

Appendix C: Equipment Noise Emission Data and Calculations

SWT-2.3-113, Rev. 1, Max. Power 2030 kW Contract Acoustic Emission, Hub Height 99.5 m Ontario - Canada

Sound Power Levels

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

Wind speed [m/s]	4	5	6	7	8	9	10	11	12	Up to cut-out
Max. Power 2030kW	96.4	101.3	102.0	102.0	102.0	102.0	102.0	102.0	102.0	102.0

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

Typical Sound Power Frequency Distribution

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

Octave band, centre frequency [Hz]	Wind Speed (m/s)				
	6	7	8	9	10
63	84.3	83.6	83.1	83.2	82.9
125	90.2	89.0	88.1	87.6	86.7
250	96.4	95.5	95.1	94.5	93.8
500	95.2	95.5	95.5	95.3	95.1
1000	96.0	96.3	96.1	96.0	96.3
2000	94.4	94.7	95.2	95.4	95.9
4000	83.8	87.0	89.3	91.2	91.4
8000	66.9	70.7	73.1	73.1	73.0

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

Tonality

Typical tonal audibility for the Siemens wind turbine generators has not exceeded 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

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

SWT-2.3-113, Rev. 1, Max. Power 2126 kW Contract Acoustic Emission, Hub Height 99.5 m Ontario - Canada

Sound Power Levels

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

Wind speed [m/s]	4	5	6	7	8	9	10	11	12	Up to cut-out
Max. Power 2126kW	96.5	102.3	103.0	103.0	103.0	103.0	103.0	103.0	103.0	103.0

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

Typical Sound Power Frequency Distribution

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

Octave band, centre frequency [Hz]	Wind Speed (m/s)				
	6	7	8	9	10
63	84.6	83.9	83.3	83.4	83.2
125	90.6	89.3	88.5	88.0	87.2
250	97.0	96.3	96.3	95.7	95.0
500	96.7	96.9	97.0	96.9	96.6
1000	97.4	97.7	97.0	97.0	97.3
2000	95.0	95.2	96.0	96.2	96.8
4000	84.0	87.0	89.3	91.2	91.4
8000	66.3	70.4	73.0	73.1	73.0

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

Tonality

Typical tonal audibility for the Siemens wind turbine generators has not exceeded 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

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

SWT-2.3-113, Rev. 1, Max. Power 2221 kW Contract Acoustic Emission, Hub Height 99.5 m 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 (L_{WA}) presented are valid for the corresponding wind speeds referenced to a height of 10 m above ground level.

Wind speed [m/s]	4	5	6	7	8	9	10	11	12	Up to cut-out
Max. Power 2221kW	96.6	102.6	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0

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

Typical Sound Power Frequency Distribution

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

Octave band, centre frequency [Hz]	Wind Speed (m/s)				
	6	7	8	9	10
63	84.8	83.6	83.5	83.7	83.4
125	90.9	91.3	88.8	88.3	87.5
250	97.6	97.7	97.2	96.7	95.9
500	98.2	98.0	97.8	97.7	97.4
1000	98.8	98.7	98.0	98.0	98.3
2000	95.6	95.4	97.1	97.4	97.9
4000	84.1	87.8	90.8	92.7	92.9
8000	65.6	71.2	74.5	74.6	74.5

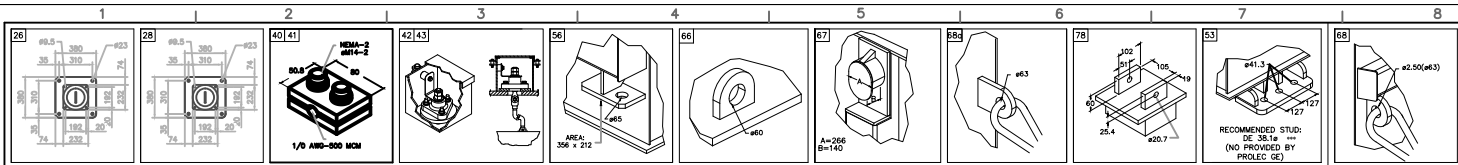
Table 2: Typical octave bands for 6-10 m/s, L_{WA} [dB(A) re 1 pW]

Tonality

Typical tonal audibility for the Siemens wind turbine generators has not exceeded 2 dB as determined in accordance with IEC 61400-11:2002.

Measurement Uncertainty

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



NOTES

- 1. REFERENCE DRAWING: GE TRANSFORMER
- 2. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED
- 3. FINISHES ARE TO BE AS SHOWN IN THE DRAWING
- 4. SURFACE FINISH TO BE AS SHOWN IN THE DRAWING
- 5. DIMENSIONS TO BE AS SHOWN IN THE DRAWING

TECHNICAL DATA

1/2 AND-000 MCM

3/8 x 21/2

A=206 B=140

RECOMMENDED STUD: DE 38.1φ (NO PROVIDED BY PROLEC CE)

