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ACOUSTIC ASSESSMENT REPORT

PENN ENERGY – VANDORP SOLAR FARM

Municipality of Port Hope, County of Northumberland, Ontario

FIT Contract ID# F-001573-SPV-130-505
EBR Registry No: 011-9684

Prepared for:

Port Hope Solar Farm Partnership
620 Righters Ferry Road,
Bala Cynwyd, PA, 19004
USA

Prepared by

Petr Chocensky, PhD

Reviewed by

LICENSED PROFESSIONAL ENGINEER
I. R. BONSMA
100100550
27-Nov-13
PROVINCE OF ONTARIO

Ian Bonsma, PEng

November 27, 2013

VERSION CONTROL

Penn Energy - Vandorp Solar Farm
Highway 401 at Wesleyville/Morrish Church Road, Municipality of Port Hope, County of Northumberland, Ontario

Ver.	Date	Version Description	Prepared By
1	3-May-12	Original Acoustic Assessment Report supporting an application for a Renewable Energy Approval	P. Chocensky
2	13-Jun-12	Updated Acoustic Assessment Report supporting an application for a Renewable Energy Approval to address an additional inverter installation	P. Chocensky
3	20-Feb-13	Updated Acoustic Assessment Report supporting an application for a Renewable Energy Approval incorporating refined sound level data for transformers	P. Chocensky
4	7-Mar-13	Updated Acoustic Assessment Report supporting an application for a Renewable Energy Approval addressing updated source height for primary transformer	P. Chocensky
5	13-Mar-13	Updated Acoustic Assessment Report supporting an application for a Renewable Energy Approval addressing updated sound rating for primary transformer	P. Chocensky
6	6-Aug-13	Updated Acoustic Assessment Report supporting an application for a Renewable Energy Approval addressing updated site layout and equipment selection, and introducing noise control measures	P. Chocensky
7	27-Nov-13	Updated Acoustic Assessment Report supporting an application for a Renewable Energy Approval addressing updated site layout and equipment selection	P. Chocensky

EXECUTIVE SUMMARY

Port Hope Solar Farm Partnership retained HGC Engineering to undertake an Acoustic Assessment of their proposed Vandorp Solar Farm in the Municipality of Port Hope, County of Northumberland, Ontario. The study is required in support of an application for a Renewable Energy Approval from the Ontario Ministry of The Environment ("MOE"), under the Renewable Energy Act ("REA"), pursuant to Ontario Regulation 359/09. The assessment considers all acoustically significant sound sources currently proposed for use at the facility. This assessment has been prepared in accordance with the Ontario Ministry of the Environment publication "Basic Comprehensive Certificates of Approval (AIR) – User Guide".

Previously, HGC Engineering issued a number of Acoustic Assessment Reports for the Vandorp site, addressing comments from the Ministry of the Environment, as well as refinements in the site design.

Sound emissions from key items of proposed equipment were based on information provided by the equipment manufacturers and established prediction methods for the transformers. The source sound levels were used as input to a predictive acoustical model to quantify the sound emissions associated with the facility.

The predictive analysis indicates that the sound emissions of the facility will be within the sound level limits as set out in MOE guideline NPC-300 during normal 'predictable worst case' operations at all identified residential receptors.

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Ministry of the Environment | Ministère de l'Environnement

Ontario

ACOUSTIC ASSESSMENT REPORT CHECK-LIST

Company Name: Port Hope Solar Farm Partnership

Company Address: 620 Righters Ferry Rd

Bala Cynwyd, USA 19004

Location of Facility: Intersection of Highway 401 and Wesleyville/Morrish Church Road,

Municipality of Port Hope, County of Northumberland, Ontario

The attached Acoustic Assessment Report was prepared in accordance with the guidance in the ministry document "Information to be Submitted for Approval of Stationary Source of Sound" (NPC 233) dated October 1995 and the minimum required information identified in the check-list on the reverse of this sheet has been submitted.

Company Contact:

Name: David Savoia

Representing: Port Hope Solar Farm Partnership

Phone Number: 610-668-0300

Signature:

Date: November 27, 2013

Technical Contact:

Name: Petr Chocensky, PhD

Representing: HGC Engineering

Phone Number: 905-826-4044

Signature:

Date: November 27, 2013

ACOUSTIC ASSESSMENT REPORT CHECK-LIST

	Required Information		
		Submitted	Explanation/Reference
1.0	**Introduction** (Project Background and Overview)	☒ Yes	Section 1
2.0	**Facility Description**		
	2.1 Operating hours of facility and significant Noise Sources	☒ Yes	Section 2
	2.2 Site Plan identifying all significant Noise Sources	☒ Yes	Figure 3
3.0	**Noise Source Summary**		
	3.1 ***Noise Source Summary Table***	☒ Yes	Appendix A
	3.2 Source noise emissions specifications	☒ Yes	Appendix A
	3.3 Source power/capacity ratings	☒ Yes	Appendix A
	3.4 Noise control equipment description and acoustical specifications	☐ Yes	N/A
4.0	**Point of Reception Noise Impact Calculations**		
	4.1 ***Point of Reception Noise Impact Table***	☒ Yes	Appendix A
	4.2 Point(s) of Reception (POR) list and description	☒ Yes	Section 4
	4.3 Land-use Zoning Plan	☒ Yes	Appendix B
	4.4 Scaled Area Location Plan	☒ Yes	Figure 1
	4.5 Procedure used to assess noise impacts at each POR	☒ Yes	Appendix D
	4.6 List of parameters/assumptions used in calculations	☒ Yes	Appendix D
5.0	**Acoustic Assessment Summary**		
	5.1 ***Acoustic Assessment Summary Table***	☒ Yes	Appendix A
	5.2 Rationale for selecting applicable noise guideline limits	☒ Yes	Appendix E
	5.3 Predictable Worst Case Impacts Operating Scenario	☒ Yes	Figure 4
6.0	**Conclusions**		
	6.1 Statement of compliance with selected noise performance limits	☒ Yes	Sections 6 & 7
7.0	**Appendices** (provide details such as)	☒ Yes	
	Listing of Insignificant Noise Sources	☐ Yes	N/A
	Manufacturer's Noise Specifications	☒ Yes	Appendix C
	Calculations	☒ Yes	Appendices F & G
	Instrumentation	☐ Yes	N/A
	Meteorology during Sound Level Measurements	☐ Yes	N/A
	Raw Data from Measurements	☐ Yes	N/A
	Drawings (Facility / Equipment)	☒ Yes	Figure 3, Appendix C

1 INTRODUCTION

1.1 Context

The Vandorp Solar Farm is proposed to be located southwest of the intersection of Highway 401 and Wesleyville/Morrish Church Road in the Municipality of Port Hope and the County of Northumberland, Ontario. A scaled location map of the surrounding area is included as Figure 1. The purpose of this assessment is to evaluate the sound emissions of the facility under a predictable worst case operating scenario, which is defined as an hour when typical full operation of the stationary sources under consideration could coincide with an hour of low background sound.

This report has been prepared in accordance with the Ontario Ministry of The Environment ("MOE") guideline documents NPC-233 "Information to be Submitted for Approval of Stationary Sources of Sound", dated October 1995 [1], and "Supporting Information for the Preparation of an Acoustic Assessment Report", dated November 2003 [2].

A zoning map identifying the land uses surrounding the subject facility, obtained from the Municipality of Port Hope, is included as Appendix B. The lands surrounding the Vandorp Solar Farm are zoned for agricultural and development use. Twenty-six points of reception have been considered in this assessment in order to represent the existing residential dwellings and vacant lots, which permit noise-sensitive use, within 1000 metres of the proposed equipment at the solar facility, labelled as locations R01 through R26 in Figure 2.

During a site visit by HGC Engineering on January 23, 2012, the background sound in the vicinity of the subject site was dominated by road traffic on Highway 401. Although the area surrounding the site is best characterized as a Class 2 acoustical environment, under MOE noise assessment guidelines, a number of points of reception can be considered to be located in Class 3 areas. For conservatism, all receptor locations were assessed in regards to the sound level limits applicable to Class 3 area.

1.2 Summary of Updates Addressed In This Assessment

The updates addressed in this report include:

- Updated site layout of the Vandorp Solar Farm,
- Updated number of inverter collection houses; this assessment includes a total of six collection houses, each containing two inverters and one small transformer,
- Updated sound levels of small transformers, reflecting that transformers will be 1.75 MVA units (1 MVA units were assumed previously),
- Updated modeling approach; each inverter house and accompanying transformer is represented by a single source of sound, based on instructions from the MOE. Previously, sound emissions from inverter houses and transformers were modeled individually,
- Addition of one HVAC unit (NS-08).

2 FACILITY DESCRIPTION

The Vandorp Solar Farm is a proposed 10 MW solar electrical generation project. The facility will consist of numerous fixed array mounted solar panels, six collection houses, and one primary transformer. The sound sources associated with the facility will be the collection houses, each including two inverters and a small transformer, and one primary transformer. The inverters are power semiconductor devices which synthesize alternating current ("A/C") from the direct current produced by the solar panels. The solar panels themselves are passive, direct current devices and do not produce sound. They are thus not considered as sources in this assessment.

The inverter units will typically operate during hours when daylight is available. However, the transformers will be energized throughout the 24 hour period. Since daylight can occur during some hours of the nighttime period (19:00 – 7:00), the facility was assumed to operate fully during both daytime (7:00 – 19:00) and nighttime hours (19:00 – 7:00). The facility will operate 7 days per week.

3 SOUND SOURCE SUMMARY

A Sound Source Summary is included as Table A1 in Appendix A, which lists the sources associated with the facility, in the standard format required by the MOE. Each noise source has been assigned an identification number of the form NS-## (e.g. NS-01).

Figure 3 shows the location of each source. The non-negligible sources of sound at the facility are described below.

The site plan for the proposed development includes six inverter collection houses (NS-01 through NS-06) which will be distributed throughout the site. Each inverter collection house will include two 800 kW inverters and will be accompanied by a small 1.75 MVA transformer. The facility will also have one larger, 10 MVA, transformer (NS-07) and a small HVAC unit (NS-08) associated with a facility control house located in the south part of the site.

Sound emissions from inverter units were based on sound measurements of a single 800 kW inverter provided by SMA Solar Technology.

For the transformers, Cooper Power Systems provided NEMA sound ratings and drawings with dimensions for the proposed 1.75 MVA and 10 MVA transformers. The total A-weighted sound power levels of the transformers were determined using the NEMA rating and the transformer dimensions, assuming the sound level ratings apply at the distance of 0.3 m from the transformer. The shape of the octave band spectrum for the transformers was based on established engineering prediction methods [3].

The inverter sound levels, NEMA sound ratings, drawings, and details of the prediction calculation for the transformers and inverter collection houses are included in Appendix C.

Sound levels of the HVAC unit were based on measured sound data on file by HGC Engineering.

