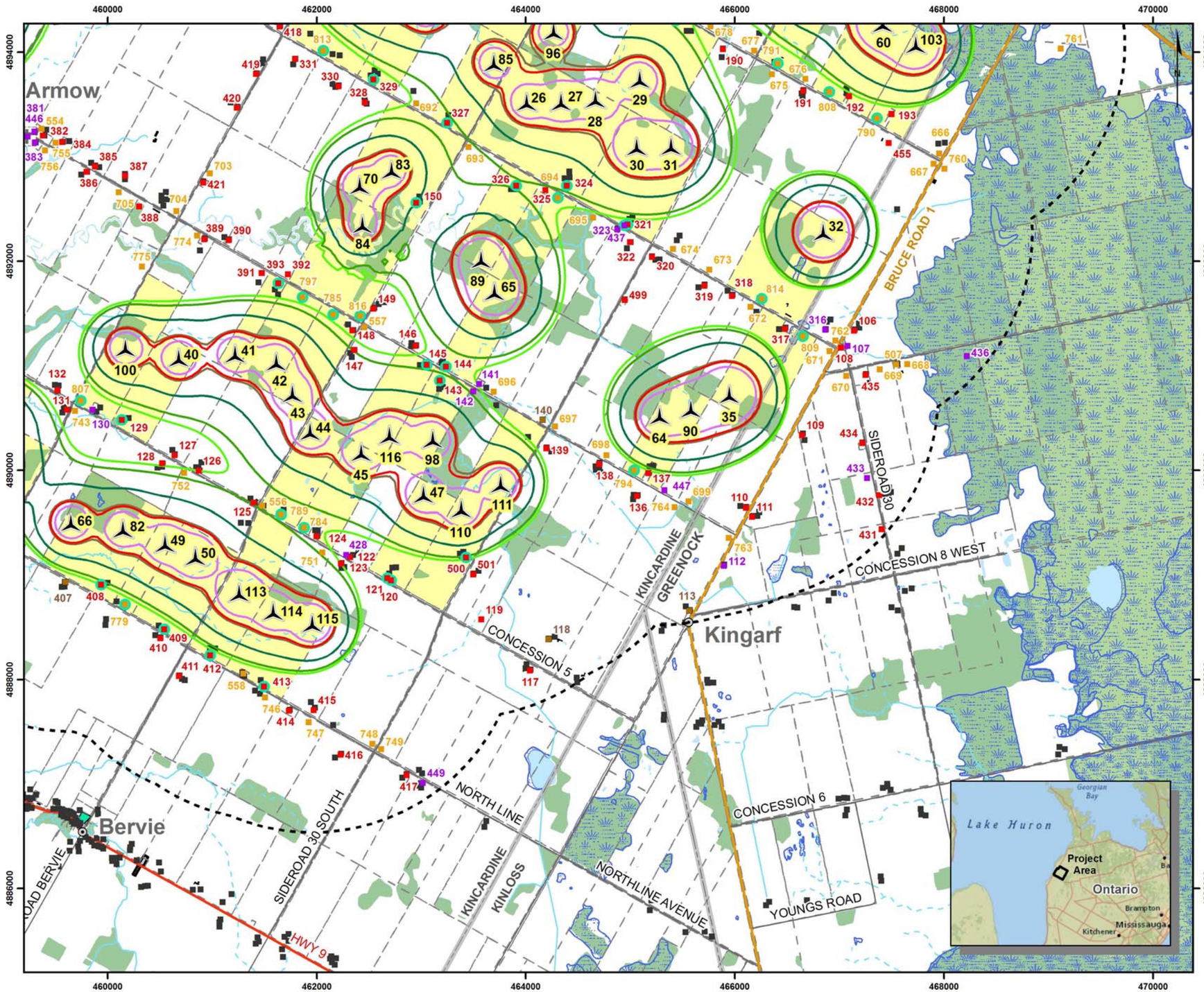
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 8 m/s) MAP 3 of 4

GL Garrad Hassan

800235-001-130811-L10-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



Legend

Project Components

- Wind Turbine (98)
- Participating Receptor
- Participating Lot
- Investigation Area (2 km)

Predicted Sound Level at Wind Speed of 8 m/s

- 40 dB(A) at 1.5 m agl*
- 40 dB(A) at 4.5 m agl*
- 40 dB(A) at 7.5 m agl*
- 45 dB(A) at 1.5 m agl*
- 45 dB(A) at 4.5 m agl*
- 45 dB(A) at 7.5 m agl*

* agl : above ground level

Other Components

- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Cemetery
- Transmission Line
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- Highway
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- Local Road / Street
- Railway
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- Intermittent Watercourse
- Residential Area
- Cemetery
- Campground
- Golf Course
- Park / Sports Field
- Pit or Quarry
- Runway
- Waterbody
- Wetland
- Wooded Area
- Provincial Park
- Conservation Area
- Lot Line
- Municipal Boundary

0 250 500 1,000 1,500 2,000 Meters

Pattern ENERGY GROUP

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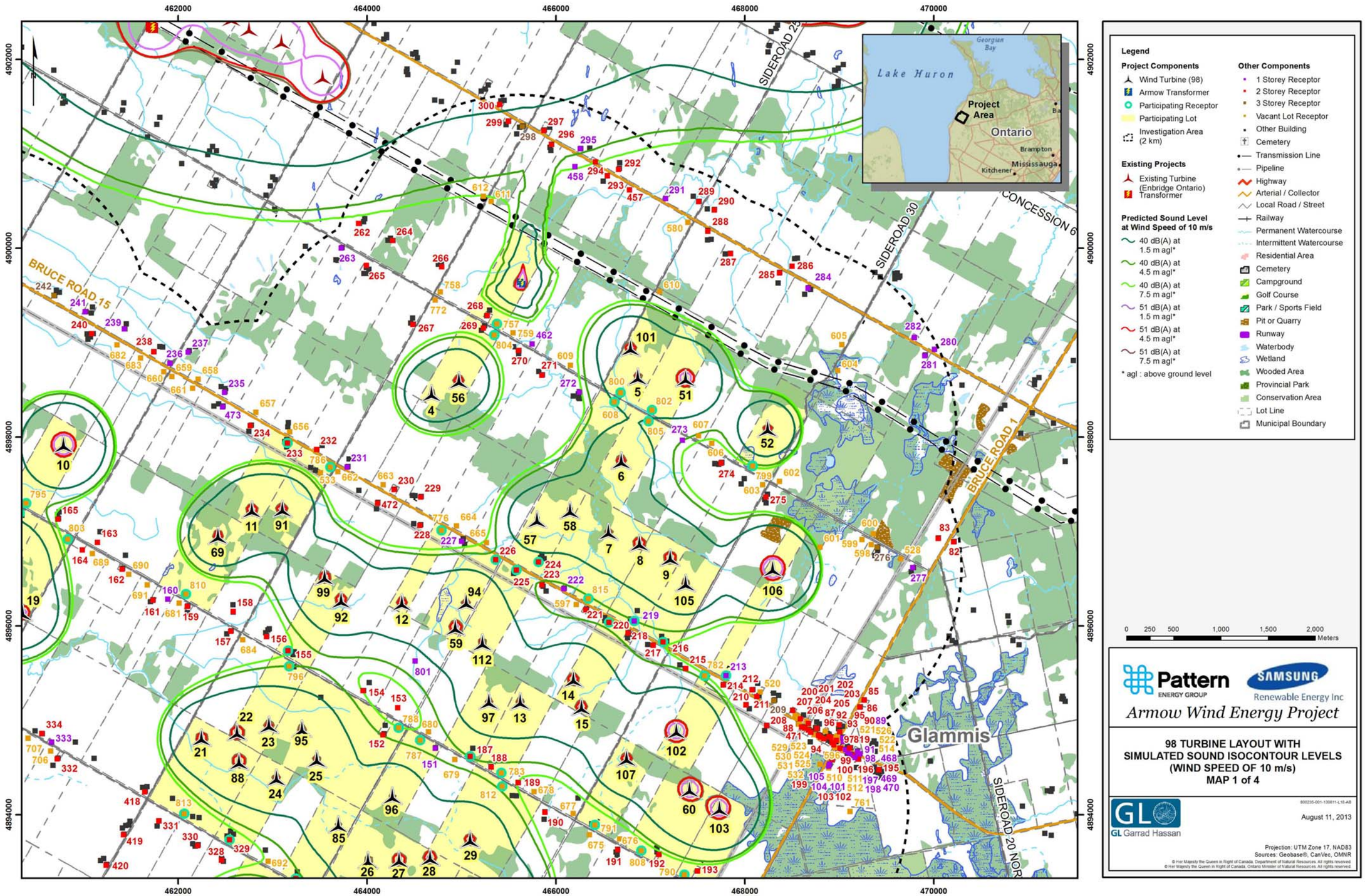
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 8 m/s) MAP 4 of 4

GL Garrad Hassan

800235-001-130811-L18-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



Pattern ENERGY GROUP

SAMSUNG Renewable Energy Inc

Armow Wind Energy Project

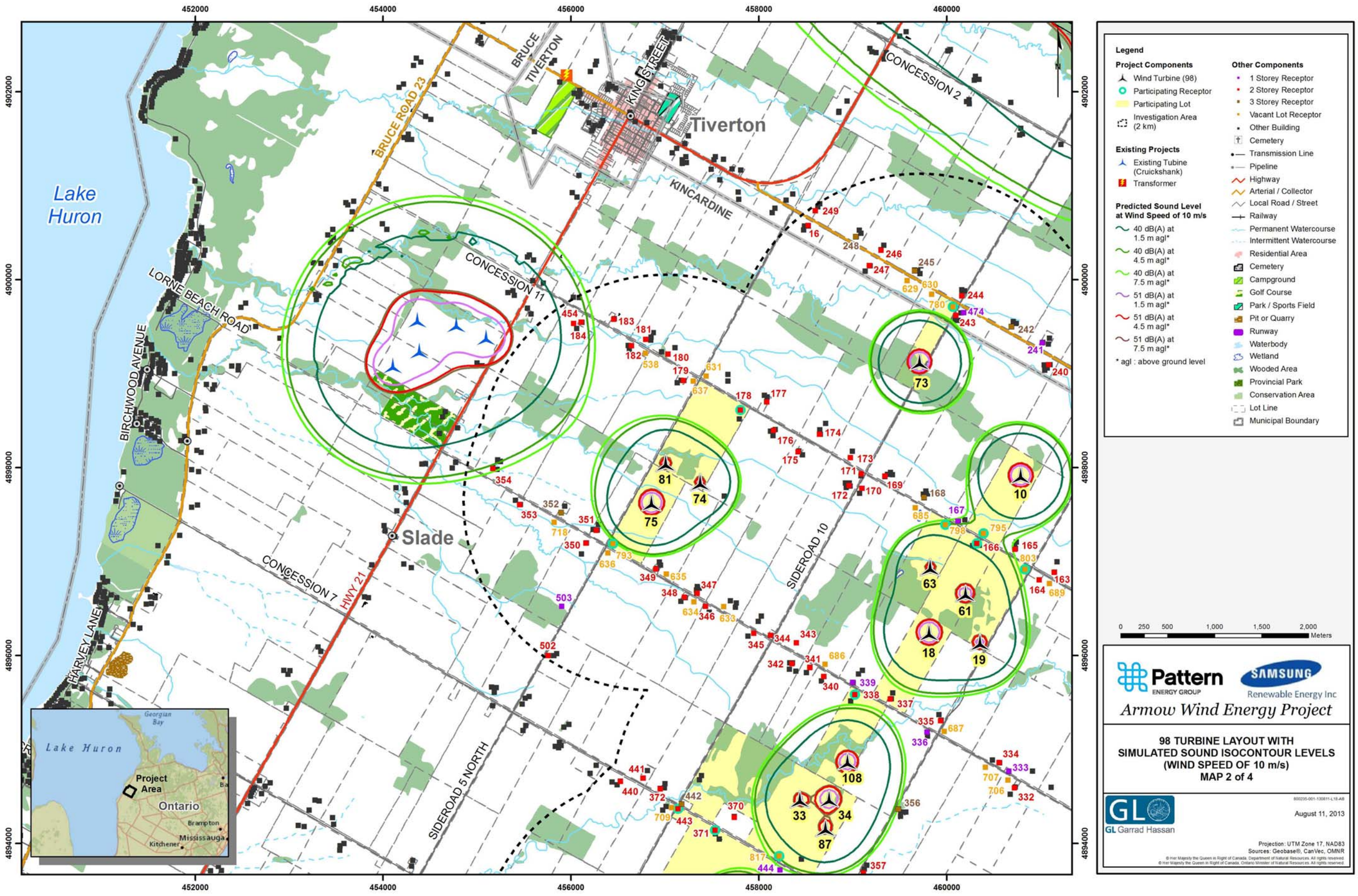
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 10 m/s) MAP 1 of 4

GL Garrad Hassan

800235-001-130811-L18-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



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Armow Wind Energy Project

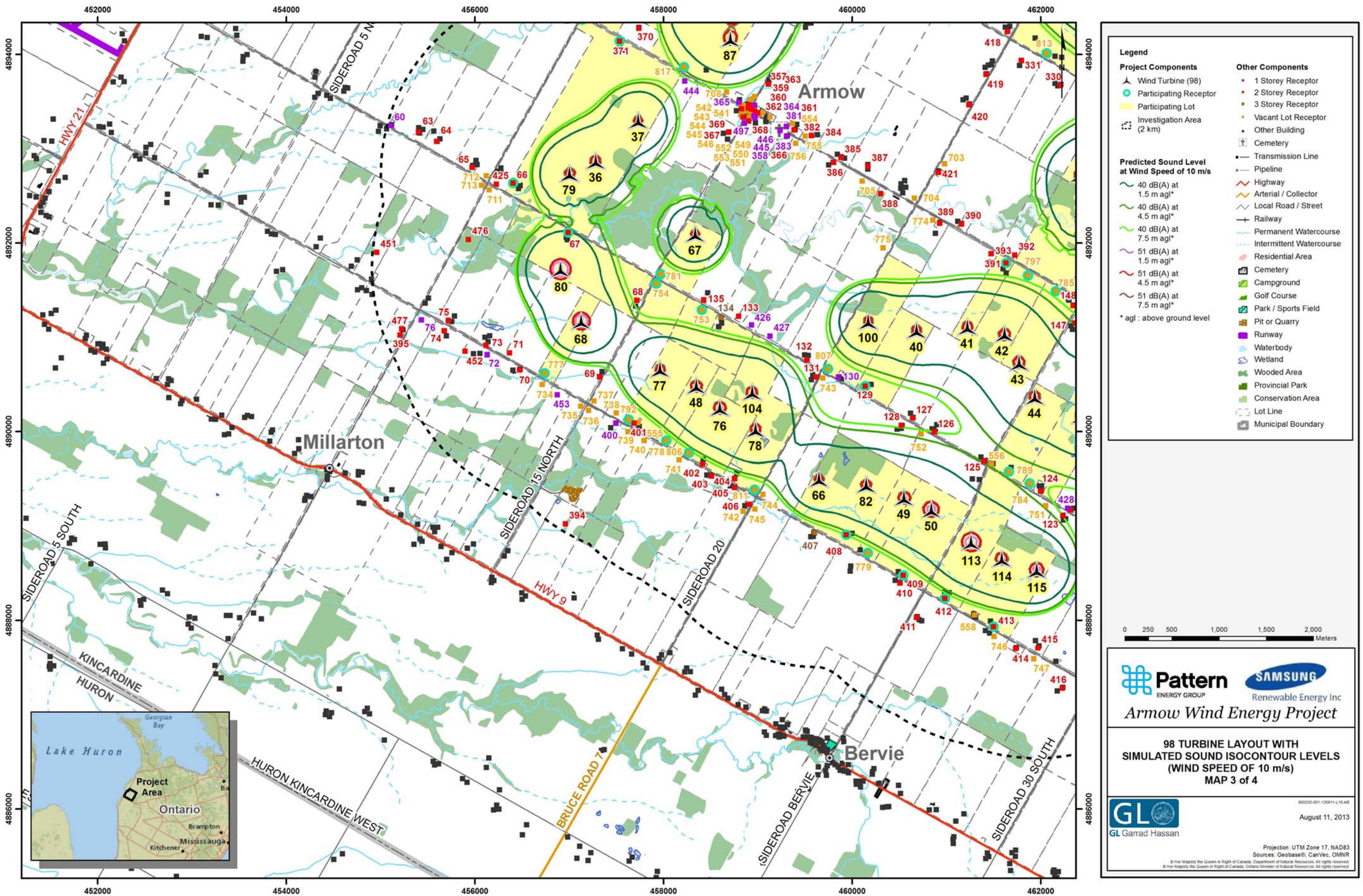
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 10 m/s) MAP 2 of 4

GL Garrad Hassan

800235-001-130811-L10-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



Legend

Project Components
- Wind Turbine (98)
- Participating Receptor
- Participating Lot
- Investigation Area (2 km)