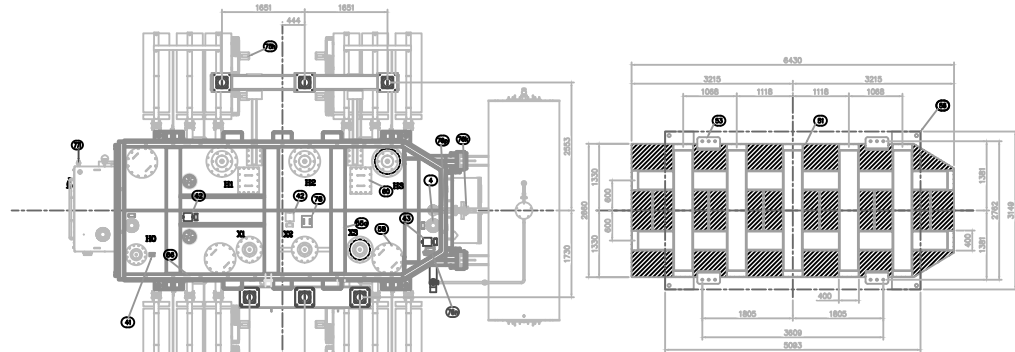
GENERAL ELECTRIC CANADA
P.O. No: 512-03118
GE Reg. No: TD7-04344
CUSTOMER ID: JERICHO
PROLEC GE Serial No: G2994-01

STEP UP TRANSFORMER
ONAN/ONAF/ONAF
102/36/170 MVA
60 HZ, THREE PHASE, 65°C, 1000 MASL
121/69.86 KV - 34.5 KV

APPROVAL DRAWING
F39/15/2013

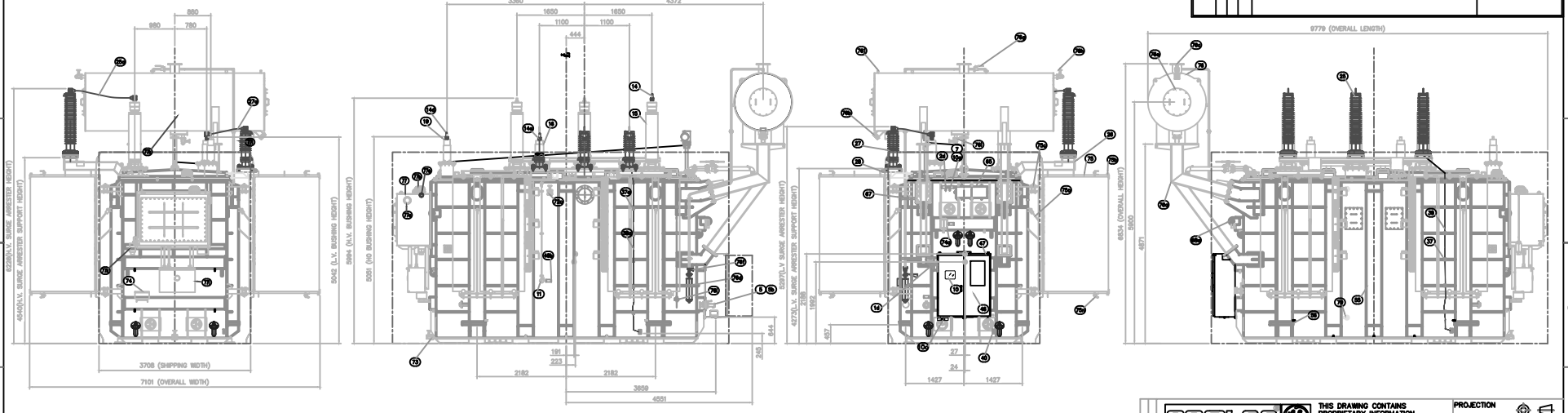
APPROXIMATE WEIGHTS (KG)

CORE AND COILS	94780
TANK AND FITTINGS	40330
MINI TANK INSULATING LIQUID (6270 LIT)	41480
COOLING EQUIPMENT INSULATING LIQUID (2945 LIT)	3015
CONSERVATOR TANK INSULATING LIQUID (2208 LIT)	2130
LIC TANK INSULATING LIQUID (1200 LIT)	1170
TOTAL WEIGHT	163775
LIFTING WEIGHT (HEAVIEST PIECE)	94780
SHIPPING WEIGHT (WITHOUT INSULATING LIQUID)	116540



SECTION A - A

* THE HATCHED AREA REPRESENT THE BOTTOM OF THE TRANSFORMER. THIS AREA IS NOT IN CONTACT WITH FOUNDATION OR PAD



REV	DESCRIPTION	CAT./MOD.
1	ISSUE FOR FABRICATING	SAU/ROL, 01-08-03
2	ISSUE FOR FABRICATING	SAU/ROL, 09-08-03
3	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
4	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
5	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
6	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
7	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
8	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
9	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02
10	ISSUE FOR FABRICATING	SAU/ROL, 09-05-02

PROLEC

THIS DRAWING CONTAINS PROPRIETARY INFORMATION WHICH CAN NOT BE REPRODUCED WITHOUT PERMISSION OF PROLEC GE.