The sound power levels for the sources outlined above were used to develop the sound source inventory included as Table A1 in Appendix A, and was input to a predictive computer model (see Appendix D) to quantify the sound emissions of the facility during a predictable worst case hour of

operation. As outlined in Section 2, the facility can operate throughout both daytime and nighttime hours. Therefore, for the purposes of this assessment, all sources were assumed to operate 24 hours per day, seven days per week.

4 POINT OF RECEPTION SUMMARY

The twenty-six points of reception included in this assessment are marked as locations R01 through R26 in Figure 2. These locations represent the most impacted point of reception on each noise sensitive land use within 1000 metres of the equipment at the proposed site. Typically, these locations are upper storey windows of existing residential dwellings, outdoor amenity areas associated with dwellings, or locations on vacant lots where a dwelling would be reasonably expected in the future based on the typical building pattern in the area.

The selected points of reception are described briefly in Table A3, the Acoustic Assessment Summary Table.

5 ASSESSMENT CRITERIA

The applicable sound level limits for the purposes of this assessment were established in accordance with the environmental noise guideline NPC-300 [4]. The details by which the applicable sound level limits were established for the assessment of this facility are provided in Appendix E. For the purposes of this assessment, the applicable sound level criterion at all locations is 40 dBA. This limit is also included in Table A3 of Appendix A.

Some types of sound have a special quality which may tend to increase their audibility and potential for disturbance or annoyance. For tonal sound, MOE guidelines [5] stipulate that a penalty of 5 dBA is to be added to the measured source level. A tonal sound is defined as one which has a “pronounced audible tonal quality such as a whine, screech, buzz or hum”. A/C transformers and inverters typically exhibit a humming character at twice the line frequency (120 Hz) and harmonics thereof, as a result of magnetostrictive forces in the windings and semiconductors. In the subsequent analysis, a tonal penalty has been applied to the sounds of all inverters and transformers.

6 IMPACT ASSESSMENT

The predictive analysis indicates that the sound levels will be in the range of 20 to 38 dBA at all key points of reception, which are within the applicable sound level limit.

The results of the analysis are summarized in Table A3 and are shown graphically in Figure 4. Details of the prediction methods are summarized in Appendix D, and sample calculation results are included as Appendices F and G.

7 CONCLUSIONS

The acoustical analysis indicates that the predicted sound levels of the Vandorp Solar Farm will be within the applicable sound level limits specified in MOE guideline NPC-300, during all hours of the day and night, under typical “predictable worst case” operating conditions at all identified off-site receptor locations.

REFERENCES

1. Ontario Ministry of Environment Publication NPC-233, *Information to be Submitted for Approval of Stationary Sources of Sound*, October, 1995.

2. Ontario Ministry of Environment Guide, *Supporting Information for the Preparation of an Acoustic Assessment Report*, November 2003.

3. Crocker, Malcolm, J., Sound *Power Level Predictions for Industrial Machinery*, In Encyclopedia of Acoustics (Vol. 2, pp. 1049 - 1057), John Wiley & Sons, Inc., 1997.

4. Ontario Ministry of the Environment Publication NPC-300, *Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning*, August, 2013.

5. Ontario Ministry of the Environment Publication NPC-104, *Sound Level Adjustments*, August, 1978.

6. International Organization for Standardization, *Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation*, ISO-9613-2, Switzerland, 1996.