Predicted Sound Level at Wind Speed of 10 m/s
- 40 dB(A) at 1.5 m agl*
- 40 dB(A) at 4.5 m agl*
- 40 dB(A) at 7.5 m agl*
- 51 dB(A) at 1.5 m agl*
- 51 dB(A) at 4.5 m agl*
- 51 dB(A) at 7.5 m agl*

* agl : above ground level

Other Components
- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Cemetery
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
- Permanent Watercourse
- Intermittent Watercourse
- Residential Area
- Cemetery
- Campground
- Golf Course
- Park / Sports Field
- Pit or Quarry
- Runway
- Waterbody
- Wetland
- Wooded Area
- Provincial Park
- Conservation Area
- Lot Line
- Municipal Boundary

0 250 500 1,000 1,500 2,000 Meters

Pattern ENERGY GROUP

SAMSUNG Renewable Energy Inc

Armow Wind Energy Project

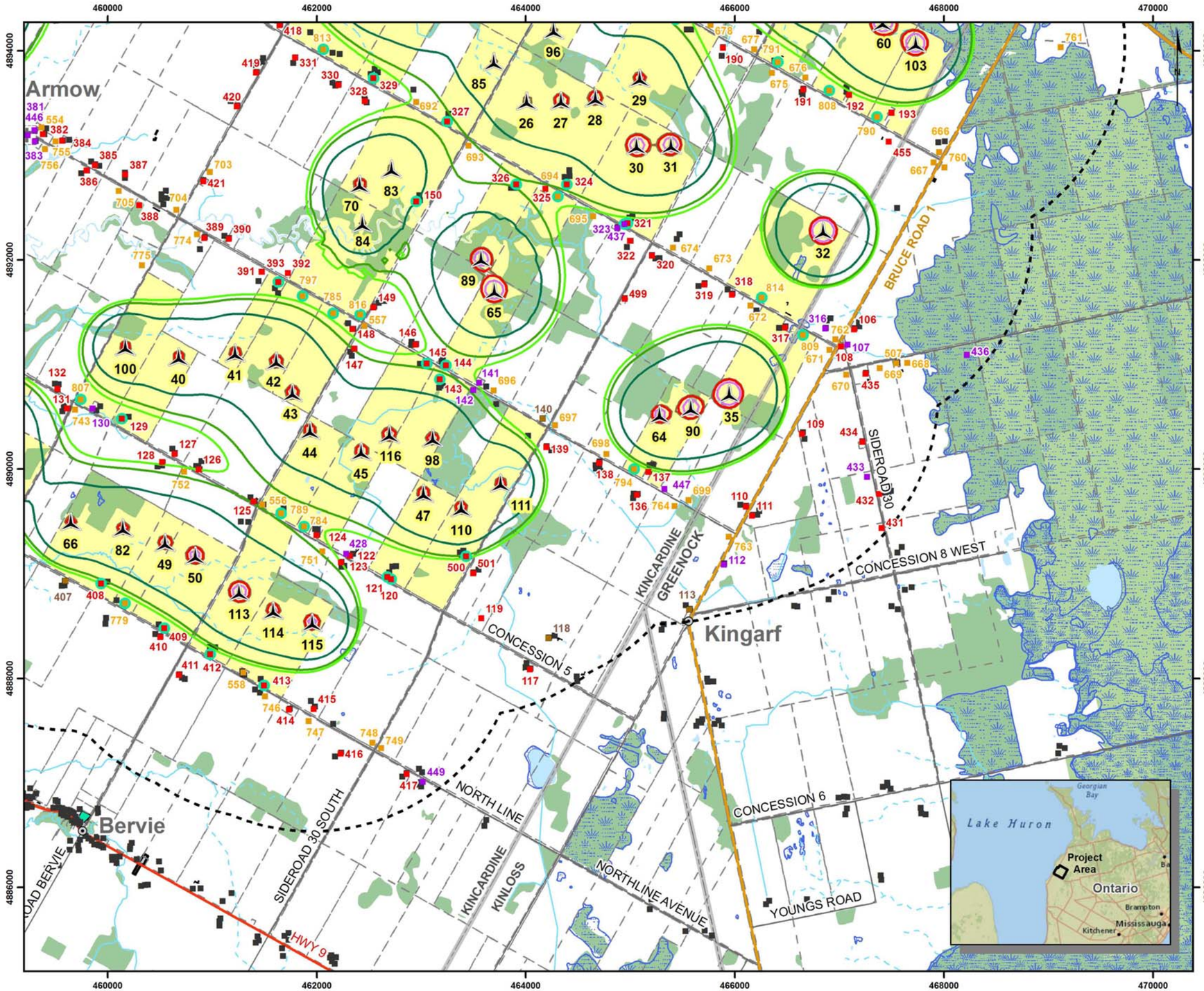
98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 10 m/s) MAP 3 of 4

GL Garrad Hassan

800235-001-130811-L10-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR



Legend

Project Components

- Wind Turbine (98)
- Participating Receptor
- Participating Lot
- Investigation Area (2 km)

Predicted Sound Level at Wind Speed of 10 m/s

- 40 dB(A) at 1.5 m agl*
- 40 dB(A) at 4.5 m agl*
- 40 dB(A) at 7.5 m agl*
- 51 dB(A) at 1.5 m agl*
- 51 dB(A) at 4.5 m agl*
- 51 dB(A) at 7.5 m agl*

* agl : above ground level

Other Components

- 1 Storey Receptor
- 2 Storey Receptor
- 3 Storey Receptor
- Vacant Lot Receptor
- Other Building
- Cemetery
- Transmission Line
- Pipeline
- Highway
- Arterial / Collector
- Local Road / Street
- Railway
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- Intermittent Watercourse
- Residential Area
- Cemetery
- Campground
- Golf Course
- Park / Sports Field
- Pit or Quarry
- Runway
- Waterbody
- Wetland
- Wooded Area
- Provincial Park
- Conservation Area
- Lot Line
- Municipal Boundary

0 250 500 1,000 1,500 2,000 Meters

Pattern ENERGY GROUP

SAMSUNG Renewable Energy Inc

Armow Wind Energy Project

98 TURBINE LAYOUT WITH SIMULATED SOUND ISOCONTOUR LEVELS (WIND SPEED OF 10 m/s) MAP 4 of 4

GL Garrad Hassan

600235-001-130811-L18-AB

August 11, 2013

Projection: UTM Zone 17, NAD83
Sources: Geobase®, CanVec, OMNR

APPENDIX B SAMPLE CALCULATION FOR NOISE MODELING

Resulting A-weighted sound pressure level at Receptors R_152 and VLR V_556

The calculation of cumulative receptor noise levels from wind turbines uses the methodology of ISO 9613-2, "*Acoustics — Attenuation of sound during propagation outdoors: Part 2: General method of calculation*". These calculations are conducted with CadnaA *(which is an implementation of ISO 9613-1 and ISO 9613-2).*

As an example, in this appendix, the results are presented for the worst impacted dwelling (R_152) and VLR (V_556). The following conditions were used:

- Turbine locations and models (Appendix F);
- Receptor locations (Appendix C).

Turbine characteristics and modeling parameters:

- Hub-heights: 99.5 m and 80 m, as described in the NIA;
- Ambient air temperature: 10ºC;
- Ambient barometric pressure: 101.32 kPa;
- Relative humidity: 70%;
- Source ground factor: 0.7 (soft ground);
- Middle ground factor: 0.7; and
- Receptor ground factor: 0.7
- Tonal penalty for transformer: 5.0 dBA; and
- See Table 5-1 to Table 5-8 for broadband and octave band sound power level.

The following table presents an example result and intermediate values of the calculations as the A-weighted sound pressure levels at two chosen example receptors, due to each turbine or substation and each octave band. The net results, the A-weighted sound pressure levels at the example receptors PoR R_152 and VLR V_556 for all bands and all noise sources within 5000 m of the example receptor are 39.96 and 39.91 dBA, respectively.

Sample Calculations

Sound Pressure Levels at PoR R_152

Turbine ID	Distance* [m]	Octave Band Sound Pressure Levels [dBA]									Total A-Weighted Sound Pressure Level by Turbine and for all Octave Bands [dBA]
		32 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
4	3653	N/A	5.6	4.1	8.9	5.2	-0.2	-22.8	+	+	12.6
5	4652	N/A	4.0	1.7	5.9	1.4	-5.8	-34.4	+	+	9.8
6	3847	N/A	5.5	3.9	8.7	5.7	0.2	-24.0	+	+	12.6
7	3215	N/A	6.5	5.3	10.4	7.1	2.4	-17.6	+	+	14.1
8	3392	N/A	6.3	5.1	10.1	7.6	2.9	-18.6	+	+	14.1
9	3576	N/A	6.0	4.6	9.5	6.9	1.8	-20.8	+	+	13.5
10	4569	N/A	5.4	4.1	7.7	6.8	1.9	-27.6	+	+	12.6
11	2761	N/A	7.9	7.1	12.5	10.6	6.9	-10.8	-78.7	+	16.6
12	1419	N/A	13.9	13.4	19.7	18.9	17.6	8.0	-28.9	+	24.5
13	1499	N/A	13.2	12.6	18.7	17.0	15.3	5.6	-33.0	+	23.0
14	2101	N/A	10.4	9.7	15.6	14.2	11.7	-2.1	-54.7	+	19.9
15	2123	N/A	10.3	9.6	15.5	14.1	11.5	-2.4	-55.5	+	19.8
18	4578	N/A	5.4	4.1	7.7	6.7	1.8	-27.7	+	+	12.6
19	4030	N/A	5.5	3.9	8.5	6.2	0.6	-25.0	+	+	12.7
21	1925	N/A	11.2	10.5	16.5	15.3	13.1	0.4	-48.2	+	21.0
22	1549	N/A	13.1	12.6	18.8	17.9	16.3	5.9	-34.0	+	23.5
23	1217	N/A	15.0	14.5	20.9	19.3	18.1	10.1	-22.0	+	25.4
24	1221	N/A	15.0	14.5	20.8	19.3	18.1	10.1	-22.1	+	25.3
25	755	N/A	19.3	19.0	25.5	24.4	24.0	18.8	-2.7	-78.4	30.5
26	1341	N/A	14.2	13.6	19.9	18.3	16.8	8.1	-26.9	+	24.3
27	1337	N/A	14.4	13.9	20.3	19.6	18.4	9.2	-25.8	+	25.2
28	1393	N/A	14.1	13.6	19.9	19.1	17.8	8.4	-27.9	+	24.7
29	1445	N/A	13.7	13.2	19.5	18.7	17.3	7.5	-29.9	+	24.3
30	1970	N/A	11.5	11.5	18.2	17.8	15.1	0.7	-47.7	+	22.7
31	2133	N/A	10.8	10.8	17.3	16.8	13.8	-1.6	-53.8	+	21.8
32	3712	N/A	6.8	6.1	10.3	10.1	6.7	-17.6	+	+	15.4
35	4493	N/A	5.5	4.3	8.0	7.1	2.3	-26.7	+	+	12.9
41	4761	N/A	4.0	1.8	6.0	2.3	-4.9	-34.6	+	+	10.0
42	4591	N/A	4.3	2.2	6.5	2.9	-3.9	-32.6	+	+	10.5
43	4766	N/A	4.0	1.8	6.0	2.3	-4.9	-34.6	+	+	10.0
45	4993	N/A	3.6	1.3	5.4	1.4	-6.1	-37.2	+	+	9.4
51	4951	N/A	4.2	2.6	7.4	4.4	-3.5	-35.8	+	+	11.2

56	3836	N/A	5.5	3.9	8.7	5.8	0.3	-23.9	+	+	12.6
57	2805	N/A	7.6	6.6	11.9	9.0	5.1	-12.5	-81.3	+	15.7
58	3095	N/A	6.7	5.6	10.8	7.6	3.2	-16.1	+	+	14.5
59	1375	N/A	14.2	13.7	20.0	19.3	18.0	8.6	-27.2	+	24.8
60	3297	N/A	7.4	7.1	12.7	11.5	7.4	-15.1	+	+	16.9
61	4368	N/A	5.1	3.9	9.0	6.5	-0.3	-29.2	+	+	12.8
63	4824	N/A	3.9	1.7	5.8	2.0	-5.2	-35.3	+	+	9.9
64	4469	N/A	4.8	2.8	7.2	4.6	-1.9	-30.1	+	+	11.4
65	3175	N/A	7.6	7.5	13.1	12.1	8.2	-13.6	+	+	17.4
69	2741	N/A	8.0	7.1	12.6	10.7	7.0	-10.5	-78.0	+	16.7
70	2759	N/A	7.9	7.1	12.5	10.6	6.9	-10.8	-78.6	+	16.6
83	2455	N/A	8.8	7.9	13.5	10.9	7.5	-7.9	-68.7	+	17.3
84	3039	N/A	6.9	5.8	11.0	7.9	3.5	-15.4	+	+	14.7
85	1066	N/A	16.2	15.8	22.2	20.8	19.8	12.7	-15.9	+	26.8
88	1554	N/A	13.1	12.5	18.8	17.9	16.3	5.8	-34.2	+	23.5
89	2896	N/A	8.0	7.8	13.9	12.7	8.4	-11.6	-81.4	+	17.9
90	4489	N/A	4.9	3.6	8.7	6.1	-1.0	-30.6	+	+	12.5
91	2623	N/A	8.4	7.6	13.1	11.3	7.8	-9.0	-73.7	+	17.2
92	1496	N/A	13.4	12.9	19.2	18.3	16.8	6.7	-31.9	+	23.9
94	1661	N/A	12.3	11.6	17.7	15.8	13.8	3.1	-39.2	+	21.9
95	866	N/A	18.0	17.7	24.2	23.0	22.4	16.5	-7.5	+	29.0
96	661	N/A	20.4	20.2	26.7	25.7	25.5	20.8	1.5	-66.3	31.9
97	1181	N/A	15.3	14.8	21.2	19.7	18.5	10.7	-20.5	+	25.7
98	4675	N/A	4.1	2.0	6.3	2.6	-4.4	-33.6	+	+	10.2
99	1786	N/A	11.8	11.2	17.3	16.2	14.2	2.4	-42.9	+	21.8
101	4863	N/A	3.8	1.6	5.7	1.9	-5.4	-35.7	+	+	9.8
102	3107	N/A	7.8	7.7	13.3	12.4	8.6	-12.8	+	+	17.6
103	3646	N/A	6.8	6.2	11.5	10.1	5.4	-19.2	+	+	15.6
105	3587	N/A	5.8	4.3	9.1	5.5	0.2	-22.0	+	+	12.8
106	4488	N/A	5.5	4.3	8.0	7.1	2.3	-26.6	+	+	12.9
107	2592	N/A	8.5	7.7	13.2	11.4	8.0	-8.6	-72.6	+	17.4
111	4999	N/A	3.6	1.3	5.4	1.4	-6.1	-37.2	+	+	9.4
112	1439	N/A	13.6	13.0	19.2	17.5	15.9	6.5	-30.7	+	23.5
116	4747	N/A	4.0	1.8	6.1	2.3	-4.8	-34.4	+	+	10.1
Transformer East	4982	-21.3	-2.6	2.2	1.5	4.1	-7.5	-41.6	+	+	8.0
Transformer West	4988	-21.4	-2.6	2.2	1.5	4.1	-7.5	-41.7	+	+	8.0
Total A-Weighted Sound Pressure Level											**39.96**

* Includes the heights of noise sources and receptors
\+ Indicates value is below -88.0 dBA
N/A : 31.5 Hz sound power levels were not provided by Siemens