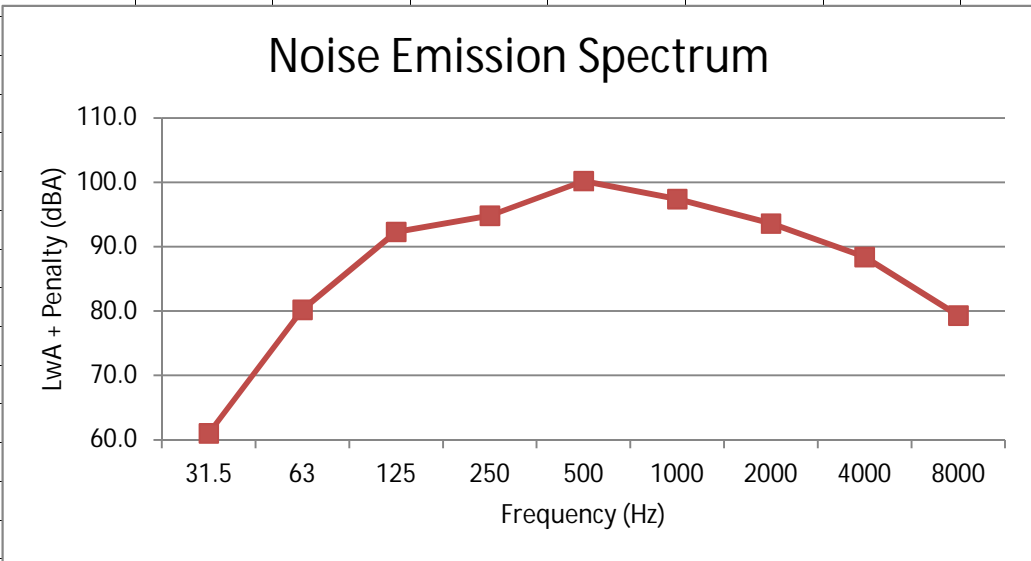
PROLEC GE ENGINEERING POWER DIVISION
<http://www.proteco.com>

TITLE: **TRANSFORMER'S OUTLINE**

DFIN: CYC 01/18/2013
 CHDR: CSP 07/18/2013

PROJECTION: 1:45
 DIMENSIONS: MM
 REVISIONS: INDICATED
 DRAWING NO.: G299401D801
 sheet 1 of 1

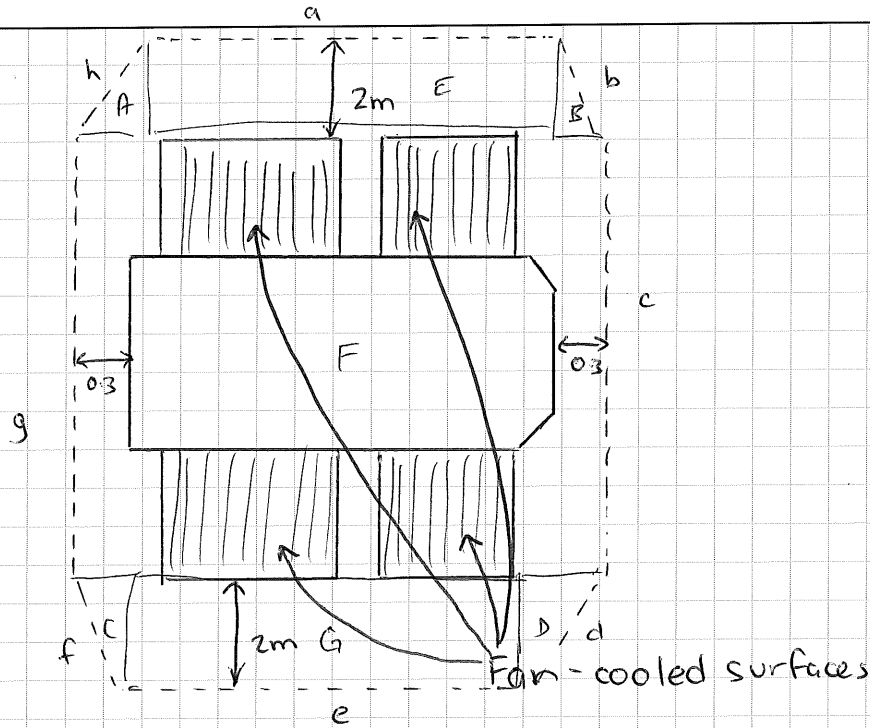
Transformer Noise Emissions		
Noise Rating	75.0	dB(A)
Measurement Dist	0.30	m
Measurement Surface Area	238.7	m ²
Sound Power Level	98.78	dB(A)
Tonal Penalty	5.0	dB
Sound Power Level	103.8	dB(A)



Octave Band Emission Estimates							
Centre Frequency	Corr ¹	Ncor ²	Lw	LwA	Tonal Penalty	Lw + Penalty	LwA + Penalty
31.5	-1.0	-2.37	95.4	56.0	5.0	100.4	61.0
63	5.0	-2.37	101.4	75.2	5.0	106.4	80.2
125	7.0	-2.37	103.4	87.3	5.0	108.4	92.3
250	2.0	-2.37	98.4	89.8	5.0	103.4	94.8
500	2.0	-2.37	98.4	95.2	5.0	103.4	100.2
1000	-4.0	-2.37	92.4	92.4	5.0	97.4	97.4
2000	-9.0	-2.37	87.4	88.6	5.0	92.4	93.6
4000	-14.0	-2.37	82.4	83.4	5.0	87.4	88.4
8000	-21.0	-2.37	75.4	74.3	5.0	80.4	79.3
Overall Sound Power Level			107.4	98.78		112.4	103.8