7. Google Maps Aerial Imagery, Internet Application: *maps.google.com*

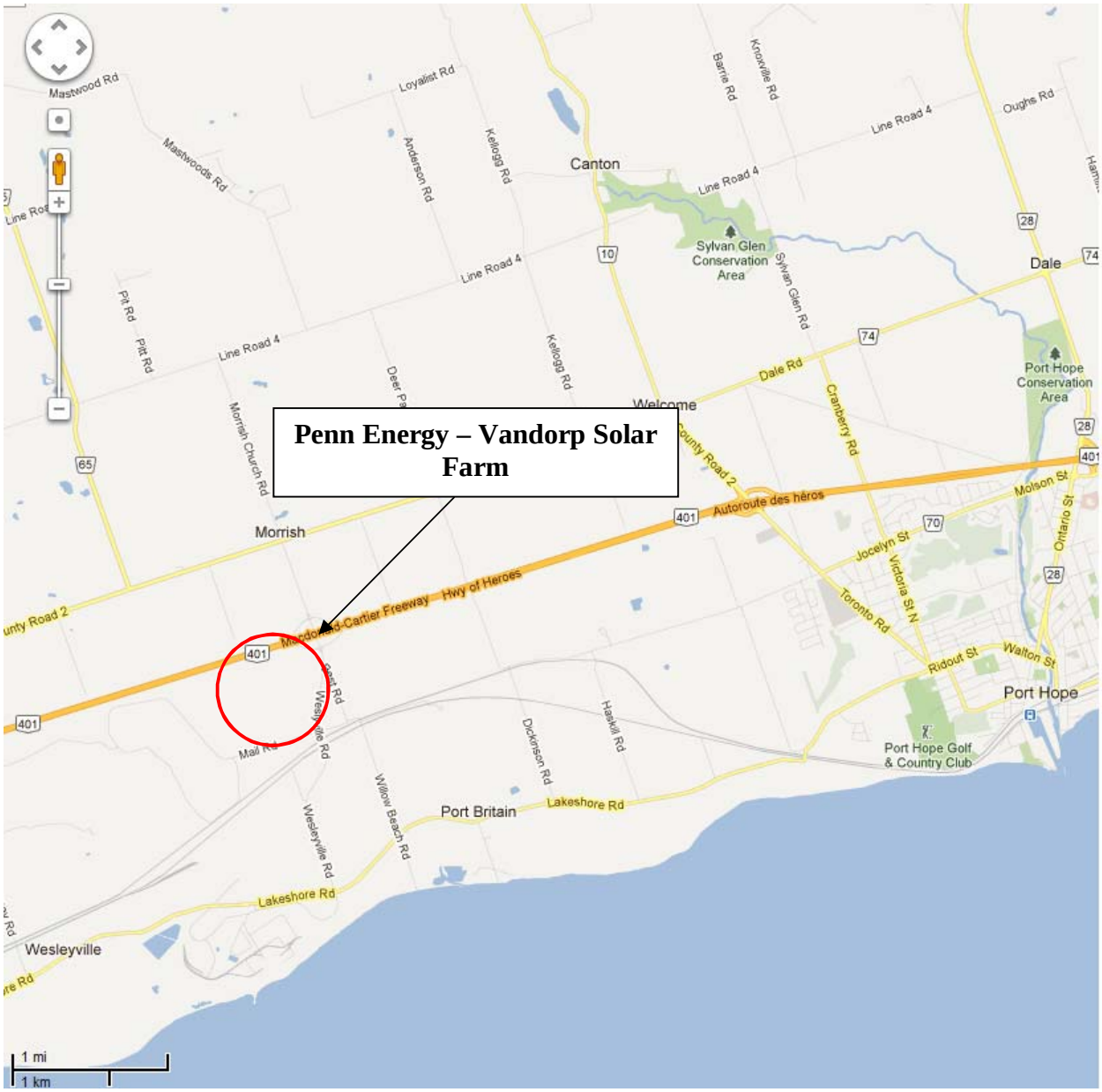


Figure 1: Location Map

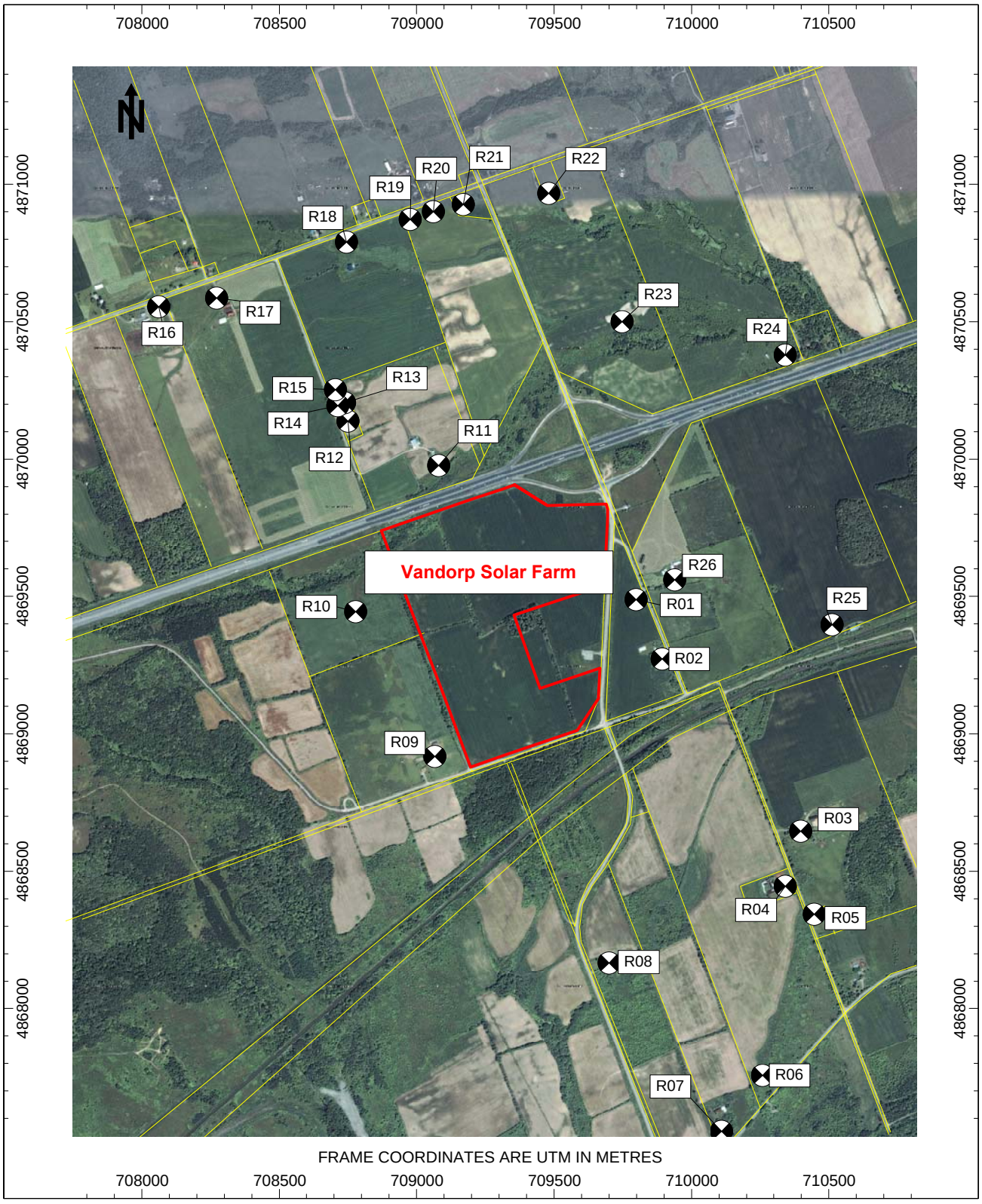


Figure 2: Locations of Points of Reception
Vandorp Solar Farm

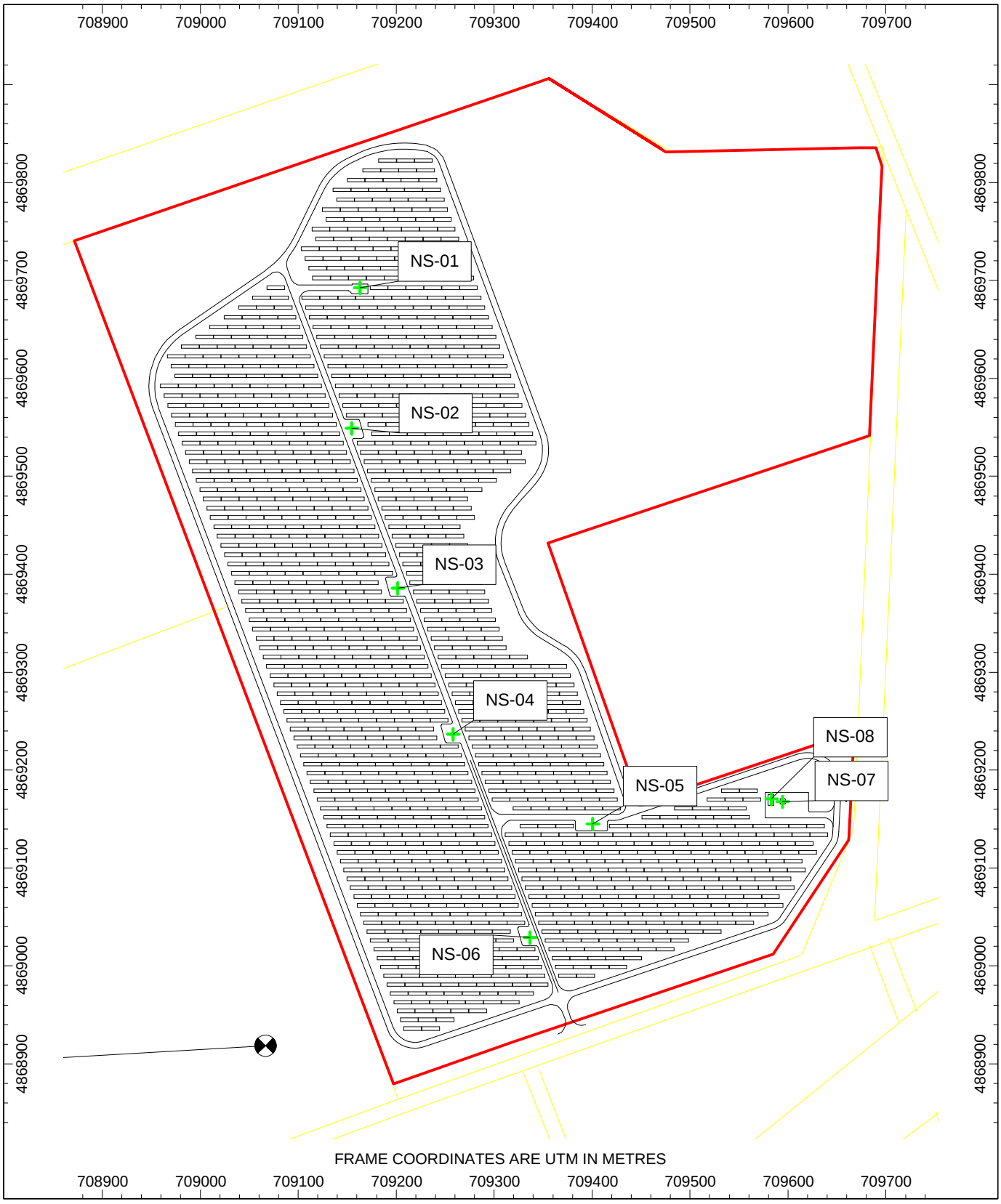


Figure 3: Locations of Sound Sources
Vandorp Solar Farm

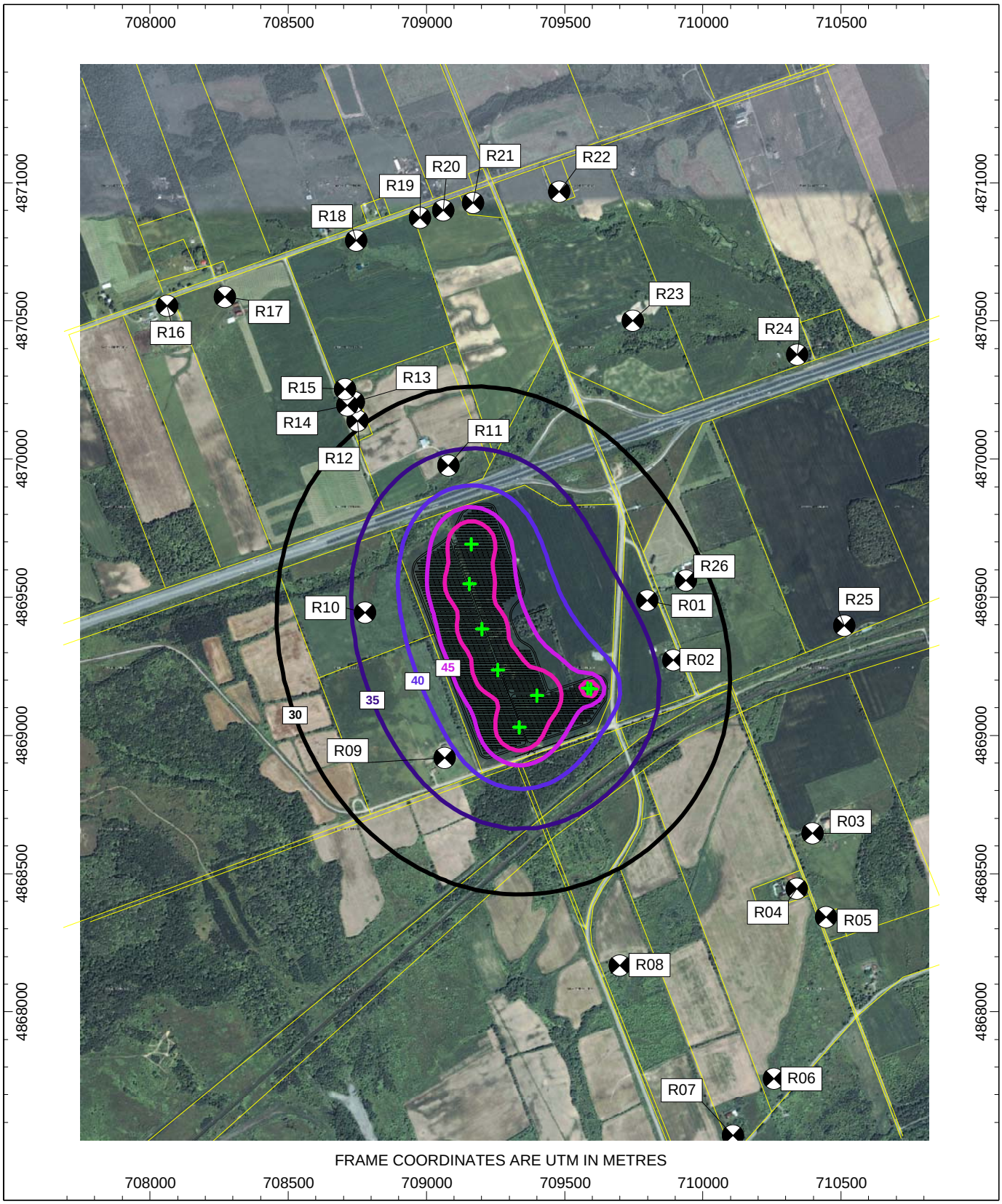


Figure 4: Sound Level Contours Leq (dBA)
Predicted at 4.5 m Above Grade
Vandorp Solar Farm

APPENDIX A

Acoustic Assessment Summary Tables

ACOUSTIC ASSESSMENT SUMMARY TABLES
VERSION CONTROL

Penn Energy – Vandorp Solar Plant
Highway 401 at Wesleyville/Morrish Church Road, Municipality of Port Hope, County of Northumberland, Ontario

Ver.	Date	Issued as Part of AAR?	Version Description	Prepared By
1.0	3-May-12	Y	Original version of tables as part of Ver. 1 of Acoustic Assessment Report	P. Chocensky
2.0	13-Jun-12	Y	Original version of tables as part of Ver. 2 of Acoustic Assessment Report	P. Chocensky
3.0	20-Feb-13	Y	Original version of tables as part of Ver. 3 of Acoustic Assessment Report	P. Chocensky
4.0	7-Mar-13	Y	Original version of tables as part of Ver. 4 of Acoustic Assessment Report	P. Chocensky
5.0	13-Mar-13	Y	Original version of tables as part of Ver. 5 of Acoustic Assessment Report	P. Chocensky
6.0	6-Aug-13	Y	Original version of tables as part of Ver. 6 of Acoustic Assessment Report	P. Chocensky
7.0	27-Nov-13	Y	Original version of tables as part of Ver. 7 of Acoustic Assessment Report	P. Chocensky

Table A1: Noise Source Summary Table

Source ID	Source Description	UTM Coordinates [m]		Sound Power Level [dBA re 10^-12 W]	Source Location	Sound Characteristic	Noise Control Measure
		Easting	Northing				
NS-01	Inverter House	709163	4869692	100	O	S, T	U
NS-02	Inverter House	709155	4869549	100	O	S, T	U
NS-03	Inverter House	709202	4869386	100	O	S, T	U
NS-04	Inverter House	709258	4869236	100	O	S, T	U
NS-05	Inverter House	709401	4869145	100	O	S, T	U
NS-06	Inverter House	709336	4869029	100	O	S, T	U
NS-07	Transformer 10 MVA	709594	4869168	92	O	S, T	U
NS-08	HVAC	709583	4869171	83	O	S	U

Legend

Sound Characteristics
S: Steady
Q: Quasi-steady impulsive
I: Impulsive
B: Buzzing
T: Tonal (+5 dBA penalty applied)
C: Cyclically varying
O: Occasional

Noise Control Measures
S: Silencer, Acoustic Louvre, Muffler
A: Acoustic Lining, Plenum
B: Barrier, Berm, Screening
L: Lagging (Acoustical Wrapping)
E: Acoustic Enclosure
O: Other
U: Currently Uncontrolled

Source Location
O: Outdoors
I: Indoors

Table A2: Point of Reception Noise Impact Table

Source ID	Source Name	Point of Reception									
		R01		R02		R03		R04		R05	
		Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]
NS-01	Inverter House	668	24	842	22	1619	13	1716	13	1862	12
NS-02	Inverter House	647	25	788	22	1537	14	1621	13	1768	12
NS-03	Inverter House	606	26	700	24	1407	15	1477	15	1624	13
NS-04	Inverter House	596	26	636	25	1284	16	1341	16	1487	15
NS-05	Inverter House	526	27	509	28	1116	18	1172	18	1318	16
NS-06	Inverter House	651	25	608	26	1129	18	1162	18	1305	16
NS-07	Transformer 10 MVA	380	29	316	30	959	19	1039	18	1186	17
NS-08	HVAC	384	19	326	21	970	10	1050	9	1196	8