Sound Pressure Levels at VLR V_556

Turbine ID	Distance* [m]	Octave Band Sound Pressure Levels [dBA]								Total A-Weighted Sound Pressure Level by Turbine and for all Octave Bands [dBA]
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
24	4985	3.5	1.1	5.0	0.2	-7.6	-38.2	+	+	9.0
26	4617	4.0	1.8	6.0	1.5	-5.6	-34.0	+	+	9.9
27	4809	3.9	1.7	5.9	2.1	-5.1	-35.1	+	+	9.9
30	4964	4.2	2.6	7.4	4.3	-3.5	-36.0	+	+	11.2
35	4592	5.4	4.1	7.7	6.7	1.8	-27.8	+	+	12.6
40	1627	12.7	12.1	18.3	17.3	15.6	4.8	-36.9	+	22.9
41	1477	13.5	13.0	19.3	18.5	17.0	7.0	-31.2	+	24.0
42	1386	14.1	13.6	19.9	19.2	17.9	8.5	-27.6	+	24.8
43	1115	16.0	15.6	22.1	21.6	20.8	13.0	-16.9	+	27.2
44	850	18.4	18.2	24.8	24.5	24.1	17.9	-5.8	+	30.1
45	1081	16.3	15.9	22.4	21.9	21.2	13.6	-15.5	+	27.5
47	1548	13.1	12.6	18.8	17.9	16.3	5.9	-33.9	+	23.5
48	3241	6.6	5.5	10.7	8.3	3.8	-16.8	+	+	14.6
49	999	17.0	16.7	23.2	22.8	22.1	15.0	-12.1	+	28.4
50	807	19.2	19.1	25.7	26.2	26.1	19.9	-3.1	-84.0	31.6
64	3898	5.7	4.2	8.9	6.7	1.3	-23.5	+	+	13.1
65	3025	8.0	8.0	13.7	12.8	9.1	-11.7	-85.3	+	18.0
66	1839	11.6	11.0	17.0	15.9	13.8	1.6	-45.0	+	21.5
67	3980	5.3	3.6	8.3	5.2	-0.6	-25.6	+	+	12.2
68	4607	5.0	2.7	7.3	4.5	-2.6	-32.0	+	+	11.4
70	3205	6.7	5.6	10.8	8.4	4.0	-16.4	+	+	14.7
76	2945	7.4	6.4	11.8	9.6	5.6	-13.1	-85.3	+	15.8
77	3659	5.8	4.4	9.3	6.5	1.3	-21.8	+	+	13.2
78	2531	8.7	7.9	13.5	11.8	8.5	-7.8	-70.4	+	17.7
82	1352	14.3	13.8	20.2	19.5	18.2	9.0	-26.3	+	25.0
83	3443	6.0	4.6	9.6	6.1	1.1	-20.3	+	+	13.3
84	2860	7.4	6.4	11.7	8.8	4.7	-13.2	-83.2	+	15.5
85	4784	3.8	1.5	5.6	0.9	-6.5	-35.9	+	+	9.5
89	3154	7.3	7.0	12.9	11.4	6.7	-14.9	+	+	16.8
90	4205	5.4	4.2	9.5	7.1	0.6	-27.3	+	+	13.3
98	1753	12.0	11.4	17.5	16.4	14.5	2.9	-41.7	+	22.1
100	2001	10.8	10.2	16.1	14.8	12.5	-0.7	-51.0	+	20.5
104	2653	8.3	7.5	13.0	11.1	7.6	-9.4	-74.8	+	17.1

110	1905	11.3	10.6	16.6	15.4	13.2	0.7	-47.4	+	21.1
111	2293	9.6	8.9	14.6	13.1	10.2	-4.7	-61.7	+	18.9
113	862	18.8	19.2	26.5	27.1	26.3	18.6	-4.2	+	32.1
114	1016	16.8	16.5	23.0	22.6	21.9	14.7	-12.8	+	28.2
115	1224	15.5	15.2	21.6	21.8	21.0	12.2	-20.4	+	27.0
116	1395	14.0	13.6	19.9	19.1	17.8	8.3	-28.0	+	24.7
Total A-Weighted Sound Pressure Level										**39.91**

* Includes the heights of noise sources and receptors.
+ Indicates value is below -88.0 dBA

APPENDIX C COORDINATES OF POINTS OF RECEPTION

Coordinates of all modeled PoRs and VLRs for the Armow Wind Farm (UTM17-NAD83 projection) are given in the tables below:

Point of Reception ID	Easting [m]	Northing [m]
R_64	455594	4893081
R_65	455971	4892805
R_68	457717	4891395
R_69	457321	4890583
R_70	456475	4890654
R_71	456367	4890837
R_72	456129	4890818
R_73	456119	4890917
R_74	455673	4891069
R_75	455718	4891179
R_90	468969	4894791
R_91	469044	4894780
R_92	468909	4894823
R_93	468893	4894831
R_94	468838	4894808
R_95	468924	4894766
R_96	468942	4894742
R_97	469006	4894708
R_98	469066	4894692
R_100	468936	4894618
R_101	468984	4894652
R_102	468861	4894644
R_103	468920	4894585
R_104	468896	4894539
R_105	468888	4894517
R_106	467139	4891338
R_107	467077	4891192
R_108	467016	4891173
R_109	466643	4890339
R_110	466104	4889642
R_111	466164	4889557
R_119	463575	4888576
R_122	462315	4889174
R_123	462234	4889111
R_124	461998	4889372
R_125	461398	4889690
R_126	460873	4889996
R_127	460641	4890145
R_128	460522	4890069
R_130	459855	4890579

Point of Reception ID	Easting [m]	Northing [m]
R_131	459614	4890581
R_132	459521	4890767
R_133	458796	4891225
R_134	458611	4891206
R_135	458426	4891398
R_136	465062	4889754
R_137	465172	4889972
R_138	464701	4890058
R_139	464197	4890211
R_140	464161	4890482
R_141	463554	4890826
R_142	463497	4890755
R_146	462948	4891190
R_147	462360	4891153
R_148	462343	4891338
R_149	462545	4891547
R_151	464722	4894708
R_152	464168	4894851
R_153	464324	4895138
R_154	463957	4895319
R_156	462934	4895889
R_157	462558	4895946
R_158	462583	4896156
R_159	462097	4896210
R_160	461890	4896287
R_161	461733	4896274
R_162	461407	4896604
R_163	461144	4896889
R_164	460985	4896808
R_165	460727	4897135
R_167	460119	4897434
R_168	459756	4897684
R_169	459342	4897912
R_170	459097	4897782
R_171	459090	4897938
R_172	458959	4897812
R_173	458974	4898107
R_174	458646	4898355
R_175	458416	4898169
R_176	458157	4898396

Point of Reception ID	Easting [m]	Northing [m]
R_177	458084	4898700
R_179	457197	4898926
R_180	457032	4899208
R_181	456795	4899365
R_182	456641	4899298
R_188	465315	4894508
R_189	465599	4894343
R_190	465885	4894030
R_191	466655	4893631
R_192	467091	4893580
R_193	467498	4893407
R_199	468800	4894827
R_200	468779	4894844
R_201	468762	4894916
R_202	468699	4894877
R_203	468673	4894900
R_204	468634	4894920
R_205	468671	4894971
R_206	468590	4895019
R_207	468506	4895108
R_208	468231	4894949
R_209	468309	4895210
R_210	468011	4895165
R_211	468126	4895256
R_212	468078	4895326
R_214	467772	4895378
R_215	467374	4895551
R_217	467028	4895798
R_218	466765	4895928
R_221	466316	4896175
R_222	466082	4896396
R_223	465850	4896439
R_227	465000	4896900
R_228	464559	4897070
R_229	464567	4897369
R_230	464286	4897449
R_231	463789	4897686
R_232	463466	4897869
R_234	462764	4898121
R_235	462490	4898475

Point of Reception ID	Easting [m]	Northing [m]
R_236	461914	4898781
R_238	461742	4898903
R_239	461431	4899146
R_240	461085	4899096
R_241	461016	4899326
R_242	460686	4899498
R_243	460096	4899622
R_244	460160	4899828
R_245	459657	4900094
R_246	459301	4900314
R_247	459177	4900150
R_248	459031	4900456
R_264	464268	4900083
R_266	464789	4899803
R_267	464487	4899193
R_268	465274	4899289
R_269	465232	4899155
R_270	465604	4898918
R_271	465852	4898653
R_272	466247	4898478
R_273	467340	4897968
R_274	467749	4897726
R_275	468224	4897369
R_276	469402	4896836
R_277	469779	4896620
R_285	468368	4899738
R_287	467849	4899944
R_288	467608	4900181
R_293	466546	4900768
R_316	466864	4891345
R_317	466480	4891354
R_318	465972	4891668
R_319	465708	4891767
R_320	465209	4892041
R_322	464998	4892183
R_323	464876	4892305
R_325	464189	4892683
R_328	462460	4893520
R_330	462208	4893676
R_331	461793	4893936

Point of Reception ID	Easting [m]	Northing [m]
R_333	460660	4894771
R_334	460557	4894864
R_335	459936	4895307
R_336	459790	4895187
R_337	459399	4895541
R_339	458997	4895718
R_340	458691	4895779
R_341	458541	4895875
R_342	458353	4895916
R_343	458400	4896139
R_346	457432	4896527
R_347	457345	4896665
R_348	457207	4896623
R_349	456902	4896923
R_350	456159	4897200
R_351	456268	4897337
R_352	455896	4897521
R_353	455453	4897607
R_356	459484	4894365
R_357	459113	4893688
R_358	458964	4893459
R_359	458910	4893464
R_360	458897	4893434
R_361	458937	4893420
R_362	458973	4893397
R_363	458999	4893381
R_364	458957	4893349
R_365	458800	4893495
R_366	458828	4893426
R_367	458844	4893337
R_368	458901	4893297
R_369	458691	4893178
R_370	457739	4894279
R_372	456951	4894583
R_381	459303	4893241
R_382	459383	4893202
R_383	459304	4893136
R_384	459567	4893142
R_388	460303	4892525
R_389	460927	4892211

Point of Reception ID	Easting [m]	Northing [m]
R_390	461160	4892202
R_391	461473	4891888
R_392	461726	4891875
R_400	457494	4890090
R_401	457689	4890090
R_402	458416	4889661
R_403	458511	4889532
R_404	458752	4889505
R_405	458753	4889412
R_406	458904	4889233
R_407	459599	4888932
R_410	460506	4888398
R_411	460681	4888035
R_414	461735	4887704
R_415	461971	4887710
R_416	462229	4887283
R_418	461646	4894245
R_419	461421	4893792
R_420	461238	4893469
R_421	460916	4892752
R_425	456226	4892626
R_426	458934	4891132
R_427	459128	4891015
R_428	462284	4889193
R_434	467219	4890262
R_435	467250	4890911
R_442	457178	4894418
R_444	458226	4893721
R_445	458972	4893330
R_446	459235	4893194
R_447	465327	4889811
R_452	455897	4890855
R_453	456874	4890392
R_455	467473	4893131
R_458	466200	4900864
R_462	465748	4898985
R_469	469113	4894646
R_470	469091	4894669
R_471	468601	4894932
R_472	464112	4897303

Point of Reception ID	Easting [m]	Northing [m]
R_473	462470	4898319
R_474	460180	4899649
R_476	455932	4892040
R_497	458858	4893275
R_499	464946	4891630
R_501	463498	4889008
R_503	455900	4896527
V_507	467543	4891014
V_510	468980	4894713
V_511	469036	4894684
V_512	468889	4894500
V_514	469016	4894786
V_520	468164	4895301
V_521	468977	4894838
V_522	468943	4894816
V_523	468533	4895060
V_524	468562	4895044
V_525	468653	4894995
V_526	468853	4894889
V_528	469649	4896714
V_529	468735	4894851
V_530	468787	4894822
V_531	468811	4894810
V_532	468573	4894963
V_533	463507	4897626
V_538	456793	4899216
V_541	458826	4893471
V_542	458848	4893459
V_543	458874	4893403
V_544	458824	4893374
V_545	458967	4893558
V_546	458927	4893524
V_549	459050	4893385
V_550	459003	4893366
V_551	458924	4893363
V_552	458910	4893339
V_553	459128	4893337
V_554	459369	4893270
V_555	457728	4890096
V_556	461479	4889661

Point of Reception ID	Easting [m]	Northing [m]
V_557	462457	4891368
V_558	461299	4888060
V_580	467397	4900275
V_596	468798	4894539
V_597	466215	4896230
V_598	469340	4896864
V_599	469242	4896918
V_600	469361	4896980
V_601	468798	4896839
V_602	468366	4897534
V_603	468191	4897500
V_604	468983	4898706
V_605	469029	4898981
V_606	467650	4897933
V_607	467511	4898014
V_609	466155	4898760
V_610	467099	4899540
V_611	465314	4900498
V_612	465231	4900552
V_629	459579	4899990
V_630	459839	4899846
V_631	457439	4898974
V_633	457627	4896524
V_634	457308	4896573
V_635	457017	4896870
V_636	456392	4897095
V_637	457303	4898920
V_656	463183	4898057
V_657	462823	4898263
V_658	462213	4898613
V_659	461934	4898643
V_660	461847	4898693
V_661	462154	4898517
V_662	463691	4897638
V_663	464171	4897499
V_664	464948	4897063
V_665	465264	4896884
V_666	467955	4893032
V_667	467900	4892933
V_668	467648	4891018

Point of Reception ID	Easting [m]	Northing [m]
V_669	467387	4890967
V_670	467066	4890904
V_671	466907	4891142
V_672	466151	4891564
V_673	465757	4891920
V_674	465411	4892118
V_675	466355	4893791
V_676	466674	4893747
V_677	466185	4894017
V_678	465768	4894248
V_679	464930	4894588
V_680	464651	4894882
V_681	462011	4896245
V_682	461354	4898978
V_683	461601	4898837
V_684	462684	4895858
V_685	459665	4897577
V_686	458706	4895910
V_687	459974	4895195
V_689	461093	4896770
V_690	461478	4896551
V_691	461674	4896437
V_692	462953	4893510
V_693	463452	4893093
V_695	464646	4892419
V_696	463694	4890753
V_697	464281	4890422
V_698	464772	4890144
V_699	465558	4889703
V_703	460980	4892842
V_704	460660	4892479
V_705	460107	4892660
V_706	460650	4894679
V_707	460411	4894813
V_708	458669	4893605
V_709	457072	4894384
V_711	456152	4892568
V_712	456122	4892716
V_713	456070	4892614
V_718	455822	4897420

Point of Reception ID	Easting [m]	Northing [m]
V_734	456714	4890500
V_735	457122	4890271
V_736	457207	4890225
V_737	457263	4890325
V_738	457500	4890199
V_739	457624	4890001
V_740	457795	4889905
V_741	458165	4889700
V_742	458844	4889160
V_743	459690	4890569
V_744	459054	4889340
V_745	458969	4889182
V_746	461506	4887831
V_747	461925	4887595
V_748	462535	4887386
V_749	462619	4887337
V_751	462055	4889218
V_752	460733	4889977
V_755	459504	4893135
V_756	459403	4893060
V_758	464776	4899538
V_759	465546	4899104
V_760	468005	4892888
V_761	469115	4894037
V_762	466963	4891241
V_763	465943	4889358
V_764	465425	4889647
V_772	464721	4899453
V_774	460858	4892245
V_775	460330	4891950
R_801	464510	4895633

APPENDIX D COORDINATES OF PARTICIPATING RECEPTORS

Coordinates of all modeled participating receptors for the Armow Wind Farm (UTM17-NAD83 projection) are given in the table below:

Participating receptor ID	Easting [m]	Northing [m]
R_66	456404	4892637
R_67	456989	4892113
R_120	462714	4888951
R_121	462676	4888972
R_129	460138	4890483
R_143	463179	4890859
R_144	463238	4890992
R_145	463053	4891010
R_150	462954	4892559
R_155	463164	4895742
R_166	460321	4897197
R_178	457804	4898613
R_187	465094	4894620
R_213	467803	4895479
R_216	467135	4895832
R_219	466830	4896056
R_220	466563	4896042
R_224	465815	4896681
R_225	465580	4896595
R_226	465361	4896706
R_233	463158	4897938
R_321	464975	4892354
R_324	464394	4892723
R_326	463909	4892723
R_327	463248	4893325
R_329	462543	4893739
R_338	459021	4895587
R_371	457533	4894145
R_393	461633	4891791
R_408	459938	4888910
R_409	460544	4888482
R_412	460983	4888234
R_413	461499	4887934
R_437	464944	4892345
R_443	457141	4894372
R_500	463429	4889171
V_608	466619	4898372
V_694	464308	4892609

Participating receptor ID	Easting [m]	Northing [m]
V_753	458405	4891293
V_754	457922	4891573
V_757	465375	4899201
V_776	464789	4897015
V_777	456738	4890621
V_778	458031	4889907
V_779	460167	4888719
V_780	460065	4899712
V_781	457971	4891672
V_782	467572	4895475
V_783	465422	4894447
V_784	461881	4889455
V_785	462160	4891490
V_786	463611	4897686
V_787	464563	4894794
V_788	464333	4894924
V_789	461662	4889579
V_790	467360	4893368
V_791	466412	4893894
V_792	457630	4890129
V_793	456446	4897194
V_794	465036	4889999
V_795	460391	4897303
V_796	463175	4895576
V_797	461865	4891657
V_798	459983	4897395
V_799	468082	4897696
V_800	466684	4898470
V_802	467017	4898286
V_803	460831	4896920
V_804	465346	4899082
V_805	466980	4898170
V_806	458270	4889775
V_807	459743	4890668
V_808	466903	4893622
V_809	466650	4891282
V_810	462082	4896339
V_811	458966	4889388
V_812	465432	4894304
V_813	462063	4894014
V_814	466257	4891641
V_815	466343	4896293

Participating receptor ID	Easting [m]	Northing [m]
V_816	462416	4891480
V_817	458215	4893868

APPENDIX E TURBINE ACOUSTIC EMISSION SPECIFICATIONS

SWT-2.3-101, Rev. 4, Max. Power 1824 kW
Contract Acoustic Emission, Hub Height 99.5m
Armow - Ontario - Canada

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

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 1824kW	91.4	95.2	98.1	100.4	101.0	101.0	101.0	101.0	101.0	101.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	85.3	84.9	84.0	84.0	83.8
125	88.6	89.5	89.6	89.5	89.1
250	95.2	94.9	94.0	93.8	93.2
500	93.8	93.5	92.6	92.4	92.0
1000	92.8	94.4	95.0	94.9	95.1
2000	91.5	93.7	94.7	94.9	95.3
4000	89.2	89.7	89.6	90.4	90.7
8000	76.2	77.5	78.0	78.2	78.1