1. Correction from "Engineering Noise Control", David A. Bies and Colin H. Hansen

2. Normalization correction to ensure total sound power after band corrections does not exceed measured overall value



Perimeter = a + b + c + d + e + f + g + h

e = a = 6.43 m (from drawing)

f = h = d = b = $\sqrt{2^2 + 0.3^2} = 2.02 \text{ m}$

c = g = 7.10 m

∴ Perimeter = 35.14 m

Top Area = 4 triangles (A + B + C + D)
 + 2 Rectangles (E + G)
 + 1 Rectangle (F)

Area of A = B = C = D = $\frac{1}{2} \times 2 \times 0.3 = 0.6 \text{ m}^2$

Area of E = a × 2 = 12.86 m² = G

Area of F = [a + (2 × 0.3)] × c

= 49.9 m²

∴ Top area = 78.02 m²

Side area = perimeter × (height + 0.3)
 = 35.14 × 4.573 = 160.7 m²

∴ Total area = ~~78.02~~ + 160.7



Area = 238.7 m²

JER5563

JER2532



Legend

-  Transformer Barrier
-  Transformer

Technical Documentation

Wind Turbine Generator Systems

1.6-100 with LNTE

50 Hz and 60 Hz



Product Acoustic Specifications

Normal Operation according to IEC
Incl. Octave Band Spectra
Incl. 1/3rd Octave Band Spectra



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1 Introduction

This document summarizes the acoustic emission characteristics of the 1.6-100 with Low Noise Trailing Edge (LNTE) wind turbine for normal operation, including calculated apparent sound power levels $L_{WA,k}$, as well as uncertainty levels associated with the apparent sound power levels, tonal audibility, and calculated third octave band apparent sound power level.

All provided sound power levels are A-weighted.

GE continuously verifies specifications with measurements, including those performed by independent institutes. If a wind turbine noise performance test is carried out, it needs to be done in accordance with the regulations of the international standard IEC 61400-11, ed. 2.1: 2006 and Machine Noise Performance Test document.

2 Normal Operation Calculated Apparent Sound Power Level

The apparent sound power levels $L_{WA,k}$ are initially calculated as a function of the hub height wind speed v_{HH} . The corresponding wind speeds v_{10m} at 10 m height above ground level have been evaluated assuming a logarithmic wind profile. In this case a surface roughness of $z_{0ref} = 0.05$ m has been used, which is representative of average terrain conditions.

$$v_{10m} = v_{HH} \frac{\ln\left(\frac{10m}{z_{0ref}}\right)}{\ln\left(\frac{\text{hub height}}{z_{0ref}}\right)} *$$

The calculated apparent sound power levels $L_{WA,k}$ and the associated octave-band spectra are given in Table 1 and Table 2 for two different hub heights. The values are provided as mean levels as a function of v_{10m} for Normal Operation (NO) over cut-in to cut-out wind speed range. The uncertainties for octave sound power levels are generally higher than for total sound power levels. Guidance is given in IEC 61400-11, Annex D.

1.6-100 with LNTE – Normal Operation Octave Spectra									
Standard wind speed at 10 m [m/s]	3	4	5	6	7	8	9	10-Cutout	
Hub height wind speed at 80 m [m/s]	4.2	5.6	7.0	8.4	9.7	11.1	12.5	14-Cutout	
Frequency (Hz)	31.5	62.5	62.2	66.1	70.1	73.5	73.7	73.6	73.5
	63	72.1	71.9	75.9	80.3	84.0	84.1	84.1	84.0
	125	79.0	79.2	83.8	88.4	91.6	91.8	91.8	91.7
	250	84.0	84.6	89.4	94.7	95.4	95.3	95.4	95.5
	500	85.5	84.9	89.7	95.5	97.1	96.6	96.7	97.0
	1000	83.4	83.0	86.9	91.8	97.1	97.5	97.6	97.8
	2000	81.7	83.4	87.9	92.4	95.7	95.7	95.5	95.1
	4000	74.9	77.7	83.5	88.9	89.7	89.1	88.4	87.9
	8000	55.5	57.6	63.5	70.3	70.4	70.6	69.4	69.1
	16000	7.9	13.2	18.9	24.7	27.2	26.6	27.5	29.0
Total apparent sound power level $L_{WA,k}$ [dB]	90.4	90.7	95.3	100.5	103.0	103.0	103.0	103.0	103.0

Table 1: Normal Operation Calculated Apparent Sound Power Level, 1.6-100 with LNTE with 80 m hub height as a function of 10 m wind speed ($z_{0ref} = 0.05$ m), the octave band spectra are for information only