Source ID	Source Name	Point of Reception									
		R06		R07		R08		R09		R10	
		Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]
NS-01	Inverter House	2224	9	2340	9	1618	14	780	22	458	29
NS-02	Inverter House	2105	10	2213	9	1487	15	637	25	391	31
NS-03	Inverter House	1941	11	2045	10	1317	16	486	28	428	30
NS-04	Inverter House	1786	12	1887	12	1158	18	371	32	523	27
NS-05	Inverter House	1632	13	1743	13	1023	19	403	31	691	24
NS-06	Inverter House	1571	14	1666	13	936	20	291	35	696	24
NS-07	Transformer 10 MVA	1559	14	1695	13	1007	19	584	24	862	20
NS-08	HVAC	1567	5	1702	4	1011	10	574	15	850	11

Source ID	Source Name	Point of Reception									
		R11		R12		R13		R14		R15	
		Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]
NS-01	Inverter House	296	35	607	26	667	24	673	24	723	23
NS-02	Inverter House	433	30	714	24	778	23	781	22	834	22
NS-03	Inverter House	603	26	877	21	942	20	944	20	999	20
NS-04	Inverter House	761	23	1034	19	1100	18	1101	18	1157	18
NS-05	Inverter House	891	21	1187	17	1251	17	1253	17	1308	16
NS-06	Inverter House	981	20	1254	17	1320	16	1321	16	1377	16
NS-07	Transformer 10 MVA	958	19	1286	16	1346	16	1352	15	1402	15
NS-08	HVAC	949	10	1276	7	1336	6	1342	6	1393	6

Source ID	Source Name	Point of Reception									
		R16		R17		R18		R19		R20	
		Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]
NS-01	Inverter House	1398	15	1262	17	1175	18	1195	17	1213	17
NS-02	Inverter House	1484	15	1362	16	1307	16	1335	16	1355	16
NS-03	Inverter House	1632	13	1519	14	1477	15	1504	14	1522	14
NS-04	Inverter House	1779	12	1671	13	1636	13	1661	13	1676	13
NS-05	Inverter House	1943	11	1830	12	1771	12	1779	12	1789	12
NS-06	Inverter House	1987	11	1886	12	1858	12	1879	12	1892	11
NS-07	Transformer 10 MVA	2066	10	1939	11	1831	12	1814	12	1813	12
NS-08	HVAC	2056	1	1929	2	1823	3	1807	3	1807	3

Source ID	Source Name	Point of Reception									
		R21		R22		R23		R24		R25	
		Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]	Dist [m]	LEQ [dBA]
NS-01	Inverter House	1234	17	1314	16	997	20	1364	16	1380	16
NS-02	Inverter House	1377	16	1455	15	1120	18	1448	15	1365	16
NS-03	Inverter House	1541	14	1606	14	1241	17	1512	14	1310	16
NS-04	Inverter House	1692	13	1745	13	1355	16	1575	14	1263	17
NS-05	Inverter House	1796	12	1824	12	1399	15	1552	14	1139	18
NS-06	Inverter House	1904	11	1944	11	1527	14	1683	13	1231	17
NS-07	Transformer 10 MVA	1809	12	1803	12	1341	16	1423	15	945	19
NS-08	HVAC	1803	3	1799	3	1339	6	1426	6	955	10

Source ID	Source Name	Point of Reception	
		R26	
		Dist [m]	LEQ [dBA]
NS-01	Inverter House	787	22
NS-02	Inverter House	785	22
NS-03	Inverter House	758	23
NS-04	Inverter House	754	23
NS-05	Inverter House	680	24
NS-06	Inverter House	804	22
NS-07	Transformer 10 MVA	522	26
NS-08	HVAC	528	16

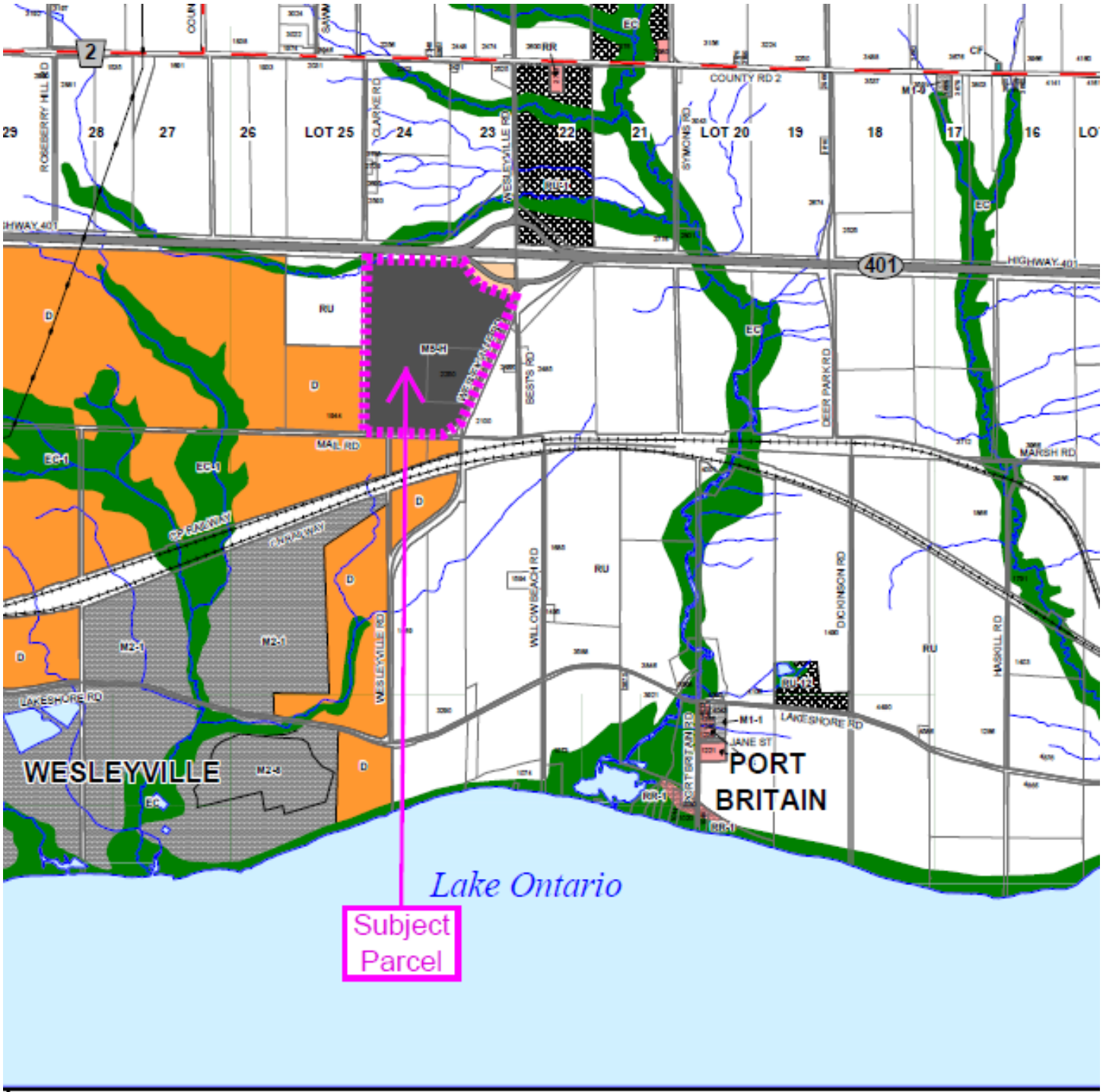
Note: Reported sound levels include all adjustment factors (time weighting, tonal penalty), as applicable.

Table A3: Acoustic Assessment Summary Table

Point of Reception	Point of Reception Description	UTM Coordinates [m]		Sound Level at Point of Reception, LEQ [dBA]	Verified by Acoustic Audit	Performance Limit, LEQ [dBA]	Compliance with Performance Limit
		Easting	Northing				
R01	Residential Dwelling	709799	4869488	35	No	40	Yes
R02	Residential Dwelling	709893	4869273	35	No	40	Yes
R03	Residential Dwelling	710398	4868645	25	No	40	Yes
R04	Residential Dwelling	710341	4868444	25	No	40	Yes
R05	Residential Dwelling	710446	4868343	23	No	40	Yes
R06	Vacant Lot	710258	4867757	21	No	40	Yes
R07	Residential Dwelling	710109	4867552	20	No	40	Yes
R08	Residential Dwelling	709700	4868167	26	No	40	Yes
R09	Residential Dwelling	709067	4868918	38	No	40	Yes
R10	Vacant Lot	708778	4869445	36	No	40	Yes
R11	Residential Dwelling	709080	4869976	37	No	40	Yes
R12	Residential Dwelling	708751	4870138	30	No	40	Yes
R13	Residential Dwelling	708737	4870205	29	No	40	Yes
R14	Residential Dwelling	708714	4870194	29	No	40	Yes
R15	Residential Dwelling	708705	4870252	28	No	40	Yes
R16	Residential Dwelling	708062	4870554	21	No	40	Yes
R17	Residential Dwelling	708272	4870586	22	No	40	Yes
R18	Residential Dwelling	708745	4870791	23	No	40	Yes
R19	Residential Dwelling	708976	4870873	23	No	40	Yes
R20	Vacant Lot	709060	4870901	23	No	40	Yes
R21	Residential Dwelling	709169	4870926	23	No	40	Yes
R22	Residential Dwelling	709481	4870967	22	No	40	Yes
R23	Vacant Lot	709747	4870500	25	No	40	Yes
R24	Residential Dwelling	710342	4870378	23	No	40	Yes
R25	Vacant Lot	710511	4869396	26	No	40	Yes
R26	Residential Dwelling	709939	4869561	32	No	40	Yes

APPENDIX B

Zoning Maps



LEGEND

RU - Rural	M1 - Rural Industrial	HR1 - Hamlet Residential 1	C1 - Highway Commercial
RR - Rural Residential	M2 - General Industrial	HR1-1 - Hamlet Residential 1 Exception One	C2 - Recreational Commercial
OS - Open Space	M3 - Extractive Industrial	HR2 - Hamlet Residential 2	C3 - Hamlet Commercial
D - Development	M4 - Waste Disposal Industrial	ER - Estate Residential	ORM-ENV - Oak Ridges Moraine Environmental Zone
EC - Environmental Constraint	M5 - Prestige Industrial/Commercial	CF - Community Facility	ORM-C - Oak Ridges Moraine Core Zone

APPENDIX C

Equipment Sound Data

Acoustic Environmental Test

SC 800CP-US central inverter

(Extract of Test report SC800CP-US-91:LE1613)

1 Overview

Project title:	SC800CP-US
Type of test / thresholds and requirements:	Sound level measurement according to DIN EN ISO 3744:2011-02 and DIN EN ISO 9614-2:2010-11 of sinusoidal, irregularly shaped, transient signals. Classification of ambient conditions in compliance with the German Noise Control Guidelines (TA Lärm). (according to Section 2)
Type of device:	e.g. solar central inverter for large-scale PV power plants
Type designation:	SC800CP-US
Test specification:	Level of emissions according to the German Noise Control Guidelines and acoustic power

2 Results

The EN 3744:04/2005 and German Noise Control Guidelines form the testing specification for the thresholds and requirements	Requirement		Results [dBA]/ without fan (distance 1m)	Results [dBA]/ with fan (distance 1m)
	Standard (Germany)	SMA		
EN 3744:2011-02 typical value; LAeq averaged [1]	-	-	-	78,74
§48 of the German Federal Emission Control ACT (BImSchG): 09-2002 German Noise Control Guidelines; L_{pa} [2]	-	-	-	77,81
EN 9614-2 sound power L_{WA} [3]	-	-	-	92,30
Sound pressure level in 10m L_{xpA} [4]	-	-	-	64,31
Sound pressure level in 50m L_{xpA} [4]	-	-	-	50,32
Overall result (if applicable)			*Standard requirments: - passed	

* Dependent on the local conditions at the mounting location (distance of 10m standard)

3 Operating States

The following states and configurations have been defined as operating conditions:

- Operation of the inverter.
- Operating conditions: UDC =820 V; 800 kW
- The device fans must be running.
- The unit under test must have reached its operating temperature.
- The unit under test must have reached an operating temperature of 25°C.