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 1903 kW
Contract Acoustic Emission, Hub Height 99.5m
Armow - Ontario - Canada

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

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 1903kW	91.4	95.4	99.0	101.4	102.0	102.0	102.0	102.0	102.0	102.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	85.5	85.1	84.2	84.3	84.0
125	89.0	89.8	90.0	89.9	89.5
250	95.6	95.3	94.4	94.2	93.6
500	95.2	94.8	93.8	93.6	93.2
1000	94.5	95.9	96.4	96.3	96.4
2000	92.6	94.8	95.8	95.9	96.4
4000	90.1	90.7	90.6	91.5	91.7
8000	76.5	78.0	78.6	78.8	78.8

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 2030 kW
Contract Acoustic Emission, Hub Height 99.5m
Armow - Ontario - Canada

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

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2030kW	91.4	95.6	99.8	102.4	103.0	103.0	103.0	103.0	103.0	103.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	85.8	85.4	84.4	84.5	84.2
125	89.5	90.2	90.4	90.3	89.8
250	96.0	95.7	94.9	94.7	94.0
500	96.5	96.0	95.0	94.8	94.4
1000	96.2	97.3	97.8	97.6	97.8
2000	93.6	95.9	96.9	97.0	97.4
4000	90.9	91.6	91.6	92.5	92.6
8000	76.7	78.5	79.2	79.4	79.3

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 2126 kW
Contract Acoustic Emission, Hub Height 99.5m
Armow - Ontario - Canada

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

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2126kW	91.4	95.7	100.3	103.3	104.0	104.0	104.0	104.0	104.0	104.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	86.0	85.6	84.6	84.6	84.2
125	89.8	91.0	90.7	90.1	89.2
250	96.4	97.2	94.7	94.0	93.1
500	97.1	97.6	96.3	96.0	95.6
1000	97.7	98.3	99.3	99.2	99.3
2000	95.1	95.7	97.8	97.9	98.4
4000	91.6	92.8	92.5	94.3	94.4
8000	77.0	77.7	79.3	79.2	79.0

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 2221 kW
Contract Acoustic Emission, Hub Height 99.5m
Armow - Ontario - Canada

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

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2221kW	91.4	95.7	100.5	104.2	105.0	105.0	105.0	105.0	105.0	105.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	86.3	86.0	84.8	84.9	84.5
125	90.3	91.6	91.1	90.5	89.6
250	96.5	97.5	96.4	95.7	94.9
500	97.7	98.3	97.2	97.0	96.6
1000	99.2	99.9	100.1	100.0	100.2
2000	96.5	97.2	98.9	99.0	99.4
4000	92.2	93.5	93.6	95.4	95.5
8000	77.1	77.9	80.8	80.7	80.5

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 2300 kW
Contract Acoustic Emission, Hub Height 99.5m
Armow - Ontario - Canada

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

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2300kW	91.4	95.7	100.6	105.1	106.0	106.0	106.0	106.0	106.0	106.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	86.7	86.2	85.0	83.8	83.2
125	90.8	91.7	91.5	89.5	89.3
250	95.5	96.5	96.1	94.3	93.9
500	97.9	98.6	98.4	98.1	97.6
1000	100.9	101.6	101.7	101.9	101.8
2000	98.3	99.6	99.8	100.3	100.7
4000	92.8	94.2	94.4	95.0	95.3
8000	78.9	80.4	80.8	81.4	82.0

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 2126 kW
Contract Acoustic Emission, Hub Height 80.0m
Armow - Ontario - Canada

Sound Power Levels
The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 80.0 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (LWA) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2126kW	91.0	95.2	99.8	102.9	104.0	104.0	104.0	104.0	104.0	104.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	85.6	85.7	84.6	84.4	84.3
125	89.5	90.9	90.8	90.4	89.4
250	96.0	97.2	94.7	94.3	93.3
500	96.7	97.7	96.3	96.1	95.7
1000	97.3	98.4	99.3	99.2	99.3
2000	94.7	95.8	97.8	97.9	98.2
4000	91.2	92.7	92.5	93.4	94.4
8000	76.6	77.7	79.3	79.2	79.1

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

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

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

SWT-2.3-101, Rev. 4, Max. Power 2030 kW
Contract Acoustic Emission, Hub Height 80.0m
Armow - Ontario - Canada

Sound Power Levels
The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 80.0 m and a roughness length of 0.05 m as described in the IEC code. The sound power levels (LWA) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	3	4	5	6	7	8	9	10	11	Up to cut-out
Max. Power 2030kW	91.0	95.1	99.4	102.0	103.0	103.0	103.0	103.0	103.0	103.0

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

	Wind Speed (m/s)				
Octave band, centre frequency [Hz]	6	7	8	9	10
63	85.4	85.5	84.4	84.3	84.3
125	89.0	90.2	90.3	90.3	89.9
250	95.6	96.0	94.9	94.8	94.2
500	96.1	96.3	95.0	94.9	94.5
1000	95.8	97.2	97.8	97.7	97.8
2000	93.2	95.5	96.9	97.0	97.3
4000	90.5	91.6	91.6	92.1	92.6
8000	76.3	78.2	79.2	79.3	79.4

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

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

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

APPENDIX F COORDINATES OF TURBINES

Coordinates of turbines evaluated for the Armow Wind Farm and the substation location, as well as the turbine model evaluated at each location, are listed below in UTM17-NAD83 projection:

Turbine ID	Easting [m]	Northing [m]	Max Power [MW]	Hub Height [m]	Broadband PWL [dBA]
T4	464682	4898466	1.824	99.5	101
T5	466865	4898641	1.824	99.5	101
T6	466690	4897755	1.903	99.5	102
T7	466554	4897005	1.824	99.5	101
T8	466884	4896882	1.903	99.5	102
T9	467210	4896729	1.903	99.5	102
T10	460785	4897921	2.300	99.5	106
T11	462777	4897234	1.903	99.5	102
T12	464367	4896252	1.903	99.5	102
T13	465621	4895205	1.824	99.5	101
T14	466182	4895442	1.903	99.5	102
T15	466268	4895147	1.903	99.5	102
T18	459810	4896249	2.300	99.5	106
T19	460352	4896143	2.030	99.5	103
T21	462245	4894821	1.903	99.5	102
T22	462622	4894878	1.903	99.5	102
T23	462959	4894956	1.824	99.5	101
T24	463039	4894395	1.824	99.5	101
T25	463465	4894592	1.824	99.5	101
T26	464009	4893522	1.824	99.5	101
T27	464337	4893527	1.903	99.5	102
T28	464666	4893553	1.903	99.5	102
T29	465090	4893742	1.903	99.5	102
T30	465060	4893097	2.126	99.5	104
T31	465388	4893104	2.126	99.5	104
T32	466845	4892281	2.300	99.5	106
T33	458435	4894474	1.903	99.5	102
T34	458746	4894479	2.221	99.5	105
T35	465945	4890725	2.300	99.5	106
T36	457280	4892873	1.903	99.5	102
T37	457729	4893302	1.903	99.5	102
T40	460681	4891076	1.903	99.5	102
T41	461220	4891113	1.903	99.5	102
T42	461614	4891037	1.903	99.5	102
T43	461768	4890734	1.903	99.5	102

Turbine ID	Easting [m]	Northing [m]	Max Power [MW]	Hub Height [m]	Broadband PWL [dBA]
T44	461935	4890372	1.903	99.5	102
T45	462426	4890172	1.903	99.5	102
T47	463020	4889772	1.903	99.5	102
T48	458346	4890486	1.903	99.5	102
T49	460549	4889305	1.903	99.5	102
T50	460839	4889178	2.030	99.5	103
T51	467371	4898626	2.126	99.5	104
T52	468239	4898092	1.903	99.5	102
T56	464971	4898601	1.903	99.5	102
T57	465799	4897131	1.824	99.5	101
T58	466148	4897228	1.824	99.5	101
T59	464934	4895989	1.903	99.5	102
T60	467413	4894276	2.221	99.5	105
T61	460197	4896667	2.126	99.5	104
T63	459822	4896943	1.903	99.5	102
T64	465279	4890523	2.030	99.5	103
T65	463701	4891711	2.221	99.5	105
T66	459648	4889504	1.903	99.5	102
T67	458335	4892100	1.903	99.5	102
T68	457127	4891173	2.030	80.0	103
T69	462419	4896959	1.903	99.5	102
T70	462409	4892727	1.903	99.5	102
T73	459708	4899129	2.300	99.5	106
T74	457373	4897847	1.903	99.5	102
T75	456855	4897632	2.300	99.5	106
T76	458595	4890252	1.903	99.5	102
T77	457961	4890664	1.903	99.5	102
T78	458976	4890025	1.903	99.5	102
T79	457000	4892740	1.903	99.5	102
T80	456905	4891725	2.126	80.0	104
T81	457006	4898054	1.903	99.5	102
T82	460147	4889442	1.903	99.5	102
T83	462716	4892873	1.824	99.5	101
T84	462437	4892354	1.824	99.5	101
T85	463695	4893900	1.824	99.5	101

Turbine ID	Easting [m]	Northing [m]	Max Power [MW]	Hub Height [m]	Broadband PWL [dBA]
T87	458708	4894168	1.903	99.5	102
T88	462642	4894569	1.903	99.5	102
T89	463573	4892018	2.126	99.5	104
T90	465579	4890590	2.126	99.5	104
T91	463100	4897245	1.903	99.5	102
T92	463725	4896277	1.903	99.5	102
T94	465047	4896257	1.824	99.5	101
T95	463309	4894916	1.824	99.5	101
T96	464266	4894203	1.824	99.5	101
T97	465289	4895208	1.824	99.5	101
T98	463109	4890298	1.903	99.5	102
T99	463549	4896523	1.903	99.5	102
T100	460169	4891172	1.903	99.5	102
T101	466788	4898947	1.903	99.5	102
T102	467274	4894893	2.221	99.5	105
T103	467729	4894074	2.221	99.5	105
T104	458938	4890421	1.903	99.5	102
T105	467373	4896459	1.824	99.5	101
T106	468294	4896614	2.300	99.5	106
T107	466747	4894603	1.903	99.5	102
T108	458941	4894875	2.221	99.5	105
T110	463381	4889634	1.903	99.5	102
T111	463760	4889869	1.903	99.5	102
T112	465221	4895826	1.824	99.5	101
T113	461259	4888833	2.126	99.5	104
T114	461585	4888655	1.903	99.5	102
T115	461956	4888538	2.030	99.5	103
T116	462694	4890339	1.903	99.5	102
Trans -former West	465609	4899626	-	-	105.5
Trans -former East	465635	4899612			105.5

Coordinates of the installed Underwood Wind Farm turbines and transformer locations are listed below in UTM17-NAD83 projection:

Turbine ID	Easting [m]	Northing [m]
UT01	459215	4904264
UT02	459618	4904038
UT03	459955	4903846
UT04	460420	4903592
UT05	460817	4903416
UT06	461229	4903168
UT07	461501	4903011
UT08	461770	4902817
UT09	462139	4902678
UT10	462561	4902440
UT11	462748	4902329
UT12	463094	4902192
UT13	463528	4901819
UT14	459529	4905331
UT15	459925	4905210
UT16	460286	4905160
UT17	460645	4905101
UT18	461191	4904580
UT19	461599	4904499
UT20	462124	4904341
UT21	462455	4904033
UT22	464431	4902751
UT23	464877	4902801
UT24	458418	4906725
UT25	458673	4906733
UT26	458891	4906742
UT27	459204	4906576
UT28	459501	4906225
UT29	459854	4906086
UT30	460299	4906007
UT31	463040	4904495
UT32	463565	4904337
UT33	463806	4903813
UT34	464200	4903732
UT35	464573	4903717
UT36	465385	4903222
UT37	465435	4902784
UT38	465846	4902866
UT39	466181	4902817
UT40	457765	4908508
UT41	457947	4908502
UT42	458009	4908939
UT43	458197	4908926
UT44	460128	4907643
UT45	460305	4907113
UT46	460694	4907097
UT47	461070	4907088
UT48	462814	4905786

Turbine ID	Easting [m]	Northing [m]
UT49	463333	4905665
UT50	466521	4903853
UT51	467827	4903113
UT52	468286	4902796
UT53	468646	4902683
UT54	469131	4902635
UT55	462348	4907051
UT56	462683	4906719
UT57	463029	4906738
UT58	463343	4906746
UT59	464267	4905783
UT60	464884	4905527
UT61	465505	4905846
UT62	465676	4904995
UT63	466200	4904994
UT64	466700	4904962
UT65	468391	4904098
UT66	468917	4904047
UT67	469130	4903497
UT68	460904	4909077
UT69	461748	4908855
UT70	462273	4908901
UT71	462569	4908490
UT72	464836	4906860
UT73	465508	4906896
UT74	466010	4906845
UT75	466715	4905922
UT76	467412	4905639
UT77	467754	4905598
UT78	468277	4905370
UT79	468627	4905157
UT80	461802	4909491
UT81	461994	4910272
UT82	466610	4906700
UT83	460846	4911350
UT84	460978	4911650
UT85	461187	4912004
UT86	463254	4910542
UT87	463865	4909921
UT88	464309	4909838
UT89	464717	4909869
UT90	465473	4909416
UT91	465641	4908874
UT92	466892	4908611
UT93	467377	4907982
UT94	467796	4907982
UT95	468216	4907931
UT96	461390	4912392

Turbine ID	Easting [m]	Northing [m]
UT97	461559	4912396
UT98	462670	4911340
UT99	463020	4911659
UT100	464761	4911029
UT101	466846	4909469
UT102	462331	4913234
UT103	462515	4913510
UT104	462593	4913005
UT105	462791	4913355

Turbine ID	Easting [m]	Northing [m]
UT106	466170	4911381
UT107	466484	4911234
UT108	466000	4910897
UT109	466923	4911335
UT110	467337	4911062
Transformer 1	462974	4906166
Transformer 2	463000	4906151

Coordinates of the installed Cruickshank Wind Farm turbines are listed below in UTM17-NAD83 projection:

ID	Easting [m]	Northing [m]
C1	454779	4899525
C2	454362	4899575
C3	454102	4899089
C4	454385	4899246
C5	455094	4899388

Coordinates of the installed Ripley Wind Farm transformers are listed below in UTM17-NAD83 projection:

ID	Easting [m]	Northing [m]
RN1	461713	4902344
RN2	461734	4902333

APPENDIX G SIEMENS GUARANTEE LETTER

SIEMENS

August 12, 2013

To Whom It May Concern

Re. Armow Wind Projects

Dear Sir/Madam,

In respect to the Armow Wind Project, Siemens will provide the following wind turbine generators: (i) SWT 2.3-101 Rev. 4 Max. Power 2300 kW, (ii) SWT 2.3-101 Rev. 4 Max. Power 2221 kW, (iii) SWT 2.3-101 Rev. 4 Max. Power 2126 kW, (iv) SWT 2.3-101 Rev. 4 Max. Power 2030 kW, (v) SWT 2.3-101 Rev. 4 Max. Power 1903 kW and (vi) SWT 2.3-101 Rev. 4 Max. Power 1824 kW. Siemens guarantees the values shown in the table below are the maximum power levels and maximum broadband sound power levels respectively.

Official Nameplate	Maximum Rated Power	Maximum Broadband Sound Power Level	Hub Height
SWT-2.3-101, Rev. 4, Max. Power 2300 kW	2.300 MW	106 dBA	99.5m
SWT-2.3-101, Rev. 4, Max. Power 2221 kW	2.221 MW	105 dBA	99.5m
SWT-2.3-101, Rev. 4, Max. Power 2126 kW	2.126 MW	104 dBA	99.5m
SWT-2.3-101, Rev. 4, Max. Power 2030 kW	2.030 MW	103 dBA	99.5m
SWT-2.3-101, Rev. 4, Max. Power 1903 kW	1.903 MW	102 dBA	99.5m
SWT-2.3-101, Rev. 4, Max. Power 1824 kW	1.824 MW	101 dBA	99.5m
SWT-2.3-101, Rev. 4, Max. Power 2126 kW	2.126 MW	104 dBA	80.0m
SWT-2.3-101, Rev. 4, Max. Power 2030 kW	2.030 MW	103 dBA	80.0m

Siemens confirms the attached acoustic emissions data sheets correspond to each of the nameplate wind turbines listed above. The warranted sound power level is presented with reference to the code IEC 61400-11:2002 with amendment 1 dated 2006-05 based on a hub height of 99.5m or 80.0m.

Siemens can also confirm that the sound from the Siemens turbines to be supplied for the Armow Wind Project are not tonal since all of these turbines produce no tonal audibility above 3 dB as stated in our acoustic emission documents and calculated using the criteria specified in accordance with IEC 61400-11:2002. No uncertainty needs to be included or implied to the calculated tonal audibility per IEC 61400-11:2002.

Regards,

John D. Amos
Head of Engineering
Siemens Energy, Inc.
Wind Power Americas
Enclosures (8)

Siemens Energy, Inc.