* Simplified from IEC 61400-11, ed. 2.1: 2006 equation 7

1.6-100 with LNTE – Normal Operation Octave Spectra									
Standard wind speed at 10 m [m/s]	3	4	5	6	7	8	9	10-Cutout	
Hub height wind speed at 96 m [m/s]	4.3	5.7	7.1	8.6	10.0	11.4	12.8	14-Cutout	
Frequency (Hz)	31.5	62.4	62.4	66.6	70.6	73.7	73.7	73.6	73.5
	63	72.1	72.0	76.5	80.8	84.1	84.1	84.1	84.0
	125	79.0	79.5	84.4	89.0	91.6	91.8	91.8	91.7
	250	84.0	84.9	90.1	95.0	95.3	95.3	95.5	95.5
	500	85.4	85.0	90.3	96.0	96.8	96.6	96.8	97.0
	1000	83.4	83.1	87.5	92.4	97.2	97.4	97.7	97.8
	2000	81.8	83.7	88.5	92.9	95.8	95.7	95.4	95.1
	4000	75.1	78.2	84.2	89.3	89.7	88.8	88.4	87.9
	8000	55.7	57.9	64.4	70.7	71.1	69.8	69.3	69.1
	16000	8.4	13.6	19.5	25.2	27.3	26.4	27.8	29.0
Total apparent sound power level L_{WA,k} [dB]	90.4	90.9	96.0	101.0	103.0	103.0	103.0	103.0	103.0

Table 2: Normal Operation Calculated Apparent Sound Power Level, 1.6-100 with LNTE with 96 m hub height as a function of 10 m wind speed ($z_{0ref} = 0.05$ m), the octave band spectra are for information only

At 10 m wind speeds lower than 5 m/s the sound power levels decreases, and may get so low that the wind turbine noise becomes indistinguishable from the background noise. For a conservative calculation the data at 5 m/s may be used.

For 10 m wind speeds above 10 m/s, the wind turbine has reached rated power and the blade pitch regulation acts in a way that tends to decrease the noise levels. For a conservative calculation the data at 10 m/s may be used.

The highest normal operation calculated apparent sound power level for the 1.6-100 with LNTE is $L_{WA,k} = 103.0$ dB.

3 Uncertainty Levels

The apparent sound power levels given above are calculated mean levels. If a wind turbine noise performance test is carried out, it needs to be done in accordance with the regulations of the international standard IEC 61400-11, ed. 2.1: 2006. Uncertainty levels associated with measurements are described in IEC/TS 61400-14.

Per IEC/TS 61400-14, L_{WAd} is the maximum apparent sound power level for 95 % confidence level resulting from n measurements performed according to IEC 61400-11 standard: $L_{WAd} = L_{WA} + K$, where L_{WA} is the mean apparent sound power level from IEC 61400-11 testing reports and $K = 1.645 \sigma_T$.

The testing standard deviation values σ_T , σ_R and σ_P for measured apparent sound power level are described by IEC/TS 61400-14, where σ_T is the total standard deviation, σ_P is the standard deviation for product variation and σ_R is the standard deviation for test reproducibility.

Assuming $\sigma_R < 0.8$ dB and $\sigma_P < 0.8$ dB as typical values leads to a calculated $K < 2$ dB for 95 % confidence level.

4 Tonal Audibility

The tonal audibility ($\Delta L_{a,k}$), when measured in accordance with the IEC 61400-11 standard, for the GE's 1.6-100 with LNTE is less than or equal to 2 dB.

5 IEC 61400-11 and IEC/TS 61400-14 Terminology

- $L_{WA,k}$ is wind turbine apparent sound power level (referenced to 10^{-12} W) measured with A-weighting as function of reference wind speed v_{10m} . Derived from multiple measurement reports per IEC 61400-11, it is considered as a mean value
- σ_P is the product variation i.e. the 1.6-100 with LNTE unit-to-unit product variation; typically < 0.8 dB
- σ_R is the overall measurement testing reproducibility as defined per IEC 61400-11; typically < 0.8 dB with adequate measurement conditions and sufficient amount of data samples
- σ_T is the total standard deviation combining both σ_P and σ_R
- $K = 1.645 \sigma_T$ is defined per IEC/TS 61400-14 for 95 % confidence level
- R_0 is the ground measuring distance from the wind turbine tower axis per IEC 61400-11, which shall equal the hub height plus half the rotor diameter
- $\Delta L_{a,k}$ is the tonal audibility according to IEC 61400-11, described as potentially audible narrow band sound

6 1/3rd Octave Band Spectra

The tables in Annex I are showing the 1/3rd octave band values for different hub heights in different wind speeds.

Reference:

- IEC 61400-1. Wind turbines – part 1: Design requirements. ed. 2. 1999
- IEC 61400-11, wind turbine generator systems part 11: Acoustic noise measurement techniques, ed. 2.1, 2006-11
- IEC/TS 61400-14, Wind turbines – part 14: Declaration of apparent sound power level and tonality values, ed. 1, 2005-03
- MNPT – Machine Noise Performance Test, Technical documentation, GE 2011