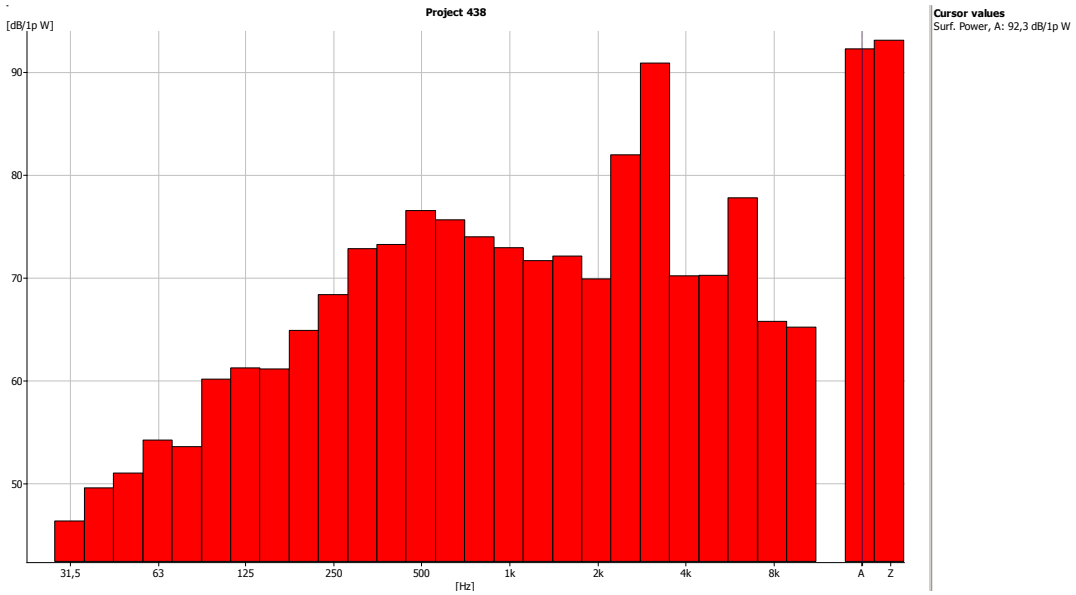
4 Calculating the Acoustic Power

L_{pA} =	average sound pressure level on the measurement surface [dB_A] *	77.81
S =	overall measurement surface [m^2]	28.09
S_0 =	1 [m^2]	

* This specified spatially/temporally averaged sound pressure level was determined using the calcu-lated acoustic power level.
$L_{PA} = L_{WA} - 10\log (S/S_0)$

Acoustic power of L_{WA}= 92,3 dBA/W results for the measurement.

Acoustic Power Levels of the Third Octave Band Frequencies According to EN ISO 9614-2



A-rated sound power = 92.3 $dB_{A/W}$

Z-rated sound power = 93.1 $dB_{A/W}$

A-rated acoustic power – based on physiologic human hearing

Z-rated acoustic power – technically linear measured value

5 Overview of the Acoustic Power

Third octave band center frequency [Hz]	Acoustic power- level LwA [dBA/pW] 880 kW	Acoustic power- level LwZ [dBA/pW] 880 kW
25 Hz	42,33	–
31.5 Hz	46,34	–
40 Hz	49,56	–
50 Hz	51	–
63 Hz	54,21	–
80 Hz	53,57	–
100 Hz	60,14	–
125 Hz	61,23	–
160 Hz	61,13	–
200 Hz	64,88	–
250 Hz	68,36	–
315 Hz	72,83	–
400 Hz	73,24	–
500 Hz	76,54	–
630 Hz	75,64	–
800 Hz	73,99	–
1 kHz	72,93	–
1.25 kHz	71,67	–
1.6 kHz	72,11	–
2 kHz	69,89	–
2.5 kHz	81,96	–
3.15 kHz	90,89	–
4 kHz	70,19	–
5 kHz	70,24	–
6.3 kHz	77,78	–
8 kHz	65,76	–
10 kHz	65,2	–
Acoustic power above the surface	A-rated	Z-rated
	92,3	93.1

6 Deriving the Emission Sound Pressure Level at a Distance

The calculated acoustic power can be used to derive an A-rated sound pressure level L_{xpA} for undirected sources at any distance x.

$$LxpA = LwA + Ko - 10 \cdot \log\left(4 \cdot \pi \cdot \frac{X^2}{So}\right)$$

K_0 = solid angle index on the floor 3 [dB]
X = distance from the source [m]
S_0 = 1 m

Device	Distance X [m]	Sound pressure level LxpA [dBA] without fan	Sound pressure level LxpA [dBA] with fan
SC800CP-US	10	–	64,30
	50	–	50.33

7 Appendix - Calculations

deriving sound pressure level at a distance

LxpA = LWA + K0 - 10log (4*PI*(x^2/S0))

LWA 92,3dB
K0 3dB
x 10m
S0 1m

LxpA 64,31dBA

Transformer 10 MVA													
NEMA (Nr):	68									MVA Rating: 10			
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A	Surface area [m^2]: 58.3	Length [m]	Width [m]	Height [m]
Correction*	3	5	0	0	-6	-11	-16	-23		10*logS: 17.7	3.4	4.4	2.775
Lw [dB]	89	91	86	86	80	75	70	63	86				

Transformer 1.75 MVA													
NEMA (Nr):	61									MVA Rating: 1.75			
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A	Surface area [m^2]: 32.3	Length [m]	Width [m]	Height [m]
Correction*	3	5	0	0	-6	-11	-16	-23		10*logS: 15.1	2.4	2.85	2.425
Lw [dB]	79	81	76	76	70	65	60	53	76				

*based on *Crocker, Malcolm, J., Sound Power Level Predictions for Industrial Machinery, In Encyclopedia of Acoustics (Vol. 2, pp. 1049 - 1057), John Wiley & Sons, Inc., 1997*

Inverter Collection House Lw										
	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A	
Inverter 1 (800 kW)	84	82	83	83	78	81	90	79	92	Based on test report provided by manufacturer
Inverter 2 (800 kW)	84	82	83	83	78	81	90	79	92	Based on test report provided by manufacturer
Transformer 1.75 MVA	79	81	76	76	70	65	60	53	76	Predicted as above
Total Collection House [dB]	88	86	86	86	81	84	93	82	95	

Note: The above data does not include adjustments for tonality

Substation Transformers

COOPER Power Systems

Electrical Apparatus

210-15

Unit Type Substation Transformers

GENERAL

Cooper Power Systems Unit Type Substation Transformers are designed to meet customer specifications.

Flexibility in design, combined with the highest quality manufacturing processes, equipment, and testing procedures enable Cooper Power Systems to provide a product optimized to the customer's requirements. All units meet applicable American National Standards Institute (ANSI®), Institute of Electrical and Electronics Engineers, Inc. (IEEE®)and National Electrical Manufacturers Association (NEMA) standards, as well as National Electric Code® (NEC®), Department of Energy (DOE) and Canadian Electricity Association (CEA) specifications.

Unit type substation transformers are available with enclosed sidewall-mounted bushings for connections to primary and/or secondary switchgear.

Substation transformers are made with a wide range of core steels and winding conductors to optimize efficiency versus cost. Flexible core/coil and tank construction enable your dimensional requirements to be met.

Cooper Power Systems transformers are available with our patented Envirotemp FR3 fluid, a less-flammable and bio-degradable fluid or electrical grade mineral insulating oil. Unit type substation transformers intended for indoor use are solely filled with Envirotemp FR3 fluid. Electrical codes recognize the advantages of using Envirotemp FR3 fluid both indoors and outdoors for fire sensitive applications. Envirotemp FR3 fluid-filled units meet Occupational Safety and Health Administration (OSHA) and Section 450.23, 2008 NEC requirements.

Figure 1.
Unit type substation transformer equipped with low-voltage transition flange and high-voltage full height air terminal chamber.

PRODUCT SCOPE

Type	Three-Phase or Single-Phase, 50 or 60 Hz, 65 ºC (55 ºC/65 ºC, 75 ºC Optional)
Fluid Type	Envirotemp FR3 fluid or Mineral Oil (upon special request)
Size	Three-Phase: 300 – 12,000 kVA
	Single-Phase: 500 – 6667 kVA
Primary Voltage	2400 – 46,000 V
Secondary Voltage	208Y/120 V to 24,940 V Wye
Specialty Designs	Inverter/Rectifier Bridge
	Zig Zag
	K-Factor (up to K-19)
	Hazardous Location (Class 1 Div 2)
	Internal Circuit Breaker (VFI)
	UL Listed & Labeled/ Classified
	Factory Mutual (FM) Approved
	Solar/Wind Designs
	Differential Protection
	Automation Solutions