4400 Alafaya Trail
Orlando, FL 32826

APPENDIX H SIEMENS NOISE MEASUREMENT REPORT

Noise Measurement

SWP Report
N-2304 099-T1

Ejler Kristensen
25.05.2011

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Appendix 2 Acoustic overall analyzer measurements 10 s average **16**

Rev. no.	Rev. date	Changes	Resp.
1	25.5.2011	First version	Ejler Kristensen
1A	25.06.2012	Version without site name	Ejler Kristensen/AJJ

1 Measurement

The measurement was performed at turbine xx at xxxxxx Wind farm in Ontario on 16th April 2011 from 14:43 to 18:07 by Ejler Kristensen, Siemens Wind Power. The measurement computer time was synchronized with the turbine computer time.

The turbine type is SWT-2.3-101 with turbine ID no. 230x-xxxx.

The hub height wind speed range from 4.6 m/s - 14.0 m/s measured as 10 sec average with the nacelle anemometer, and the power output from 430 kW - 2300 kW.

10 sec average non acoustic measurements are shown in appendix 1.

The measurement fulfils IEC61400-11:2002 with following exceptions:

- The nacelle anemometer is used for background noise wind speed measurements.

2 Conclusion

A noise measurement has been performed at turbine xx at xxxxxx Wind Farm.

2.1 Results

The results are shown in table 2.1 below:

Wind speed BIN [m/s] - 10 m	5	6	7	8	9	10
LWA [dB re. 1 pW]	101.7	104.4	104.9	105.1	105.6	105.1
Tone average frequency, f [Hz]	-	117.5	118.8	517.3	517.8	519.3
Max. tonality, ΔL_k [dB]	-	- 6.7	-5.2	-2.9	-1.5	-0.2
Max. tonal audibility, $\Delta L_{a,k}$ [dB]	-	-4.7	-3.2	-0.6	0.8	2.1

Table 2.1: Results of the measurements

Sound power levels, LWA_i of the turbine are below guaranteed values.

The level of tonality in the reference position (near field) is acceptable. The maximum tonality measured in the reference position is -0.2 dB at 519.3 Hz, which corresponds to an audibility of 2.1 dB.

3 Analysis of Sound Power Level

3.1 Sound Power Level

The sound power level, $L_{WA,}$ is calculated according to IEC61400-11:2002.

Figure 3.1 shows measured sound pressure levels. Table 3.1 shows the resulting sound power level without extrapolation of the regression results.

Microphone: Signal 1_130 m ref: [Pa]

Date:	16-04-2011
Engineer:	EJK
Location:	XXXXX in Ontario
Turbine-ID:	T1
Hub Height:	80m
Distance:	130m
Roughness:	0,05m
K-Faktor:	0.7418
V_P/V_Anemo:	1.041

Calibrator with serial type 4231 serial no. 2326419 has been measured to 93,89 dB at Brüel & Kjær – Nærum DK with reference to calibration letter of 25. maj 2011.

The calibrating signal was measured to 93,8 dB at the beginning of the measurement. See appendix 2

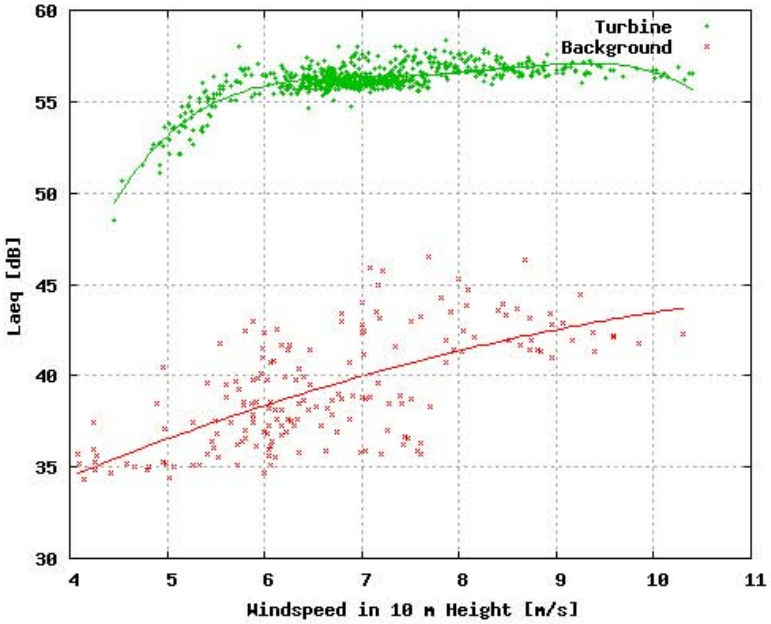


Figure 3.1: Measured background noise and total noise

Windspeed [m/s] 10 m	5	6	7	8	9	10
Averaged 2 PitchBladeB: [deg]	-1,67	-2,52	-1,57	0,9	3,86	7,27
Averaged 5 MainSRpm: [RPM]	13,14	14,44	14,55	15,23	15,55	15,62
Averaged 6 ActPower: [kW]	824,93	1397,41	1885	2259,79	2296,43	2295,79
Averaged 7 AcWindSp: [m/s]	7,1	8,12	9,5	10,73	11,99	13,43
Averaged 8 GenRpm: [RPM]	1190,69	1308,2	1318,88	1379,96	1409,2	1415,96
Laeq total [dB(A) re 20 µPa]	53,1	55,85	56,33	56,58	57,04	56,63
Laeq BG [dB(A) re 20 µPa]	36,52	38,35	39,96	41,35	42,51	43,45
Laeq BG corr. [dB(A) re 20 µPa]	53,01	55,78	56,23	56,44	56,89	56,41
LWA [dB(A) re pW]	101,67	104,44	104,90	105,11	105,55	105,08

*) difference between LAeg total and LAeq BG is between 3 and 6 dB(A)

Table 3.1: Turbine noise

General Calculation Settings and Information

All wind speeds are measured in hub height and are recalculated to 10 m height.

Background Definition
Power [kW]: <20
RPM [1/min]: <20

Total Noise Definition
Power [kW]: >20
RPM [1/min]: >500

Windspeed in 10m Height
Offset: +1.5 m/s

Used Powercurve:
C:\VBA-Pulse\Powercurves\SWT-2 3-101.txt

Status Setting
Status1: Status1 used Powercurve for Calculation

Values which are not used for the calculation

Range Values:

Time		z-Index
	22	
	50	calibrator
	63	
	200	mic moved
	750	
	804	mic moved
	319	
	325	xxxxx at mic.
	384	
	408	mic moved

4 Analyses of Tonality

4.1 Info

Txxx, ID no. 23xx-xxxx.

4.1.1 Tonal analysis method

The tonal analysis presented in this report is performed according to the L70 method as described in IEC 61400-11:2002.

Due to air absorption, different level of masking noise etc. tonal analysis in the reference position is not comparable with tonality analysis in the far field.

Wind speeds in the tonal analysis are given at 10 m height.

4.2 Tonal analysis at 6 m/s

The 2 periods of 1 minute with averaged wind speeds closest to 6 m/s are used for this tonal analysis.

The twelve 10 sec. FFT spectra are shown in Figure 4.1 below.

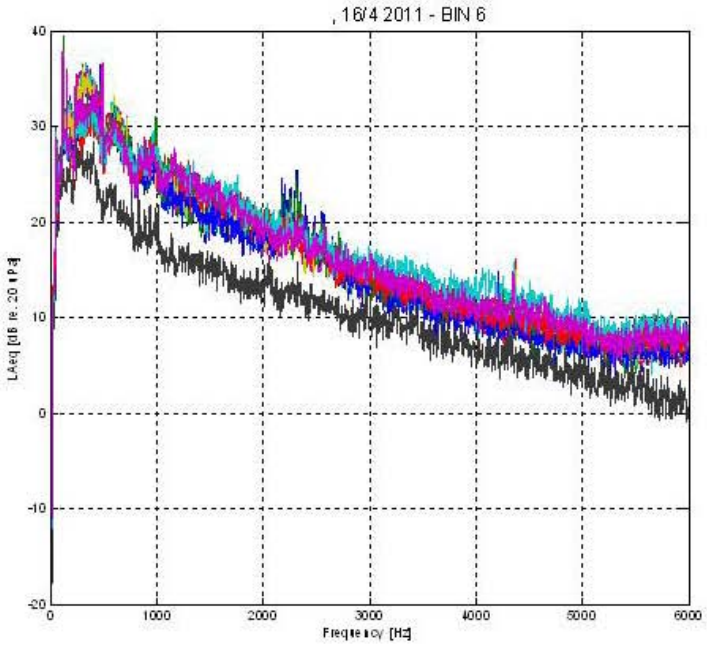


Figure 4.1: The twelve 10 sec FFT spectra used for tonal analysis.

Results are shown below as well as examples of tonality analysis at each frequency.

4.2.1 Tonality analysis at 117.5 Hz

6 m/s	Ztdx	fc [Hz]	CB [Hz]	CBmin [Hz]	CBmax [Hz]	L70%	Lpt,aug [dB]	Lpt [dB]	Lpt [dB]	dLta [dB]	dLak [dB]
1	248		101,0	68,0	168,0					-15,3	
2	249		101,0	68,0	168,0					-15,3	
3	250		101,0	68,0	168,0					-15,3	
4	251		101,0	68,0	168,0					-15,3	
5	252		101,0	68,0	168,0					-15,3	
6	253		101,0	68,0	168,0					-15,3	
7	347		101,0	68,0	168,0					-15,3	
8	348		101,0	68,0	168,0					-15,3	
9	349	118	101,0	68,0	168,0	27,1	28,4	43,6	41,5	-2,2	-0,2
10	350	118	101,0	68,0	168,0	26,3	27,5	42,7	40,4	-2,3	-0,3
11	351	118	101,0	68,0	168,0	26,4	27,7	43,0	40,5	-2,5	-0,5
12	352	116	101,0	66,0	166,0	26,4	27,7	43,0	40,5	-2,5	-0,5

Average frequency	117,5	Hz
Average dLta	-6,7	dB
dLak	-4,7	dB

4.3 Tonal analysis at 7 m/s

The 2 periods of 1 minute with averaged wind speeds closest to 7 m/s are used for this tonal analysis.

The twelve 10 sec. FFT spectra are shown in Figure 4.2 below.

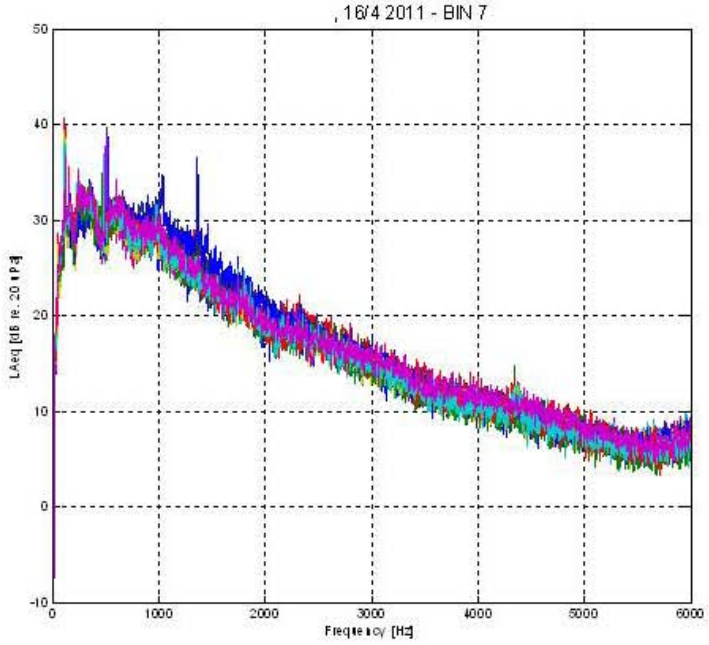


Figure 4.2: The twelve 10 sec FFT spectra used for tonal analysis.

Results are shown below as well as examples of tonality analysis at each frequency.

4.3.1 Tonality analysis at 118.8 Hz

7 m/s	Zidx	fc [Hz]	CB [Hz]	CBmin [Hz]	CBmax [Hz]	L70%	Lpn,avg [dB]	Lpn [dB]	Lpt [dB]	dLtn [dB]	dLak [dB]
1	605	118	101,0	68,0	168,0	26,9	28,1	43,4	39,6	-3,7	-1,7
2	606	116	101,0	66,0	166,0	27,9	29,3	44,5	41,1	-3,4	-1,4
3	607	116	101,0	66,0	166,0	29,5	30,4	45,7	41,2	-4,5	-2,4
4	608	118	101,0	68,0	168,0	27,4	28,6	43,9	37,9	-6,0	-4,0
5	609	118	101,0	68,0	168,0	28,1	29,2	44,5	38,8	-5,7	-3,7
6	610	116	101,0	66,0	166,0	26,5	27,5	42,7	42,0	-0,7	1,3
7	995	124	101,1	74,0	174,0	28,4	29,6	44,9	35,9	-8,9	-6,9
8	996	126	101,1	76,0	176,0	28,6	29,6	44,8	36,1	-8,7	-6,7
9	997	120	101,0	70,0	170,0	28,1	29,3	44,6	36,7	-7,9	-5,9
10	998	118	101,0	68,0	168,0	28,6	30,0	45,3	38,6	-6,7	-4,6
11	999	116	101,0	66,0	166,0	28,3	29,5	44,8	39,3	-5,5	-3,5
12	1000	120	101,0	70,0	170,0	29,2	30,7	46,0	36,9	-9,1	-7,1

Average frequency	118,8	Hz
Average dLtn	-5,2	dB
dLak	-3,2	dB

4.3.2 Tonality analysis at 495.3 Hz

7 m/s	Zidx	fc [Hz]	CB [Hz]	CBmin [Hz]	CBmax [Hz]	L70%	Lpn,avg [dB]	Lpn [dB]	Lpt [dB]	dLtn [dB]	dLak [dB]
1	605		116,9	436,0	552,0					-15,9	
2	606		116,9	436,0	552,0					-15,9	
3	607		116,9	436,0	552,0					-15,9	
4	608		116,9	436,0	552,0					-15,9	
5	609		116,9	436,0	552,0					-15,9	
6	610		116,9	436,0	552,0					-15,9	
7	995	508	117,8	450,0	566,0	29,1	29,8	45,8	44,6	-1,2	1,1
8	996	516	118,3	458,0	574,0	28,9	29,8	45,7	42,2	-3,5	-1,2
9	997	484	116,2	426,0	542,0	28,3	29,3	45,2	36,3	-8,9	-6,7
10	998	490	116,6	432,0	548,0	28,9	29,9	45,8	37,9	-8,0	-5,7
11	999	480	116,0	424,0	536,0	28,3	29,2	45,0	40,7	-4,4	-2,1
12	1000	494	116,9	436,0	552,0	29,0	30,1	46,0	42,6	-3,4	-1,1

Average frequency	495,3	Hz
Average dLtn	-6,9	dB
dLak	-4,6	dB

4.4 Tonal analysis at 8 m/s

The 2 periods of 1 minute with averaged wind speeds closest to 8 m/s are used for this tonal analysis.

The twelve 10 sec. FFT spectra are shown in Figure 4.3 below.

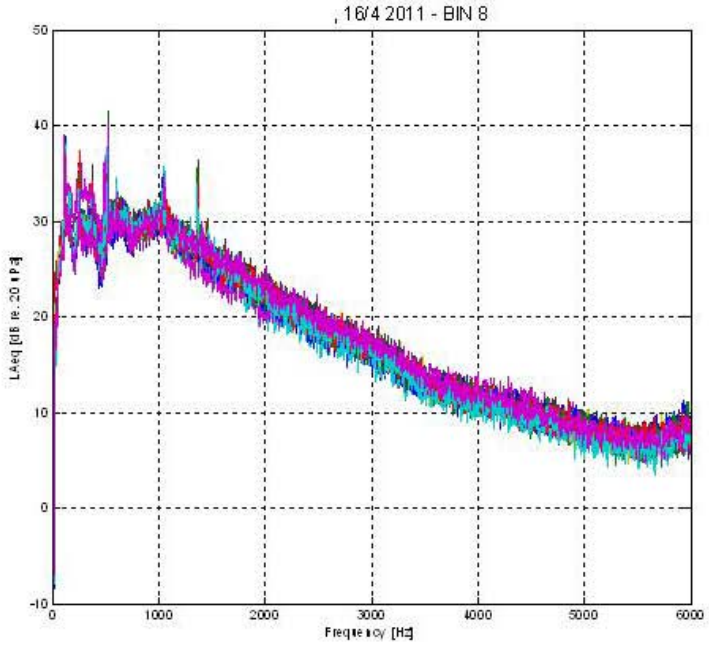


Figure 4.3: The twelve 10 sec FFT spectra used for tonal analysis.

Results are shown below as well as examples of tonality analysis at each frequency.