Appendix I - Calculated 1/3rd Octave Band Apparent Sound Power Level $L_{WA,k}$

1.6-100 with LNTE - Normal Operation 1/3 rd Octave Band Spectra									
Standard wind speed at 10 m [m/s]	3	4	5	6	7	8	9	10-Cutout	
Hub height wind speed at 80 m [m/s]	4.2	5.6	7.0	8.4	9.7	11.1	12.5	14-Cutout	
Frequency (Hz)	25	52.2	52.1	55.8	59.7	63.0	63.2	63.1	62.9
	32	56.6	56.4	60.2	64.2	67.5	67.7	67.7	67.5
	40	60.6	60.3	64.2	68.3	71.6	71.9	71.8	71.7
	50	63.7	63.5	67.4	71.6	75.0	75.2	75.2	75.0
	63	66.5	66.2	70.3	74.6	78.1	78.3	78.3	78.2
	80	69.7	69.5	73.6	78.0	81.8	82.0	81.9	81.8
	100	72.3	72.2	76.5	81.0	84.8	84.9	84.9	84.7
	125	74.1	74.2	78.7	83.3	86.6	86.9	86.9	86.8
	160	75.6	76.1	80.8	85.6	88.3	88.5	88.6	88.5
	200	77.5	78.1	83.0	87.9	89.7	89.9	90.0	90.0
	250	79.5	80.1	85.0	90.2	91.0	90.9	91.0	91.1
	315	80.3	80.7	85.6	91.0	91.1	90.8	90.8	91.0
	400	80.7	80.6	85.4	91.1	91.5	91.0	91.0	91.2
	500	81.0	80.4	85.1	91.0	92.4	91.9	91.9	92.2
	630	80.3	79.4	84.0	89.9	92.9	92.6	92.7	93.0
	800	79.0	78.0	82.3	87.8	92.6	92.6	92.7	93.0
	1000	78.4	77.9	81.7	86.4	92.3	92.7	92.8	93.0
	1250	78.5	78.7	82.4	86.6	92.1	92.8	92.9	93.0
	1600	77.9	78.7	82.8	87.0	91.4	91.9	91.9	91.6
	2000	77.0	78.8	83.3	87.8	91.1	91.0	90.6	90.2
2500	75.7	78.5	83.4	88.1	90.4	89.7	89.1	88.6	
3150	73.2	76.1	81.8	86.9	88.1	87.2	86.7	86.1	
4000	69.1	71.7	77.7	83.5	83.6	83.5	82.5	82.2	
5000	63.7	65.4	72.0	78.0	78.0	78.2	76.7	76.7	
6300	55.3	57.3	63.3	70.0	70.1	70.2	69.1	68.7	
8000	42.6	45.5	51.0	57.4	58.6	58.8	57.9	57.4	
10000	27.1	31.3	36.5	42.5	44.6	44.4	44.4	44.4	
12500	7.9	13.2	18.9	24.6	27.2	26.6	27.4	29.0	
16000	-19.0	-13.2	-6.1	-0.3	1.9	1.8	4.0	6.3	
20000	-47.8	-42.5	-34.1	-26.9	-25.9	-24.6	-21.8	-19.1	
Total apparent sound power level $L_{WA,k}$ [dB]	90.4	90.7	95.3	100.5	103.0	103.0	103.0	103.0	103.0

Table 3: Calculated Apparent 1/3rd Octave Band Sound Power Level (A-weighted) 1.6-100 with LNTE with 80 m hub height as Function of Wind Speed v_{10m}

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1.6-100 with LNTE - Normal Operation 1/3 rd Octave Band Spectra									
Standard wind speed at 10 m [m/s]	3	4	5	6	7	8	9	10-Cutout	
Hub height wind speed at 96 m [m/s]	4.3	5.7	7.1	8.6	10.0	11.4	12.8	14-Cutout	
Frequency (Hz)	25	52.1	52.2	56.4	60.2	63.2	63.2	63.1	62.9
	32	56.6	56.5	60.7	64.7	67.7	67.7	67.6	67.5
	40	60.6	60.5	64.7	68.8	71.8	71.9	71.8	71.7
	50	63.7	63.6	67.9	72.1	75.2	75.2	75.2	75.0
	63	66.5	66.4	70.8	75.1	78.3	78.3	78.3	78.2
	80	69.7	69.7	74.2	78.6	81.9	81.9	81.9	81.8
	100	72.3	72.4	77.0	81.5	84.9	84.9	84.9	84.7
	125	74.0	74.5	79.3	83.8	86.7	86.9	86.9	86.8
	160	75.6	76.4	81.4	86.1	88.3	88.5	88.6	88.5
	200	77.5	78.5	83.6	88.4	89.7	89.9	90.0	90.0
	250	79.5	80.4	85.6	90.6	90.9	90.9	91.1	91.1
	315	80.3	81.0	86.2	91.4	90.9	90.8	90.9	91.0
	400	80.7	80.8	86.1	91.5	91.2	90.9	91.1	91.2
	500	80.9	80.5	85.8	91.5	92.1	91.8	92.0	92.2
	630	80.3	79.4	84.7	90.5	92.7	92.6	92.8	93.0
	800	78.9	78.1	82.9	88.5	92.5	92.5	92.8	93.0
	1000	78.3	78.1	82.2	87.2	92.5	92.6	92.9	93.0
	1250	78.5	78.8	82.9	87.2	92.4	92.8	93.0	93.0
	1600	77.9	78.9	83.3	87.5	91.6	91.9	91.9	91.6
	2000	77.1	79.1	83.9	88.3	91.1	90.9	90.6	90.2
2500	75.9	78.8	84.0	88.6	90.3	89.6	89.0	88.6	
3150	73.4	76.5	82.4	87.3	87.9	87.0	86.6	86.1	
4000	69.2	72.2	78.4	83.8	83.7	83.2	82.5	82.2	
5000	63.8	65.9	72.8	78.3	78.4	77.5	76.8	76.7	
6300	55.4	57.6	64.1	70.4	70.8	69.4	69.0	68.7	
8000	42.9	45.8	51.8	57.9	59.1	58.4	57.7	57.4	
10000	27.5	31.6	37.2	43.0	44.9	44.1	44.4	44.4	
12500	8.4	13.6	19.5	25.2	27.3	26.4	27.8	29.0	
16000	-18.5	-12.7	-5.4	0.2	1.8	2.0	4.6	6.3	
20000	-47.5	-41.9	-33.2	-26.3	-26.0	-24.1	-21.1	-19.1	
Total apparent sound power level L_{WA,k} [dB]	90.4	90.9	96.0	101.0	103.0	103.0	103.0	103.0	103.0