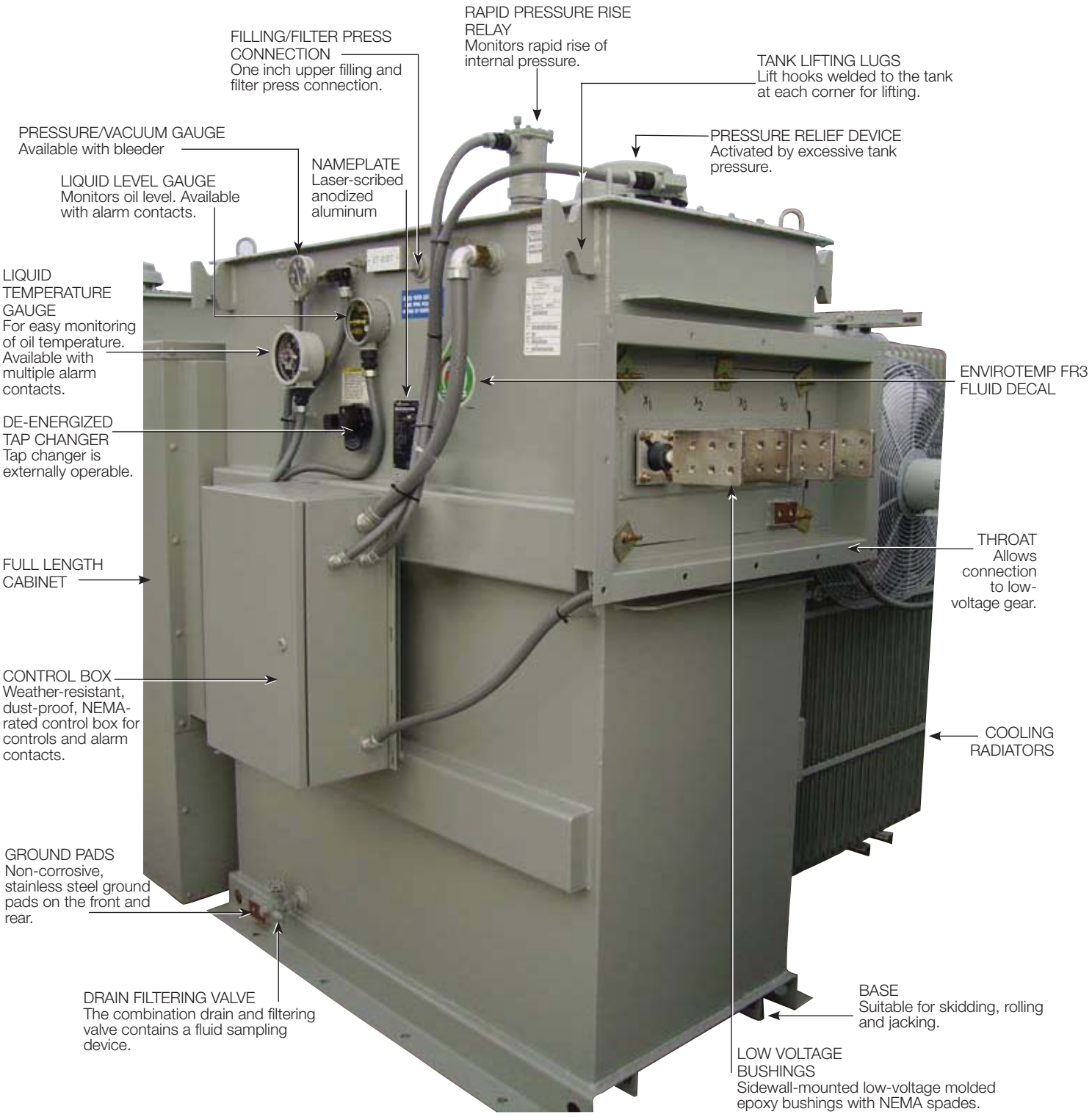


Figure 2.
Unit type substation transformer with standard features and optional accessories.

TABLE 1
Three-Phase, Single Temperature kVA Ratings

Three-Phase kVA Self-Cooled and Forced-Air Cooled with 65 ºC Temperature Rise		
65 ºC Rise KNAN		65 ºC Rise KNAN/ KNAF
500	+15%	575
750		863
1000		1150
1500		1725
2000		2300
2500	+25%	3125
3750		4688
5000		6250
7500		9375
10000		12500
12000	+33%	16000

TABLE 4
Three-Phase, Dual or Triple Temperature kVA Ratings

Three-Phase kVA Self-Cooled and Forced-Air Cooled with Triple Rated 55 ºC/65 ºC/75 ºC Temperature Rise							
55 ºC Rise KNAN		65 ºC Rise KNAN		75 ºC Rise KNAN	55 ºC Rise KNAN/ KNAF	65 ºC Rise KNAN/ KNAF	75 ºC Rise KNAN/ KNAF
500	+12%	560	+9%	610	575	644	702
750		840		916	863	966	1053
1000		1120		1221	1150	1288	1404
1500		1680		1831	1725	1932	2106
2000		2240		2442	2300	2576	2808
2500		2800		3052	3125	3500	3815
3750		4200		4578	4688	5250	5723
5000		5600		6104	6250	7000	7630
7500		8400		9156	9375	10500	11445
10000		11200		12208	12500	14000	15260
12000		13440		14650	16000	17920	19533

TABLE 2
Percentage Impedance Voltage[1]

kV BIL Class	Low Voltage	
	< 2400V	≥ 2400V
45-150	5.75[2]	6.5[3]
200	7.25	7
250	7.75	7.5

1 The standard tolerance is ± 7.5%.
2 Option for 6.75% is available.
3 Option for 5.50% is available.

TABLE 3
Audible Sound Levels

Self-Cooled, Two Winding kVA Rating	NEMA Average	
	dB, KNAN	dB, KNAF
500	56	67
501-700	57	67
701-1000	58	67
1001-1500	60	67
1501-2000	61	67
2001-2500	62	67
2501-3000	63	67
3001-4000	64	67
4001-5000	65	67
5001-6000	66	68
6001-7500	67	70
7501-10000	68	71
12500	69	71

TABLE 5
Insulation Test Levels

kV Class	Induced Test 180 or 400 Hz-7200 Cycle	kV BIL		Applied Test 60Hz (kV)
		Distribution	Power	
1.2	TWICE RATED VOLTAGE	30	45	10
2.5		45	60	15
5		60	75	19
8.7		75	95	26
15		95	110	34
25 (Grd Y Only)		125	150	40
25		150	150	50
34.5 (Grd Y Only)		125	150	50
34.5		150	200	70
46		200	250	95

TABLE 6
Temperature Rise Ratings 0 - 3300 feet (0-1000 meters)

	Standard	Optional
Unit Rating	65 ºC	55/65 ºC, 75 ºC
Ambient Temperature Rise	40 ºC	40 ºC
Ambient Temperature 24 Hour Av.	30 ºC	30 ºC
Temperature Rise Winding[1]	65 ºC	55 ºC
Temperature Rise Hotspot	80 ºC	65 ºC

1 Average Rise by resistance. Refer to ANSI/IEEE Std C57.12.00™ standard.
NOTE: Derate kVA by 0.4% for each 100 M (330 ft.) that the altitude is above 1000 M (3300 ft.)

TABLE 7
Fluid-Filled - Aluminum Windings 55/65 °C Rise[1]

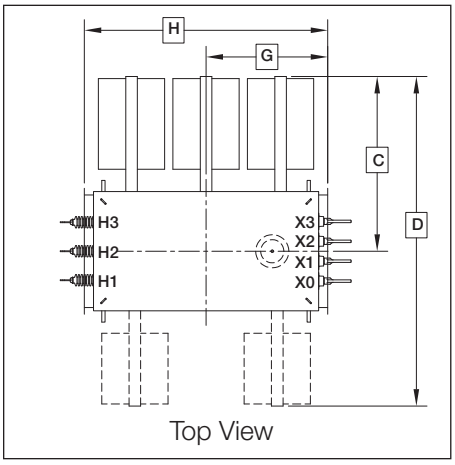
kVA	Drawing Dimensions (in.)									Gallons Of Fluid	Approx. Total Weight (lbs.) (With Fluid)
	A	B	C	D	E	F	G	H	J		
500	66	51	26	52	45	45	30	60	35	300	5600
750	75	59	26	52	55	55	34	68	35	360	7000
1000	75	67	26	52	55	55	38	76	35	420	8400
1500	75	59	59	80	55	55	34	68	35	400	9500
2000	85	67	67	90	55	55	38	76	39	520	12000
2500	85	75	68	92	55	55	42	84	41	570	14600
3750	85	75	70	120	65	65	42	84	45	790	20500
5000	99	87	72	144	65	65	48	96	49	1050	26000
7500	99	95	74	148	75	75	52	104	53	1320	35000
10,000	99	103	76	152	75	75	56	112	57	1740	43000
12,000	99	103	82	164	75	75	56	112	61	1850	49000

[1] Weights, gallons of fluid and dimensions are for reference only, and not for construction. Please contact Cooper Power Systems for exact dimensions

TABLE 8
Fluid-Filled - Copper Windings 55/65 °C Rise[1]

kVA	Drawing Dimensions (in.)									Gallons Of Fluid	Approx. Total Weight (lbs.) (With Fluid)
	A	B	C	D	E	F	G	H	J		
500	66	51	26	52	45	45	30	60	35	310	5900
750	75	59	26	52	55	55	34	68	35	370	7400
1000	75	67	26	52	55	55	38	76	35	430	8800
1500	75	59	59	80	55	55	34	68	35	420	10000
2000	85	63	67	90	55	55	36	72	39	500	12800
2500	85	67	68	92	55	55	38	76	41	590	14900
3750	85	75	70	120	65	65	42	84	45	830	21500
5000	99	87	72	144	65	65	48	96	49	1090	28000
7500	99	95	74	148	75	75	52	104	53	1360	37000
10,000	99	103	76	152	75	75	56	112	57	1780	45000
12,000	99	103	82	164	75	75	56	112	61	1880	50000

[1] Weights, gallons of fluid and dimensions are for reference only, and not for construction. Please contact Cooper Power Systems for exact dimensions



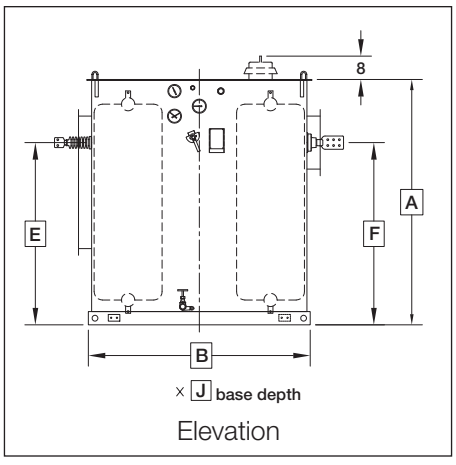


Figure 3.
High-Voltage left (Segment 2) shown. High-Voltage right (Segment 4) also available.

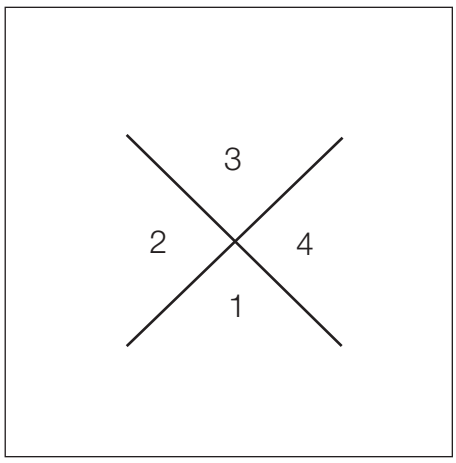


Figure 4.
ANSI segment designation.

APPENDIX D

Details of Predictive Acoustical Modelling

The predictive model used for this Assessment (*Cadna-A version 4.3.143*) is based on the methods from ISO Standard 9613-2.2 "Acoustics - Attenuation of Sound During Propagation Outdoors" [6], which accounts for reduction in sound level with distance due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures (or by topography and foliage where applicable). This modeling technique is acceptable to the MOE.