4.4.1 Tonality analysis at 517.3 Hz

8 m/s	ZBx	fc [Hz]	CB [Hz]	CBmin [Hz]	CBmax [Hz]	LTQ%	Lpt,aug [dB]	Lpt [dB]	Lpt [dB]	dLtn [dB]	dLak [dB]
1	1007	516	118,3	458,0	574,0	26,6	27,8	43,8	41,5	-2,2	0,1
2	1008	514	118,2	456,0	572,0	28,3	29,3	45,2	39,9	-5,3	-3,0
3	1009	522	118,7	464,0	580,0	28,6	29,5	45,4	40,4	-5,0	-2,7
4	1010	504	117,5	446,0	562,0	29,1	30,6	46,6	38,8	-7,7	-6,4
5	1011		118,5	460,0	576,0					-16,0	
6	1012	518	118,5	460,0	576,0	27,6	28,9	44,9	36,5	-9,4	-7,1
7	1115	520	118,6	462,0	578,0	28,4	29,5	45,4	43,3	-2,1	0,2
8	1116	518	118,5	460,0	576,0	28,0	28,9	44,8	41,3	-3,5	-1,2
9	1117	516	118,3	458,0	574,0	27,5	28,3	44,3	44,9	0,6	2,9
10	1118	522	118,7	464,0	580,0	27,8	28,9	44,9	43,0	-1,9	0,5
11	1119	516	118,3	458,0	574,0	28,2	28,9	44,8	44,9	0,1	2,4
12	1120	524	118,9	466,0	582,0	27,4	28,5	44,4	43,1	-1,4	1,0

Average frequency	517,3	Hz
Average dLtn	-2,9	dB
dLak	-0,6	dB

4.5 Tonal analysis at 9 m/s

The 2 periods of 1 minute with averaged wind speeds closest to 9 m/s are used for this tonal analysis.

The twelve 10 sec. FFT spectra are shown in Figure 4.4 below.

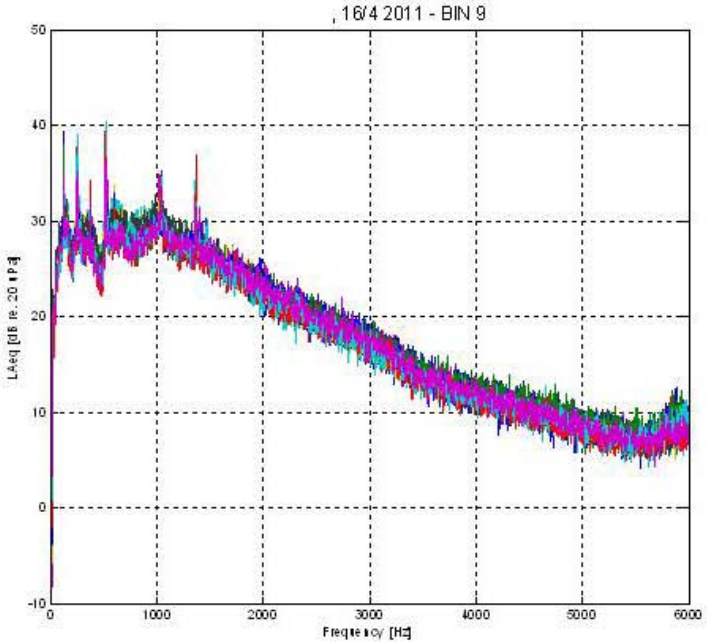


Figure 4.4: The twelve 10 sec FFT spectra used for tonal analysis.

Results are shown below as well as examples of tonality analysis at each frequency.

4.5.1 Tonality analysis at 517.8 Hz

9 m/s	Zidx	fc [Hz]	Cfi [Hz]	Cfmin [Hz]	Cfmax [Hz]	L70%	Lpi,avg [dB]	Lpi [dB]	Lpt [dB]	dLta [dB]	dLak [dB]
1	1037	518	118,5	460,0	576,0	26,8	27,9	43,9	42,2	-1,7	0,6
2	1038	522	118,7	464,0	580,0	27,4	28,3	44,3	41,5	-2,9	-0,5
3	1039	510	117,9	452,0	568,0	25,8	26,6	42,5	40,5	-2,1	0,2
4	1040	518	118,5	460,0	576,0	28,4	29,4	45,4	41,0	-4,4	-2,1
5	1041	512	118,1	454,0	570,0	26,6	27,2	43,2	43,7	0,5	2,8
6	1042	512	118,1	454,0	570,0	27,6	28,4	44,4	43,3	-1,1	1,2
7	1051	524	118,9	466,0	582,0	28,2	29,3	45,2	41,1	-4,1	-1,8
8	1052	528	119,1	470,0	586,0	26,7	27,9	43,9	39,3	-4,6	-2,3
9	1053	520	118,6	462,0	578,0	28,3	27,3	43,3	41,3	-1,9	0,4
10	1054	514	118,2	456,0	572,0	25,3	26,6	42,5	43,2	0,7	3,0
11	1055	522	118,7	464,0	580,0	26,5	27,5	43,5	42,8	-0,6	1,7
12	1056	514	118,2	456,0	572,0	25,9	26,6	42,5	42,8	0,2	2,5

Average frequency	517,8	Hz
Average dLta	-1,5	dB
dLak	0,8	dB

4.6 Tonal analysis at 10 m/s

The 2 periods of 1 minute with averaged wind speeds closest to 10 m/s are used for this tonal analysis.

The twelve 10 sec. FFT spectra are shown in Figure 4.5 below.

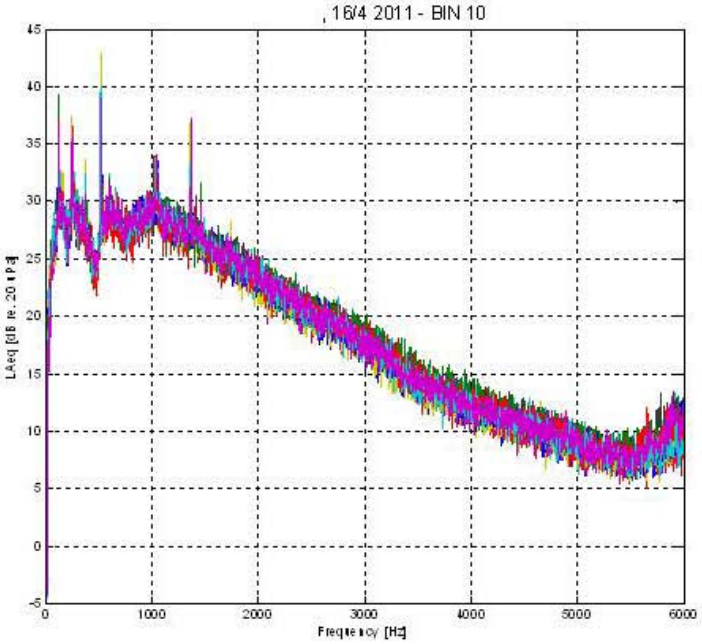


Figure 4.5: The twelve 10 sec FFT spectra used for tonal analysis.

Results are shown below as well as examples of tonality analysis at each frequency.

4.6.1 Tonality analysis at 519.3 Hz

10 m/s	Ztdx	fc [Hz]	C8 [Hz]	C8min [Hz]	C8max [Hz]	L70%	Lpt,avg [dB]	Lpt [dB]	Lpt [dB]	dLta [dB]	dLak [dB]
1	1031	528	119,1	470,0	586,0	26,8	27,7	43,7	44,3	0,7	3,0
2	1032	518	118,5	460,0	576,0	26,3	27,3	43,3	41,0	-2,3	0,0
3	1033	520	118,6	462,0	578,0	26,3	27,2	43,1	46,1	3,0	5,3
4	1034	518	118,5	460,0	576,0	26,4	27,3	43,3	42,6	-0,6	1,7
5	1035	516	118,3	458,0	574,0	26,5	27,4	43,4	43,7	0,4	2,7
6	1036	516	118,3	458,0	574,0	26,6	27,5	43,4	45,4	1,9	4,2
7	1091	520	118,6	462,0	578,0	26,2	27,3	43,3	41,9	-1,4	1,0
8	1092	520	118,6	462,0	578,0	26,2	26,9	42,9	41,8	-1,1	1,2
9	1093	524	118,9	466,0	582,0	26,3	27,7	43,7	37,3	-6,3	-4,0
10	1094	514	118,2	456,0	572,0	25,5	26,5	42,5	41,2	-1,3	1,0
11	1095	514	118,2	456,0	572,0	26,1	27,1	43,0	42,5	-0,5	1,8
12	1096	524	118,9	466,0	582,0	26,6	27,5	43,5	42,7	-0,8	1,5

Average frequency	519,3	Hz
Average dLta	-0,2	dB
dLak	2,1	dB

Appendix 1 Non acoustic measurements 10 s average

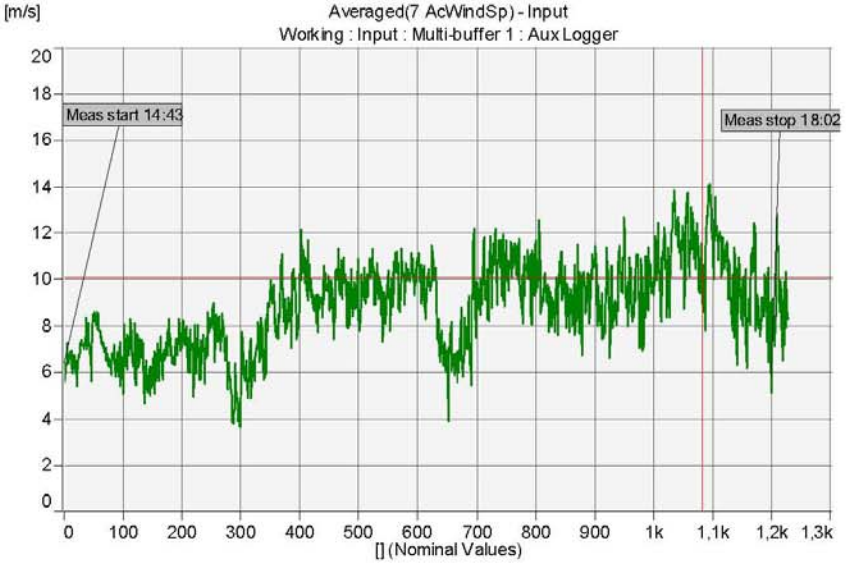


Figure A1.1: Dark green line: Measured 10 s avg. wind speed from the nacelle anemometer.

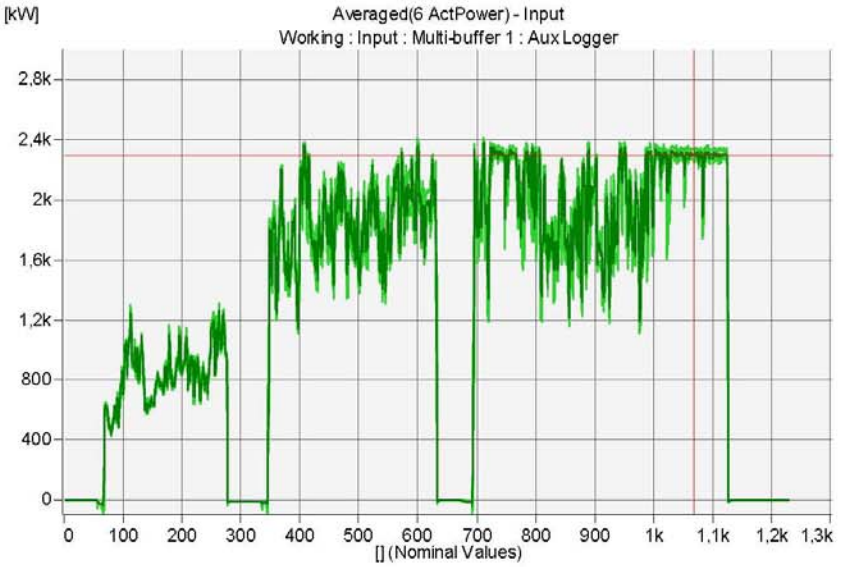


Figure A1.2: Dark green line: Measured 10 s avg. produced power. Light green line shows max instantaneous measurements within the averaging period.

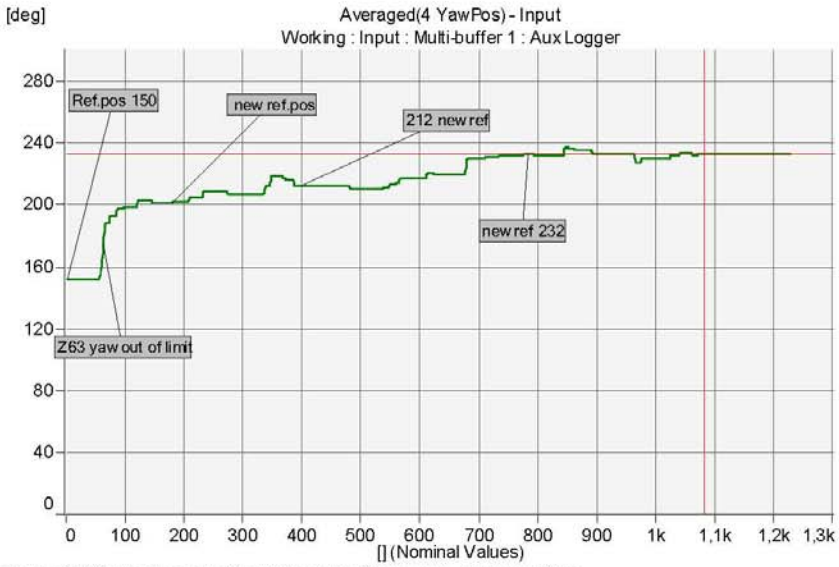


Figure A1.3: Dark green line: Measured 10 s avg. yaw position.

Appendix 2 Acoustic overall analyzer measurements 10 s average

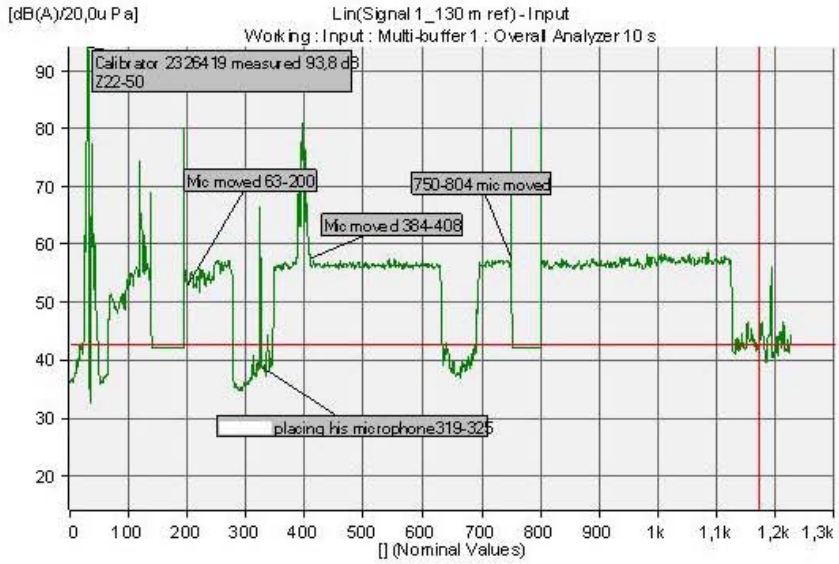


Figure A2.1: Dark green line: Measured 10 s avg. overall analyzer values.

APPENDIX I V82/NM82 NOISE SPECIFICATIONS SUMMARY

TABLE 2

WIND TURBINE SOUND POWER LEVELS

Vesta V82 – 1.65 mW

Wind Speed (m/sec)	Sound Power Level (dBA)(1)								L_{WA} (dBA)
	Octave Band Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	
4	83.4	89.2	93	93.7	95.5	96.1	91.2	81.2	101.6
5	79.8	86.4	93.9	98	94.5	92.2	91.1	74.3	101.8
6	81.8	89.8	95.9	96	96	93.9	92.7	78.9	102.4
7	85.2	92.4	97.8	97.7	97.5	95.2	93.1	81.4	104
8	88.5	95.5	100.1	100.2	101.1	98.1	96.2	86.7	106.9
9	90.8	97.6	101.4	101.7	103.7	100	98.3	91	108.9
10	88.1	97.4	104.2	105.5	103.6	97.7	88.2	76.9	109.9
11	91.1	96.3	102	103.7	103.3	98.2	90.8	80.2	108.7
12	93.8	94.9	99.5	101.6	102.7	98.4	93.1	83.2	107.5

Note:

(1) Acoustic data provided by manufacturer, indicated to be obtained according to IEC 61400-11. Wind speeds apply at 10 m above the ground.

Noise measurement summary, NM82/1650

1. Identification of Measuring institute

Windtest Grevenbroich GmbH
Frimmersdorfer str. 73
D 41517 Grevenbroich, Germany

Windtest Grevenbroich is accredited by DAR (DPT-DL-3175.00) to perform noise measurements on wind turbines.