Table 4: Calculated Apparent 1/3rd Octave Band Sound Power Level (A-weighted), 1.6-100 with LNTE with 96 m hub height as Function of Wind Speed v_{10m}

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Wind Shear Calculation

Night-time Monthly Average Wind Speed Data (2300 to 0700)

Data Set	Wind Speed Sensor	Height	Wind Speed (m/s)											
			Winter	Winter	Winter	Spring	Spring	Spring	Summer	Summer	Summer	Fall	Fall	Fall
			January	February	March	April	May	June	July	August	September	October	November	December
			1	2	3	4	5	6	7	8	9	10	11	12
1	48.5m_W	48.50	6.78	6.71	6.03	6.48	5.33	4.66	4.53	4.92	5.29	6.33	6.81	7.49
2	48.5m_S	48.50	6.72	6.68	5.95	6.40	5.28	4.64	4.48	4.90	5.32	6.38	6.84	7.55
3	41.5m_W	41.00	6.59	6.51	5.80	6.12	5.07	4.44	4.28	4.67	5.02	6.09	6.56	7.30
4	41.5m_S	41.00	6.59	6.43	5.68	6.17	5.01	4.38	4.21	4.55	4.97	6.04	6.58	7.36
5	30m_W	30.00	6.22	6.14	5.38	5.72	4.65	4.03	3.81	4.14	4.49	5.60	6.13	6.96
6	10m_W	10.00	5.32	5.16	4.34	4.59	3.62	3.06	2.66	2.82	3.21	4.23	4.94	6.03

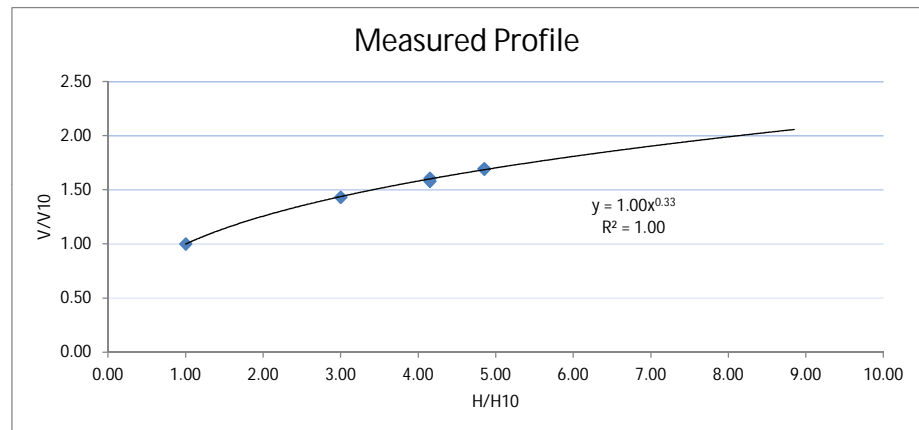
Summer Average Night-time Monthly Average Wind Speed - Based on Measurements

Data Set	Wind Speed Sensor	Height (m)	Vsavg (m/s)	H/H10	Vsavg/V10
1	spd_avg_48.5m_W_ch01	48.50	4.91	4.85	1.70
2	spd_avg_48.5m_S_ch02	48.50	4.90	4.85	1.69
3	spd_avg_41.5m_W_ch03	41.50	4.66	4.15	1.61
4	spd_avg_41.5m_S_ch04	41.50	4.58	4.15	1.58
5	spd_avg_30m_W_ch05	30.00	4.15	3.00	1.43
6	spd_avg_10m_W_ch06	10.00	2.90	1.00	1.00

Model	$V_{savg}(hub) = V_{savg}(10m) * k$ $k = C * (H/H10)^n$
Hub Height (m)	80
C	1
n	0.33
k	1.99

Vsavg - Summer Average Night-time Wind Speed (July, August and Sept)

V10 - Vsavg at 10m height



Appendix D: Noise Contour Maps

Noise Contours calculated at 4.5 metres above grade

Lake Huron

Legend

- Wind Energy Centre Study Area
- Transmission Line Study Area
- 120m Area of Investigation
- Municipal Division
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp
- Railway
- Natural Feature
 - Watercourse (ABCA, SCRCA)
 - Watercourse (MNR)
 - Waterbody
 - Cartographic Wetland
 - Wooded Area
 - Participating Receptor
 - Non-participating Receptor
 - Vacant Lot Participating Receptor
 - Vacant Lot Non-participating Receptor
- Noise Results
 - 40.0 dBA