The site and the surrounding area were conservatively modelled as flat ground, although observations during the January 23, 2012 site visit by HGC Engineering indicated minor terrain features in the area surrounding the site. Topographical data for the subject site and surrounding area were obtained from the proponent and incorporated into the predictive analysis. Ground attenuation was assumed to be spectral for all sources, with the ground factor (G) assumed to be 0.7 in all areas. The temperature and relative humidity were assumed to be 10° C and 70%, respectively.

The predictive modelling considered one order of reflection, with both on-site and off-site shielding/reflections afforded by buildings, walls, etc., with spectral absorptive characteristics applied to structures as appropriate. No credit has been assumed in the model for self-shielding of the sources on site by the arrays of solar panels themselves. In this regard the predictions are conservative (i.e. may tend to overpredict the sound levels slightly).

All mechanical sources were modeled as point sources of sound and are shown as crosses in Figures 3 and 4.

APPENDIX E

Acoustic Assessment Criteria

The MOE Publication NPC-300 [4] draws a distinction between sound produced by traffic sources and that produced by industrial or commercial activities, which are classified as *stationary sources*. According to NPC-300, sound level limits for stationary sources apply at noise sensitive points of reception, and are set as the higher of either the applicable exclusion limit, or the minimum background sound level that occurs during the time period corresponding to the operation of the source under assessment.

Although the area surrounding the site is best characterized as a Class 2 acoustic environment, under MOE noise assessment guidelines, a number of points of reception are located in a Class 3 area. For conservatism, all receptor locations were assessed in regards to the sound level limits applicable to the Class 3 areas.

The exclusion limits applicable to Class 3 areas, and consequently to the Vandorp Solar Farm, are outlined in the table below.

Table E1: Exclusion Limits in Class 3 Areas, L_{EQ} [dBA]

	Daytime (07:00 – 19:00)	**Evening (19:00 – 23:00)**	**Nighttime (23:00 – 07:00)**
Outdoor Points of Reception	45	40	--
Plane of Window of Noise Sensitive Spaces	45	40	40

The background sound is typically dominated by road traffic, except in areas well removed from the activities of people. The background sound levels can be determined through automated long-term measurement, or by predictive analysis based on road traffic volume counts, in cases where the background sound is dominated by road traffic.

Observations and measurements during the site visit by HGC Engineering suggest that background sound levels in the area are likely to fall below the exclusion limits during some hours of the day, evening or night. Given that the equipment at the subject facility will be energized throughout the day, evening and night with steady sound emissions when daylight conditions allow, the most stringent limit of 40 dBA in the table above is the applicable sound level criterion for the purposes of this assessment.

APPENDIX F

Sample Calculation Results - Condensed, Overall dBA Format

In the following tables of calculation results, the column headings for the various sound attenuation mechanisms follow the terminology of ISO Standard 9613-2. Lx is the A-weighted, one-hour energy-equivalent (or logarithmic-mean impulse) source sound power level, which includes the effects of any source-abatement measures included in the model, and any time-averaging effects for intermittent sources. Lr is the A-weighted, one-hour energy-equivalent (or logarithmic-mean impulse) sound level at the point of reception. The results are presented in terms of overall A-weighted results, at the most impacted off-site point of reception.

R01	Residential Dwelling	709799	4869488	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	67.5	0	0.0	-0.8	0.0	9.3	0.0	0.0	0.0	0.0	24
NS-02	Inverter House	709155	4869550	2.3	100	67.2	0	0.0	-0.8	0.0	9.2	0.0	0.0	0.0	0.0	25
NS-03	Inverter House	709202	4869386	2.3	100	66.7	0	0.0	-0.8	0.0	9.0	0.0	0.0	0.0	0.0	26
NS-04	Inverter House	709258	4869237	2.3	100	66.5	0	0.0	-0.8	0.0	8.9	0.0	0.0	0.0	0.0	26
NS-05	Inverter House	709401	4869145	2.3	100	65.4	0	0.0	-0.8	0.0	8.5	0.0	0.0	0.0	0.0	27
NS-06	Inverter House	709336	4869029	2.3	100	67.3	0	0.0	-0.8	0.0	9.2	0.0	0.0	0.0	0.0	25
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	62.6	0	0.0	-0.3	0.0	1.2	0.0	0.0	0.0	0.0	29
NS-08	HVAC	709583	4869171	2.5	83	62.7	0	0.0	0.2	0.0	1.1	0.0	0.0	0.0	0.0	19

R02	Residential Dwelling	709893	4869273	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	69.5	0	0.0	-0.8	0.0	10.0	0.0	0.0	0.0	0.0	22
NS-02	Inverter House	709155	4869550	2.3	100	68.9	0	0.0	-0.8	0.0	9.8	0.0	0.0	0.0	0.0	22
NS-03	Inverter House	709202	4869386	2.3	100	67.9	0	0.0	-0.8	0.0	9.5	0.0	0.0	0.0	0.0	24
NS-04	Inverter House	709258	4869237	2.3	100	67.1	0	0.0	-0.8	0.0	9.1	0.0	0.0	0.0	0.0	25
NS-05	Inverter House	709401	4869145	2.3	100	65.1	0	0.0	-0.8	0.0	8.4	0.0	0.0	0.0	0.0	28
NS-06	Inverter House	709336	4869029	2.3	100	66.7	0	0.0	-0.8	0.0	9.0	0.0	0.0	0.0	0.0	26
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	61.0	0	0.0	-0.3	0.0	1.0	0.0	0.0	0.0	0.0	30
NS-08	HVAC	709583	4869171	2.5	83	61.3	0	0.0	0.3	0.0	0.9	0.0	0.0	0.0	0.0	21

R03	Residential Dwelling	710398	4868645	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	75.2	0	0.0	-0.6	0.0	12.2	0.0	0.0	0.0	0.0	13
NS-02	Inverter House	709155	4869550	2.3	100	74.7	0	0.0	-0.6	0.0	12.0	0.0	0.0	0.0	0.0	14
NS-03	Inverter House	709202	4869386	2.3	100	74.0	0	0.0	-0.6	0.0	11.7	0.0	0.0	0.0	0.0	15
NS-04	Inverter House	709258	4869237	2.3	100	73.2	0	0.0	-0.6	0.0	11.4	0.0	0.0	0.0	0.0	16
NS-05	Inverter House	709401	4869145	2.3	100	72.0	0	0.0	-0.7	0.0	10.9	0.0	0.0	0.0	0.0	18
NS-06	Inverter House	709336	4869029	2.3	100	72.1	0	0.0	-0.7	0.0	11.0	0.0	0.0	0.0	0.0	18
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	70.6	0	0.0	-0.4	0.0	2.5	0.0	0.0	0.0	0.0	19
NS-08	HVAC	709583	4869171	2.5	83	70.7	0	0.0	0.2	0.0	2.3	0.0	0.0	0.0	0.0	10

R04	Residential Dwelling	710341	4868445	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	75.7	0	0.0	-0.5	0.0	12.5	0.0	0.0	0.0	0.0	13
NS-02	Inverter House	709155	4869550	2.3	100	75.2	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-03	Inverter House	709202	4869386	2.3	100	74.4	0	0.0	-0.6	0.0	11.9	0.0	0.0	0.0	0.0	15
NS-04	Inverter House	709258	4869237	2.3	100	73.6	0	0.0	-0.6	0.0	11.6	0.0	0.0	0.0	0.0	16
NS-05	Inverter House	709401	4869145	2.3	100	72.4	0	0.0	-0.7	0.0	11.1	0.0	0.0	0.0	0.0	18
NS-06	Inverter House	709336	4869029	2.3	100	72.3	0	0.0	-0.7	0.0	11.1	0.0	0.0	0.0	0.0	18
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	71.3	0	0.0	-0.4	0.0	2.6	0.0	0.0	0.0	0.0	18
NS-08	HVAC	709583	4869171	2.5	83	71.4	0	0.0	0.3	0.0	2.4	0.0	0.0	0.0	0.0	9

R05	Residential Dwelling	710446	4868343	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	76.4	0	0.0	-0.5	0.0	12.8	0.0	0.0	0.0	0.0	12
NS-02	Inverter House	709155	4869550	2.3	100	76.0	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-03	Inverter House	709202	4869386	2.3	100	75.2	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-04	Inverter House	709258	4869237	2.3	100	74.5	0	0.0	-0.6	0.0	11.9	0.0	0.0	0.0	0.0	15
NS-05	Inverter House	709401	4869145	2.3	100	73.4	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-06	Inverter House	709336	4869029	2.3	100	73.3	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	72.5	0	0.0	-0.3	0.0	2.9	0.0	0.0	0.0	0.0	17
NS-08	HVAC	709583	4869171	2.5	83	72.6	0	0.0	0.3	0.0	2.7	0.0	0.0	0.0	0.0	8

R06	Vacant Lot	710258	4867757	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	77.9	0	0.0	-0.4	0.0	13.5	0.0	0.0	0.0	0.0	9
NS-02	Inverter House	709155	4869550	2.3	100	77.5	0	0.0	-0.5	0.0	13.3	0.0	0.0	0.0	0.0	10
NS-03	Inverter House	709202	4869386	2.3	100	76.8	0	0.0	-0.5	0.0	13.0	0.0	0.0	0.0	0.0	11
NS-04	Inverter House	709258	4869237	2.3	100	76.0	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-05	Inverter House	709401	4869145	2.3	100	75.3	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-06	Inverter House	709336	4869029	2.3	100	74.9	0	0.0	-0.6	0.0	12.1	0.0	0.0	0.0	0.0	14
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	74.9	0	0.0	-0.3	0.0	3.6	0.0	0.0	0.0	0.0	14
NS-08	HVAC	709583	4869171	2.5	83	74.9	0	0.0	0.4	0.0	3.4	0.0	0.0	0.0	0.0	5

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

R07	Residential Dwelling	710109	4867553	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	78.4	0	0.0	-0.4	0.0	13.8	0.0	0.0	0.0	0.0	9
NS-02	Inverter House	709155	4869550	2.3	100	77.9	0	0.0	-0.4	0.0	13.5	0.0	0.0	0.0	0.0	9
NS-03	Inverter House	709202	4869386	2.3	100	77.2	0	0.0	-0.5	0.0	13.2	0.0	0.0	0.0	0.0	10
NS-04	Inverter House	709258	4869237	2.3	100	76.5	0	0.0	-0.5	0.0	12.8	0.0	0.0	0.0	0.0	12
NS-05	Inverter House	709401	4869145	2.3	100	75.8	0	0.0	-0.5	0.0	12.5	0.0	0.0	0.0	0.0	13
NS-06	Inverter House	709336	4869029	2.3	100	75.4	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	75.6	0	0.0	-0.2	0.0	3.9	0.0	0.0	0.0	0.0	13
NS-08	HVAC	709583	4869171	2.5	83	75.6	0	0.0	0.4	0.0	3.6	0.0	0.0	0.0	0.0	4