2. Report identification

Acoustic report for a wind energy converter type
NEG Micon NM 82/1650, hub height 93,6m
Report SE03007B1

Authorised signatory: Dr. Markus Koschinsky

3. Measurement date:

May 12. 2003, Grevenbroich test site

4. Description of wind turbine and surroundings

Wind turbine: NM82/1650
Rotor blades: AL 40
Main Gear: Flender PEAS 4390
Generator: ELIN MCS556M31Z7B
Terrain: Flat
Surface: Grass, low vegetation, a few tree lines
Measurement conditions: Optimal

5. Standard of measurement

IEC 61400-11: 1998 " Wind turbine generator systems – Part 11: Acoustic noise measurement techniques"

	Name:	Date:	Signature:
Written by:	ESL	19-01-2004	
Approved by:			
Filename:	Noise measurement summary NM82-1650.doc rev 1		
NEG MICON			

6. Measurement results

6.1 Apparent sound power level and uncertainty:

	6 m/s	7 m/s	8 m/s	95% RP (8,6 m/s)
L_{wA} [dB re 1 pW]	100,3	100,7	101,7	101,8
uncertainty	0,9	0,9	>0,9	>0,9

6.2 Frequency analysis at 8 m/s

A-weighted 1/1 octave analysis of the sound power level at 8 m/s

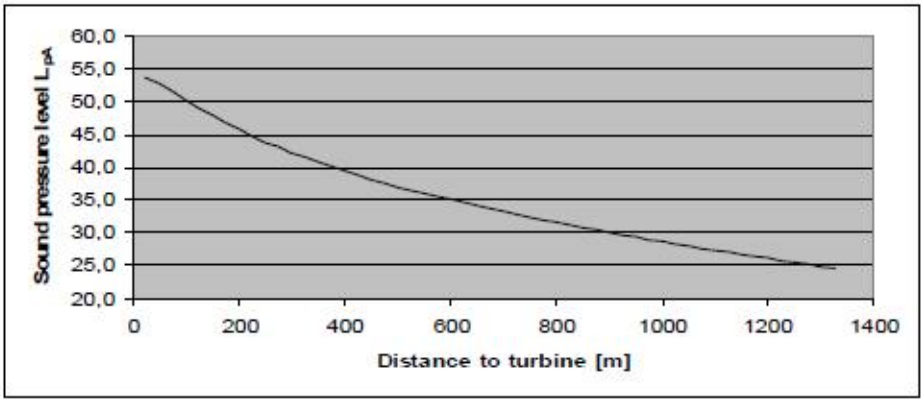
Octave band	63 Hz	125 Hz	250 Hz	500 z	1 kHz	2 kHz	4 kHz	8 kHz
L_{wA} [dB]	83,3	90,3	94,9	95,0	95,9	92,9	91	81,5

6.3 Tonality

The noise from the turbine did not contain any tonal peaks with a calculated ΔL_m above the IEC 61400-11:1998 expression (9). According to IEC 61400-11:1998 no audible tones is present in the noise.

7 Sound pressure level at distances from turbine

The graph below shows the sound pressure level L_{pA} 1.5 m above the ground at a wind speed 10 m above ground of 8 m/s as function of the distance from the turbine. It is calculated for 78 m hub height, and includes air absorption (0.005 dB(m)). At 218 meters distance from the turbine the sound pressure level is 45 dB(A), and at 376 meters distance form the turbine, the sound pressure level is 40 dB(A).



	Name:	Date:	Signature:
Written by:	ESL	19-01-2004	
Approved by:			
Filename:	Noise measurement summary NM82-1650.doc rev 1		
NEG MICON	Property of NEG Micon A/S. This document must not be passed on to any person, nor be copied or made use of without approval from NEG Micon A/S.		

APPENDIX J ARMOW SUBSTATION EXAMPLE TRANSFORMER

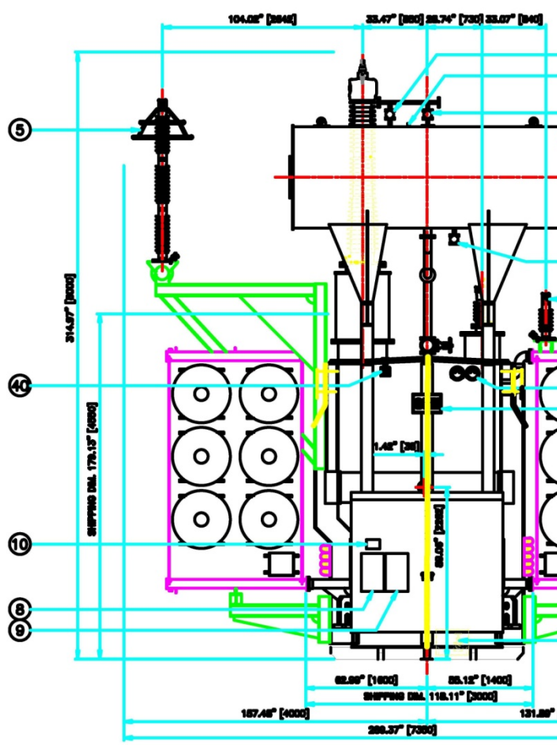
'ON '0MC)

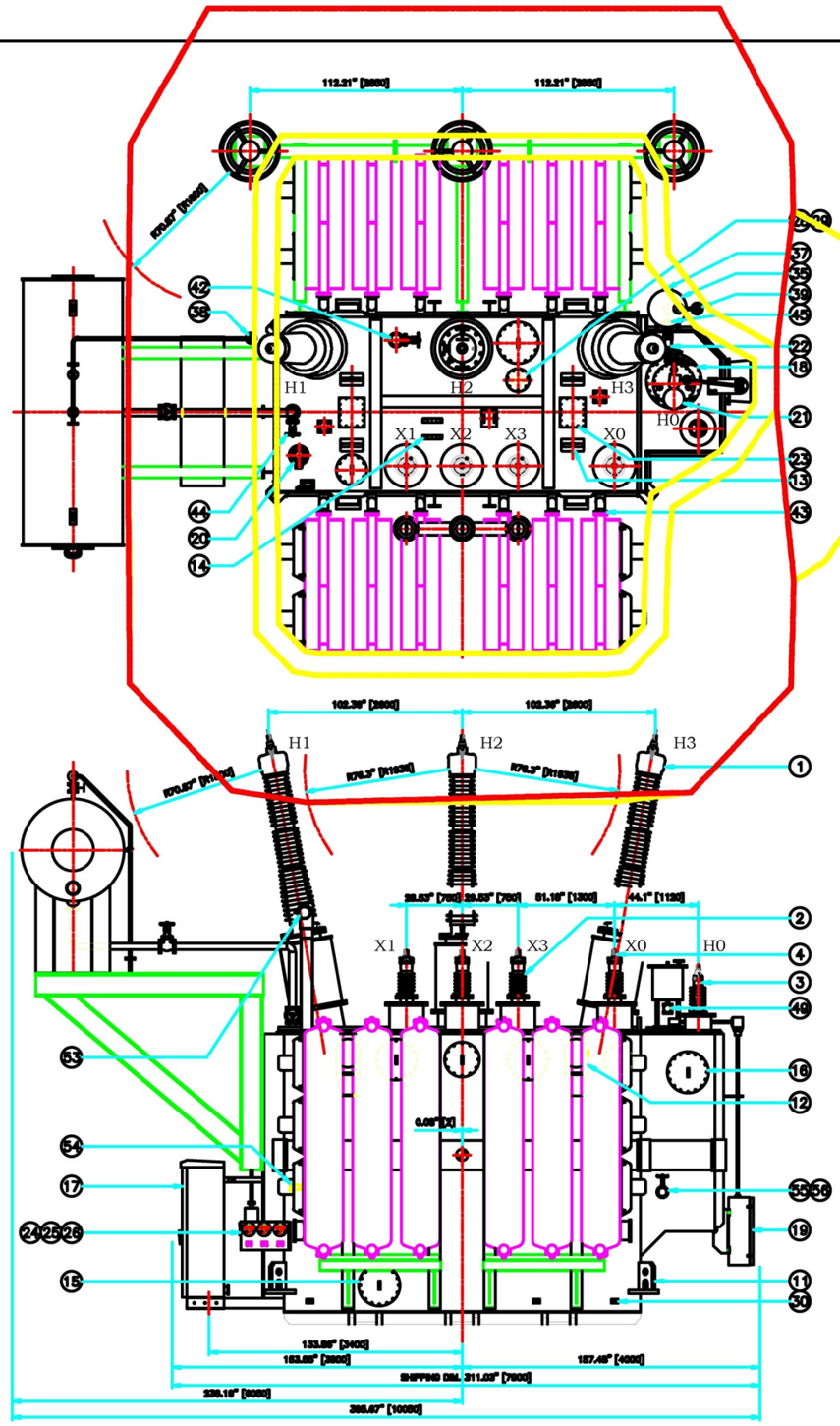
WEIGHT

CORE AND COIL	:	153,880 lbs (69,800 kg)
TANK AND FITTING	:	86,640 lbs (39,300 kg)
INSULATING OIL	:	72,972 lbs (33,100 kg)
SHIPPING (WITHOUT OIL)	:	189,154 lbs (85,800 kg)
TOTAL	:	313,493 lbs (142,200 kg)

NOTE

1. DIMENSION TOLERANCE : ± 5%
2. ALL DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. ⊕ MARK : COMPLETE CENTER OF GRAVITY (WITH OIL)





PART LIST

ITEM	DESCRIPTION
1	H.V BUSHING
2	X.V BUSHING
3	H.V NEUTRAL BUSHING
4	X.V NEUTRAL BUSHING
5	H.V ARRESTER
6	X.V ARRESTER
7	HICO MARK
8	NAMEPLATE
9	VALVE LOCATION NAMEPLATE
10	OIL LEVEL TEMPERATURE CURVE PLATE
11	TRANSFORMER JACKS STEPS WITH PULLING EYE
12	LIFTING HOOK FOR MAIN TANK
13	LIFTING STUD FOR CORE & COIL ASS'Y
14	SUPPORT FOR MULTI-AXIS IMPACT RECORDER
15	MANHOLE
16	HANDHOLE
17	LOCAL CONTROL PANEL
18	ON LOAD TAP CHANGER
19	MOTOR DRIVE UNIT FOR OLTC
20	PRESSURE RELIEF DEVICE FOR MAIN TANK
21	PRESSURE RELIEF DEVICE FOR OLTC TANK
22	PROTECTIVE RELAY FOR OLTC
23	END FRAME SUPPORTER
24	WINDING TEMPERATURE INDICATOR FOR H.V
25	WINDING TEMPERATURE INDICATOR FOR X.V
26	OIL TEMPERATURE INDICATOR
27	THERMO POCKET FOR TOP OIL & WINDING TEMPERATURE
28	GROUNDING BUSHING FOR CORE
29	GROUNDING BUSHING FOR END FRAME
30	GROUNDING TERMINAL
31	COOLING RADIATORS
32	FAN WITH MOTOR
33	JUNCTION BOX FOR COOLING FANS
34	CONSERVATOR FOR MAIN TANK
35	CONSERVATOR FOR OLTC TANK
36	OIL LEVEL GAUGE FOR MAIN CONSERVATOR
37	OIL LEVEL GAUGE FOR OLTC CONSERVATOR
38	BREATHER FOR MAIN CONSERVATOR
39	BREATHER FOR OLTC CONSERVATOR
40	UPPER FILTER VALVE
41	LOWER FILTER & DRAIN VALVE WITH SAMPLING DEVICE
42	VACUUM VALVE FOR MAIN TANK
43	INLET AND OUTLET VALVE FOR RADIATOR
44	CONNECTING VALVE FOR MAIN CONSERVATOR
45	CONNECTING VALVE FOR OLTC CONSERVATOR
46	VACUUM VALVE FOR CONSERVATOR
47	EQUALIZING VALVE FOR CONSERVATOR
48	DRAIN VALVE FOR MAIN CONSERVATOR
49	DRAIN VALVE FOR OLTC CONSERVATOR
50	AIR VENT FOR CONSERVATOR
51	AIR RELEASE PLUG FOR RADIATOR
52	DRAIN PLUG FOR RADIATOR
53	GAS ACCUMULATION INDICATOR
54	SAMPLING VALVE FOR GAS ACCUMULATION INDICATOR
55	CONNECTING VALVE FOR RAPID PRESSURE RISE RELAY
56	RAPID PRESSURE RISE RELAY

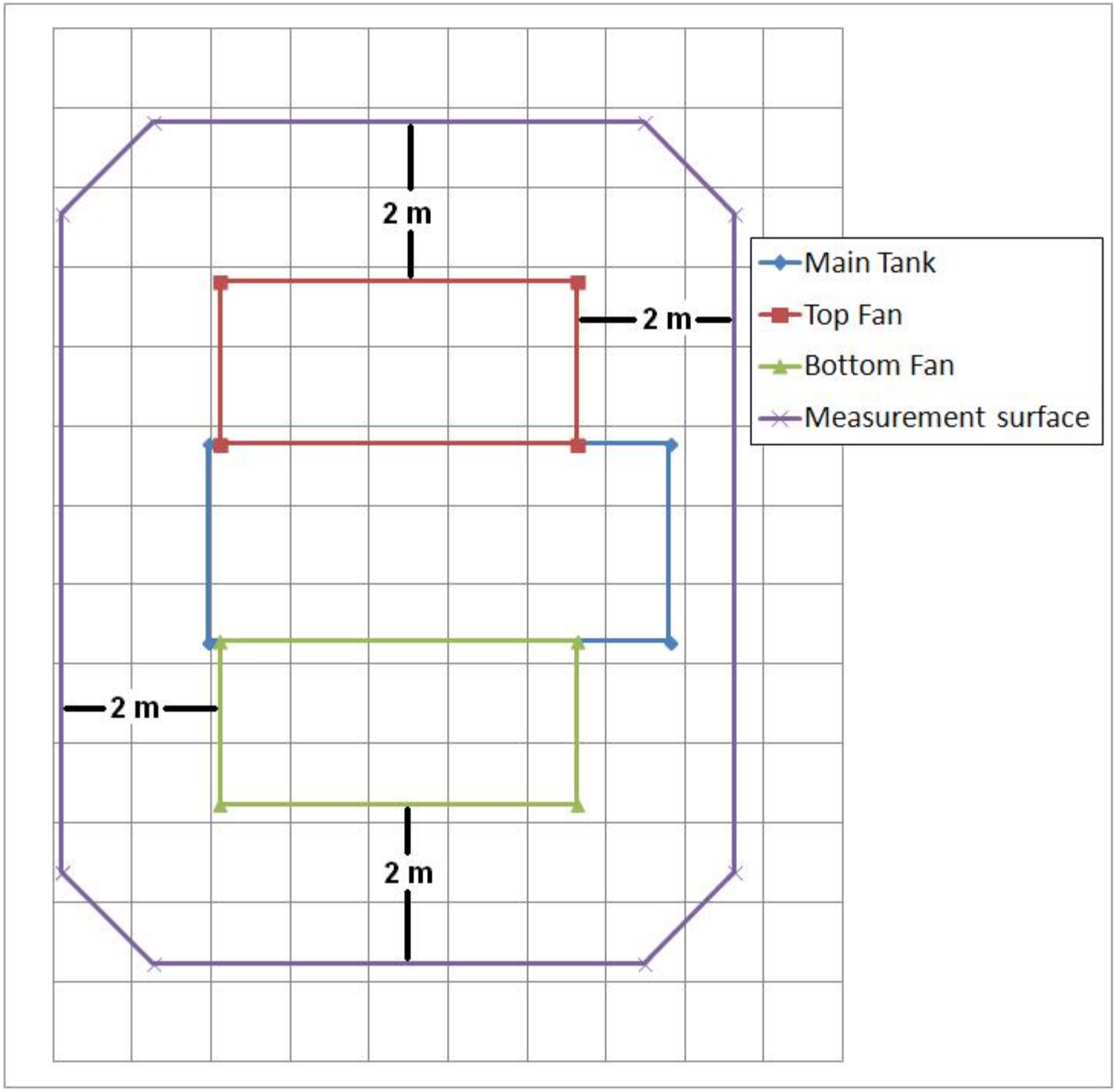
30 MVA: 7.5/13.2/13.8kV ONAN/ONAF/ONAF 22.5/34.5kV YYD 11/OLTC "Babcock & Brown/Hotchief Ridge"

TYPE	DWG. NAME
POWER TRANSFORMER	OUTLINE

DRAWN | CHECKED | CHECKED | CHECKED | APPROVED | SCALE 1/25 | DATE 2008.03.03

HICO HYOSUNG CORPORATION

CHANGE



Armow transformer – diagram of sound measurement surface area, as per IEEE C57.12.90

APPENDIX K RIPLEY SUBSTATION TRANSFORMER SPECIFICATIONS

PROLEC *ISO 9001 CERTIFIED*

Form 3.2.1-D Rev. 0

TECHNICAL PROPOSAL INFORMATION

Customer: ***K-LINE*** Date: **07/20/06**

Proposal No: **642-50706A** Spec No: **RIPLEY WIND FARM JUNE 2006** Item No: **2145862/E**

RATING									
Type	Transformer		Class	H Winding		X Winding		Y Winding	
Phase	3		-	240 Wye	kV	69 Delta	kV	-	kV
Hertz	60		ONAN	25,000	KVA	25,000	KVA	-	KVA
Temp Rise	65 °C		ONAF	33,250	KVA	33,250	KVA	-	KVA
Insul Liquid	NON PCB OIL TYPE I		ONAF	42,000	KVA	42,000	KVA	-	KVA
-	-		-	-	KVA	-	KVA	-	KVA

ADDITIONAL TAP VOLTAGES		
H Winding (Kv)	± 10 of 1 %	LTC - RCBN
X Winding (Kv)	-	-
	-	-

CONNECTIONS FOR OPERATION						
Transformers in Bank	To Transformer From	Phase	Connected	To Transformer To	Phase	Connected
-	-	-	-	-	-	-

PERFORMANCE BASED ON A LOADING OF				
H Winding	240	kV	25	MVA
X Winding	69	kV	25	MVA
Y Winding	-	-	-	-
-	-	-	-	-
-	-	-	-	-

DIELECTRIC TESTS			
Applied Voltage (To other winding and ground)	H Winding	395	kV
	X Winding	140	kV
	Y Winding	-	kV
Induced Voltage	One Hour	210	kV
	Enhancement	240	kV

INSULATION LEVELS		
ITEMS	Basic Lightning Impulse (kV)	
	Winding	Bushing
H Line	950	1050
H neutral	550	550
X line	350	350
X neutral	-	-
Y line	-	-

PERFORMANCE DATA, Based on **85** °C Reference Temperature, **25** MVA Altitude: **1000** Mts.