Project Location

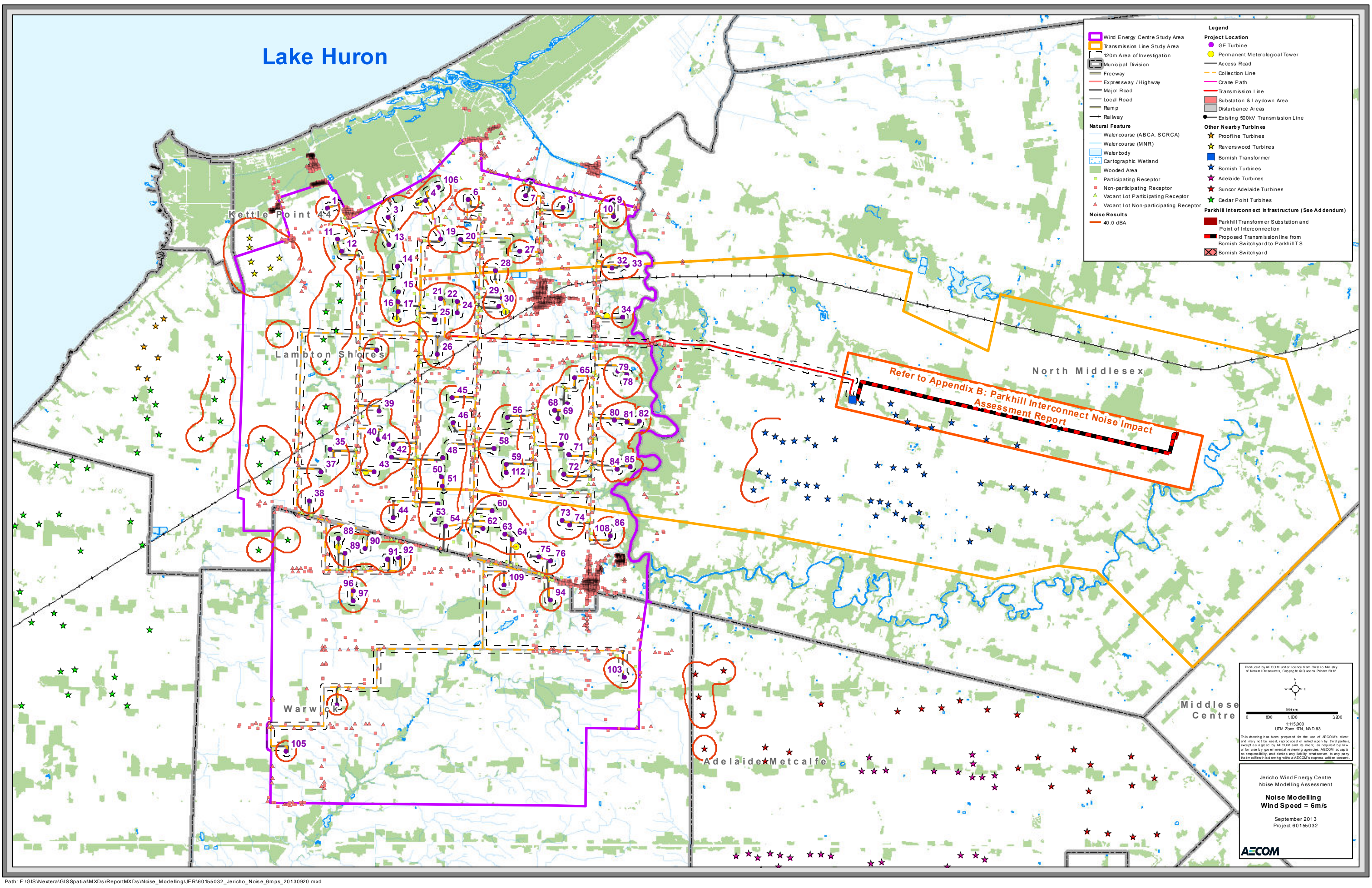
- GE Turbine
- Permanent Meteorological Tower
- Access Road
- Collection Line
- Crane Path
- Transmission Line
- Substation & Laydown Area
- Disturbance Areas
- Existing 500kV Transmission Line

Other Nearby Turbines

- Prooifline Turbines
- Ravenswood Turbines
- Bomish Transformer
- Bomish Turbines
- Adelaide Turbines
- Suncor Adelaide Turbines
- Cedar Point Turbines

Parkhill Interconnect Infrastructure (See Addendum)

- Parkhill Transformer Substation and Point of Interconnection
- Proposed Transmission line from Bomish Switchyard to Parkhill TS
- Bomish Switchyard



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Metres
0 800 1,600 3,200
1:115,000
UTM Zone 17N, NAD 83

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Jericho Wind Energy Centre
Noise Modelling Assessment

Noise Modelling
Wind Speed = 6m/s

September 2013
Project 60155032

AECOM