Losses and Exciting Current				Regulation	
Excitation	% Ex	No Load Kw (20°C)	Total Loss Kw	Power Factor	% Regulation
100%	0.628	24.5	91.5	0.80	5.206
110%	0.878	31.5 *	98.5 *	1.0	0.588
-	-	* Not Guaranteed		-	-

AUXILIARY (COOLING) LOSSES		
Transformer KVA	Class	KWatts Loss
25,000 -	ONAN	0
33,250 -	ONAF	1
42,000 -	ONAF	2
- -	-	-
- -	-	-
Average Sound Level	75/77/78	dB ONAN/ONAF/ONAF

PERCENT IMPEDANCE VOLTS					
% IZ	Between Windings	At kVA	% IZ Zero	Between Windings	At kVA
8	H-X	25,000	6.8*	H-X	25,000
-	-	-	-	-	-
-	-	-	-	-	-

* APPROXIMATE ONLY, NOT GUARANTEED

EFFICIENCIES (p.f = 1) AT 25 MVA				
Load	Full Load	3/4 Load	1/2 Load	1/4 Load
%	99.635	99.669	99.671	99.543

MECHANICAL DATA
Not for Construction Purposes

Outline Dwg No: BB20

Dimensions (Approximate)		Ft. (Mts.)
Height	(A)	23.5 (7.15)
Width	(B)	34.8 (10.60)
Depth	(C)	18.2 (5.55)
Height over Cover	(D)	13.1 (4.00)
Untanking (Plus slings)	(E)	23.0 (7.00)
Shipping Dimensions:Ft	WxDxH	22 x 12 x 13.1
Masses (Approximate)		pounds (Kg)
Core and Coils		86,530 (39,250)
Tank and Fittings		50,740 (23,020)
Liquid 45,071	Liters	89,460 (40,580)
Total Mass		226,730 (102,850)
Shipping without OIL		126,990 (57,600)
Shipping with OIL		- - -

PROLEC

http://www.geprolec.com

TRANSFORMER

SERIAL No G1929-__ , THREE-PHASE, 60 Hz. ALTITUDE 1000 m (3300 ft)

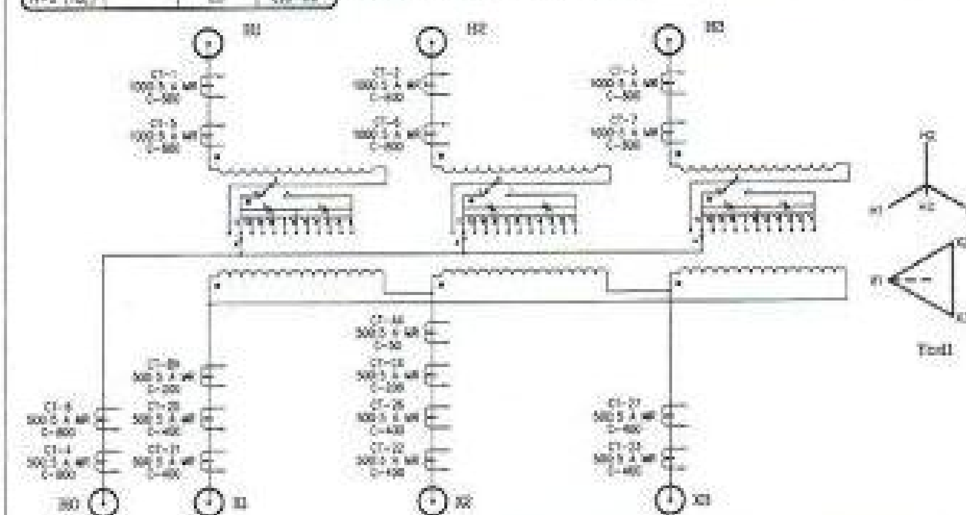
VOLTAGE RATING 240 000 GrdY/138 564 – 69 000			
COOLING CLASS	MVA RATING	AMBIENT TEMPERATURE	SERVICE CONDITIONS
ONAN	25	30°C	CONTINUOUS @ 65°C RISE
ONAF	33.25		
	42		
	49.9	0°C	CONTINUOUS

APPROXIMATE WEIGHTS (KGS)	
CORE AND COILS	42346
TANK AND FITTINGS	24655
MAIN TANK LIQUID (47801 LTS)	43086
COOLING EQUIPMENT LIQUID (738 LTS)	680
CONSERVATOR TANK LIQUID (2560 LTS)	2294
LTC LIQUID (188 LTS)	170
TOTAL WEIGHT	113604
UNTANKING WEIGHT (HEAVIEST PIECE)	42346
SHIPPING WEIGHT (WITHOUT OIL)	55240

IMPEDANCE @ 85°C			
	% Z	MVA BASE	KV BASE
H-X (10R)		25	264–69
H-X (NOM)		25	240–69
H-X (10L)		25	216–69

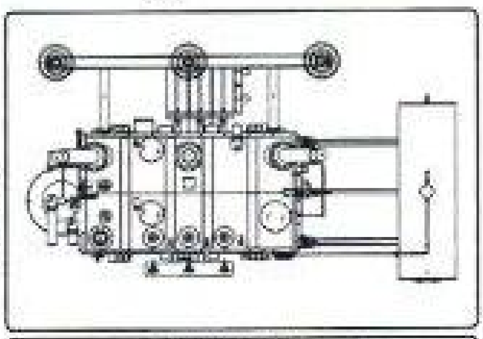
LIGHTNING IMPULSE LEVEL (kV)			
	H1,H2,H3	X1,X2,X3	H0
BUSHING	1175	350	650
WINDING	950	350	550

CUSTOMER SERIAL No.



LOW VOLTAGE WINDING	
VOLTS	AMPERES
X1, X2, X3	42 MVA
69 000	351

HIGH VOLTAGE WINDING				
VOLTS	AMPERES	LOAD TAP CHANGER		
H1, H2, H3	42 MVA	DIAL POSITION	TAP SELECTOR CONTACTS	REVERSING SWITCH CONTACTS
264 000	92	10R	1	+
261 600	93	9R	2	
259 200	94	8R	3	
256 800	94	7R	4	
254 400	95	6R	5	
252 000	96	5R	6	
249 600	97	4R	7	
247 200	98	3R	8	
244 800	99	2R	9	
242 400	100	1R	10	
240 000	101	NR	11	
		N	K	
		NL	1	–
237 600	102	1L	2	
235 200	103	2L	3	
232 800	104	3L	4	
230 400	105	4L	5	
228 000	106	5L	6	
225 600	107	6L	7	
223 200	109	7L	8	
220 800	110	8L	9	
218 400	111	9L	10	
216 000	112	10L	11	



CAUTION !

1.- BEFORE INSTALLING OR OPERATING READ INSTRUCTIONS G1929

2.- DO NOT OPERATE THE TRANSFORMER WHEN THE READING OF LIQUID LEVEL GAUGE IS BELOW THE LOW POINT OF THE SCALE.

NOTES

1.- MAXIMUM OPERATING PRESSURES OF LIQUID PRESERVATION SYSTEM: 0 Kg/cm² (ATMOSPHERIC PRESSURE)

2.- TANK DESIGNED FOR 1.05 Kg/cm² VACUUM FILLING

3.- ALL WINDINGS COPPER

4.- FILLED WITH MINERAL OIL WHICH CONTAIN NO DETECTABLE LEVEL OF PCB AT THE TIME OF MANUFACTURE

SUITABLE FOR STEP UP AND STEP DOWN OPERATION

MANUFACTURE DATE ___/ 2 0 0_

MADE IN MEXICO

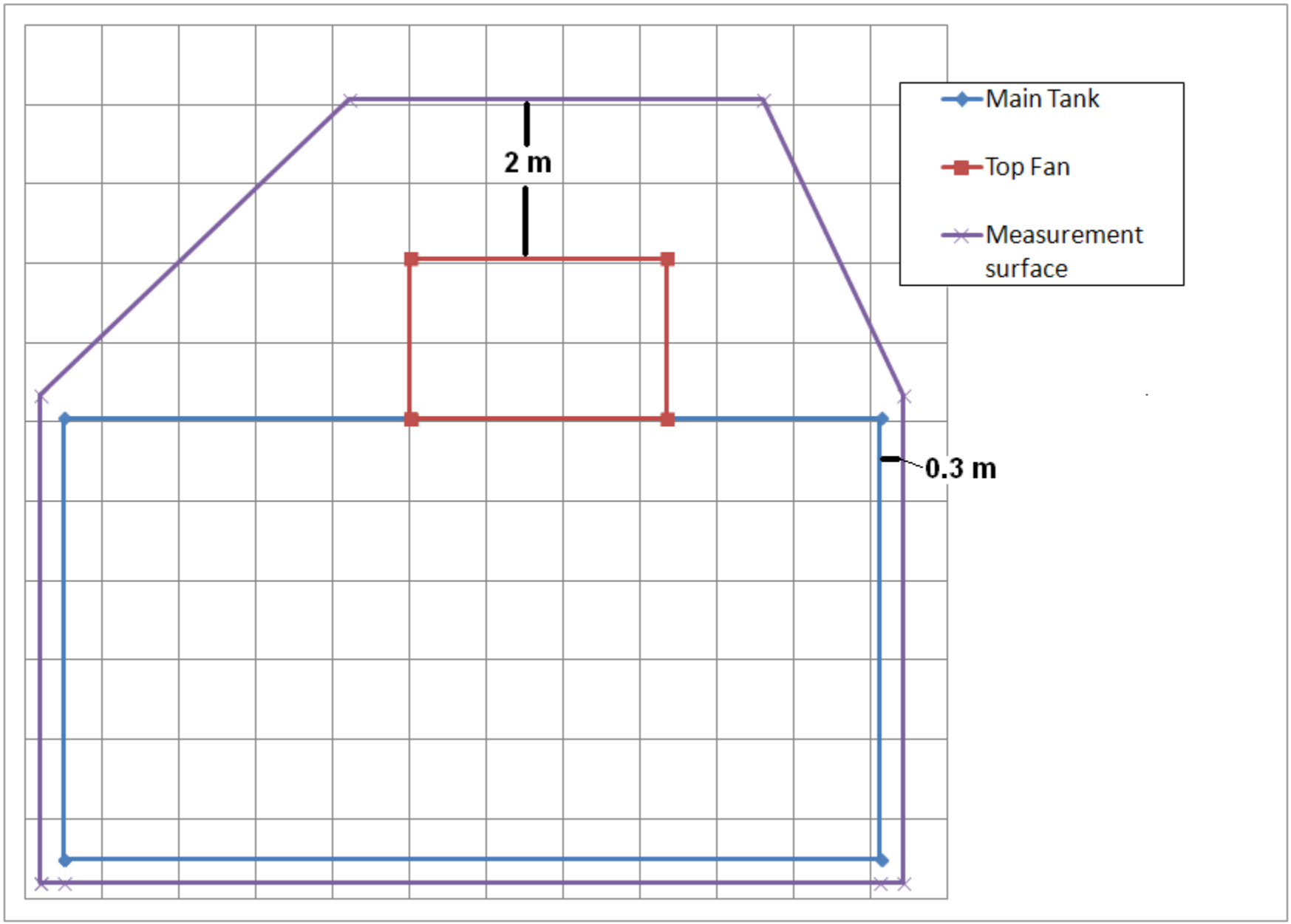
TRANSFORMER DESIGNED FOR NOMINAL IMPEDANCE (H-X) VOLTS OF 80 % AT 25 MVA THE ACTUAL MEASURED IMPEDANCE VALUE WILL BE SHOWN ON THE NAMEPLATE.

MATERIAL: STAINLESS STEEL
DIMENSIONS: 22" x 12"

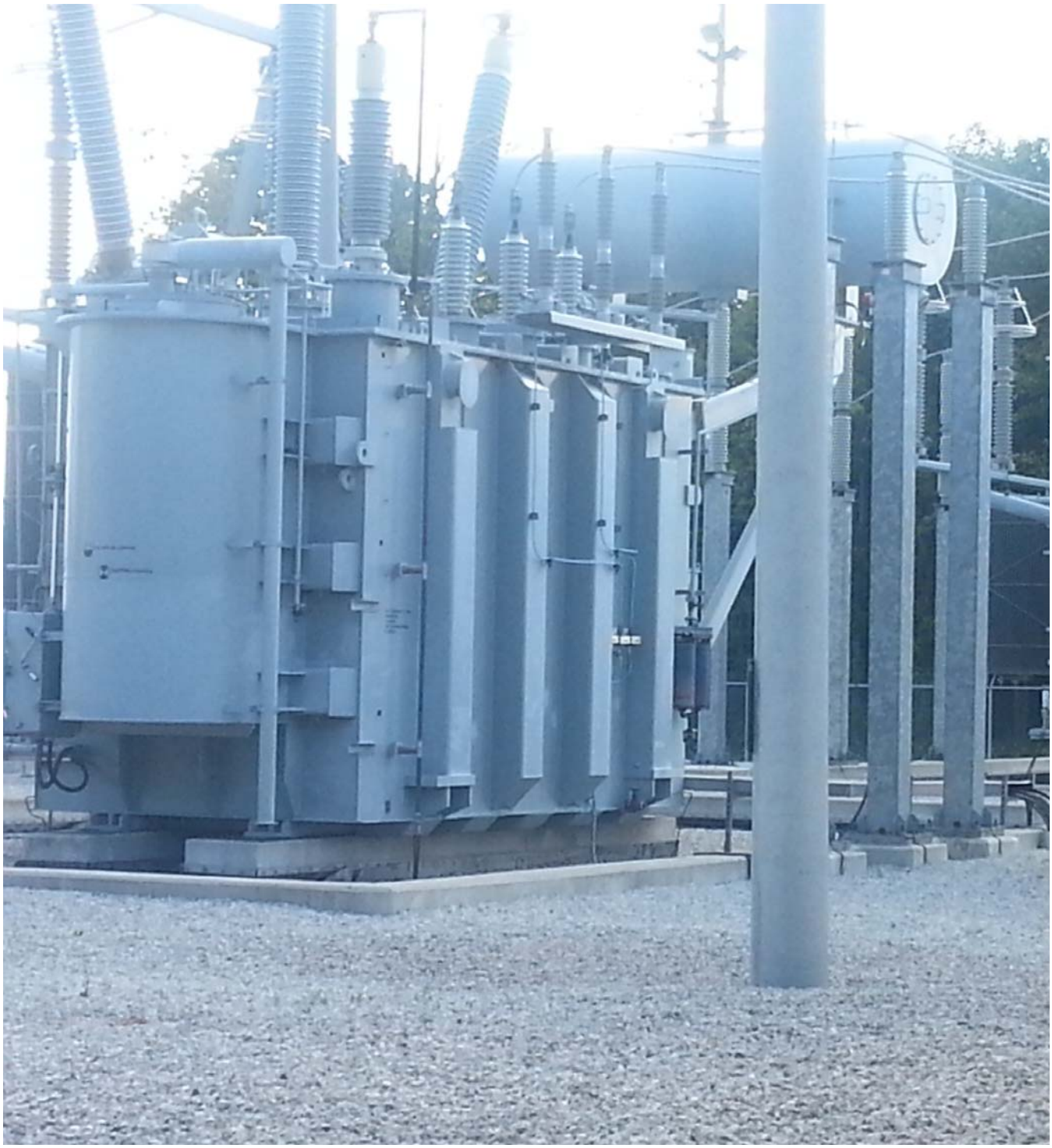
PROLEC

NAMEPLATE

G1929D1D802



Ripley transformer – diagram of sound measurement surface area, as per IEEE C57.12.90



Photograph #1 of the Ripley Substation

Photograph #2 of the Ripley Substation