R08	Residential Dwelling	709700	4868167	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	75.2	0	0.0	-0.6	0.0	12.2	0.0	0.0	0.0	0.0	14
NS-02	Inverter House	709155	4869550	2.3	100	74.4	0	0.0	-0.6	0.0	11.9	0.0	0.0	0.0	0.0	15
NS-03	Inverter House	709202	4869386	2.3	100	73.4	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-04	Inverter House	709258	4869237	2.3	100	72.3	0	0.0	-0.7	0.0	11.1	0.0	0.0	0.0	0.0	18
NS-05	Inverter House	709401	4869145	2.3	100	71.2	0	0.0	-0.7	0.0	10.7	0.0	0.0	0.0	0.0	19
NS-06	Inverter House	709336	4869029	2.3	100	70.4	0	0.0	-0.7	0.0	10.4	0.0	0.0	0.0	0.0	20
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	71.1	0	0.0	-0.4	0.0	2.6	0.0	0.0	0.0	0.0	19
NS-08	HVAC	709583	4869171	2.5	83	71.1	0	0.0	0.2	0.0	2.4	0.0	0.0	0.0	0.0	10

R09	Residential Dwelling	709067	4868919	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	68.8	0	0.0	-0.8	0.0	9.8	0.0	0.0	0.0	0.0	22
NS-02	Inverter House	709155	4869550	2.3	100	67.1	0	0.0	-0.8	0.0	9.2	0.0	0.0	0.0	0.0	25
NS-03	Inverter House	709202	4869386	2.3	100	64.7	0	0.0	-0.8	0.0	8.2	0.0	0.0	0.0	0.0	28
NS-04	Inverter House	709258	4869237	2.3	100	62.4	0	0.0	-0.8	0.0	7.1	0.0	0.0	0.0	0.0	32
NS-05	Inverter House	709401	4869145	2.3	100	63.1	0	0.0	-0.8	0.0	7.5	0.0	0.0	0.0	0.0	31
NS-06	Inverter House	709336	4869029	2.3	100	60.3	0	0.0	-0.8	0.0	6.1	0.0	0.0	0.0	0.0	35
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	66.3	0	0.0	-0.4	0.0	1.7	0.0	0.0	0.0	0.0	24
NS-08	HVAC	709583	4869171	2.5	83	66.2	0	0.0	0.2	0.0	1.5	0.0	0.0	0.0	0.0	15

R10	Vacant Lot	708778	4869445	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	64.2	0	0.0	-0.8	0.0	8.0	0.0	0.0	0.0	0.0	29
NS-02	Inverter House	709155	4869550	2.3	100	62.8	0	0.0	-0.8	0.0	7.3	0.0	0.0	0.0	0.0	31
NS-03	Inverter House	709202	4869386	2.3	100	63.6	0	0.0	-0.8	0.0	7.7	0.0	0.0	0.0	0.0	30
NS-04	Inverter House	709258	4869237	2.3	100	65.4	0	0.0	-0.8	0.0	8.5	0.0	0.0	0.0	0.0	27
NS-05	Inverter House	709401	4869145	2.3	100	67.8	0	0.0	-0.8	0.0	9.4	0.0	0.0	0.0	0.0	24
NS-06	Inverter House	709336	4869029	2.3	100	67.9	0	0.0	-0.8	0.0	9.4	0.0	0.0	0.0	0.0	24
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	69.7	0	0.0	-0.4	0.0	2.3	0.0	0.0	0.0	0.0	20
NS-08	HVAC	709583	4869171	2.5	83	69.6	0	0.0	0.2	0.0	2.1	0.0	0.0	0.0	0.0	11

R11	Residential Dwelling	709080	4869977	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	60.4	0	0.0	-0.8	0.0	6.2	0.0	0.0	0.0	0.0	35
NS-02	Inverter House	709155	4869550	2.3	100	63.7	0	0.0	-0.8	0.0	7.7	0.0	0.0	0.0	0.0	30
NS-03	Inverter House	709202	4869386	2.3	100	66.6	0	0.0	-0.8	0.0	9.0	0.0	0.0	0.0	0.0	26
NS-04	Inverter House	709258	4869237	2.3	100	68.6	0	0.0	-0.8	0.0	9.7	0.0	0.0	0.0	0.0	23
NS-05	Inverter House	709401	4869145	2.3	100	70.0	0	0.0	-0.7	0.0	10.2	0.0	0.0	0.0	0.0	21
NS-06	Inverter House	709336	4869029	2.3	100	70.8	0	0.0	-0.7	0.0	10.5	0.0	0.0	0.0	0.0	20
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	70.6	0	0.0	-0.4	0.0	2.5	0.0	0.0	0.0	0.0	19
NS-08	HVAC	709583	4869171	2.5	83	70.6	0	0.0	0.2	0.0	2.3	0.0	0.0	0.0	0.0	10

R12	Residential Dwelling	708751	4870138	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	66.7	0	0.0	-0.8	0.0	9.0	0.0	0.0	0.0	0.0	26
NS-02	Inverter House	709155	4869550	2.3	100	68.1	0	0.0	-0.8	0.0	9.5	0.0	0.0	0.0	0.0	24
NS-03	Inverter House	709202	4869386	2.3	100	69.9	0	0.0	-0.7	0.0	10.2	0.0	0.0	0.0	0.0	21
NS-04	Inverter House	709258	4869237	2.3	100	71.3	0	0.0	-0.7	0.0	10.7	0.0	0.0	0.0	0.0	19
NS-05	Inverter House	709401	4869145	2.3	100	72.5	0	0.0	-0.7	0.0	11.1	0.0	0.0	0.0	0.0	17
NS-06	Inverter House	709336	4869029	2.3	100	73.0	0	0.0	-0.7	0.0	11.3	0.0	0.0	0.0	0.0	17
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	73.2	0	0.0	-0.3	0.0	3.1	0.0	0.0	0.0	0.0	16
NS-08	HVAC	709583	4869171	2.5	83	73.1	0	0.0	0.3	0.0	2.9	0.0	0.0	0.0	0.0	7

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

R13	Residential Dwelling	708737	4870206	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	67.5	0	0.0	-0.8	0.0	9.3	0.0	0.0	0.0	0.0	24
NS-02	Inverter House	709155	4869550	2.3	100	68.8	0	0.0	-0.8	0.0	9.8	0.0	0.0	0.0	0.0	23
NS-03	Inverter House	709202	4869386	2.3	100	70.5	0	0.0	-0.7	0.0	10.4	0.0	0.0	0.0	0.0	20
NS-04	Inverter House	709258	4869237	2.3	100	71.8	0	0.0	-0.7	0.0	10.9	0.0	0.0	0.0	0.0	18
NS-05	Inverter House	709401	4869145	2.3	100	72.9	0	0.0	-0.7	0.0	11.3	0.0	0.0	0.0	0.0	17
NS-06	Inverter House	709336	4869029	2.3	100	73.4	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	73.6	0	0.0	-0.3	0.0	3.2	0.0	0.0	0.0	0.0	16
NS-08	HVAC	709583	4869171	2.5	83	73.5	0	0.0	0.3	0.0	3.0	0.0	0.0	0.0	0.0	6

R14	Residential Dwelling	708714	4870194	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	67.6	0	0.0	-0.8	0.0	9.3	0.0	0.0	0.0	0.0	24
NS-02	Inverter House	709155	4869550	2.3	100	68.9	0	0.0	-0.8	0.0	9.8	0.0	0.0	0.0	0.0	22
NS-03	Inverter House	709202	4869386	2.3	100	70.5	0	0.0	-0.7	0.0	10.4	0.0	0.0	0.0	0.0	20
NS-04	Inverter House	709258	4869237	2.3	100	71.8	0	0.0	-0.7	0.0	10.9	0.0	0.0	0.0	0.0	18
NS-05	Inverter House	709401	4869145	2.3	100	73.0	0	0.0	-0.7	0.0	11.3	0.0	0.0	0.0	0.0	17
NS-06	Inverter House	709336	4869029	2.3	100	73.4	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	73.6	0	0.0	-0.3	0.0	3.2	0.0	0.0	0.0	0.0	15
NS-08	HVAC	709583	4869171	2.5	83	73.6	0	0.0	0.3	0.0	3.0	0.0	0.0	0.0	0.0	6

R15	Residential Dwelling	708705	4870253	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	68.2	0	0.0	-0.8	0.0	9.6	0.0	0.0	0.0	0.0	23
NS-02	Inverter House	709155	4869550	2.3	100	69.4	0	0.0	-0.8	0.0	10.0	0.0	0.0	0.0	0.0	22
NS-03	Inverter House	709202	4869386	2.3	100	71.0	0	0.0	-0.7	0.0	10.6	0.0	0.0	0.0	0.0	20
NS-04	Inverter House	709258	4869237	2.3	100	72.3	0	0.0	-0.7	0.0	11.1	0.0	0.0	0.0	0.0	18
NS-05	Inverter House	709401	4869145	2.3	100	73.3	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-06	Inverter House	709336	4869029	2.3	100	73.8	0	0.0	-0.6	0.0	11.7	0.0	0.0	0.0	0.0	16
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	73.9	0	0.0	-0.3	0.0	3.3	0.0	0.0	0.0	0.0	15
NS-08	HVAC	709583	4869171	2.5	83	73.9	0	0.0	0.4	0.0	3.1	0.0	0.0	0.0	0.0	6

R16	Residential Dwelling	708062	4870554	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	73.9	0	0.0	-0.6	0.0	11.7	0.0	0.0	0.0	0.0	15
NS-02	Inverter House	709155	4869550	2.3	100	74.4	0	0.0	-0.6	0.0	11.9	0.0	0.0	0.0	0.0	15
NS-03	Inverter House	709202	4869386	2.3	100	75.3	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-04	Inverter House	709258	4869237	2.3	100	76.0	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-05	Inverter House	709401	4869145	2.3	100	76.8	0	0.0	-0.5	0.0	13.0	0.0	0.0	0.0	0.0	11
NS-06	Inverter House	709336	4869029	2.3	100	77.0	0	0.0	-0.5	0.0	13.1	0.0	0.0	0.0	0.0	11
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	77.3	0	0.0	-0.2	0.0	4.5	0.0	0.0	0.0	0.0	10
NS-08	HVAC	709583	4869171	2.5	83	77.3	0	0.0	0.6	0.0	4.1	0.0	0.0	0.0	0.0	1

R17	Residential Dwelling	708272	4870586	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	73.0	0	0.0	-0.7	0.0	11.4	0.0	0.0	0.0	0.0	17
NS-02	Inverter House	709155	4869550	2.3	100	73.7	0	0.0	-0.6	0.0	11.6	0.0	0.0	0.0	0.0	16
NS-03	Inverter House	709202	4869386	2.3	100	74.6	0	0.0	-0.6	0.0	12.0	0.0	0.0	0.0	0.0	14
NS-04	Inverter House	709258	4869237	2.3	100	75.5	0	0.0	-0.6	0.0	12.4	0.0	0.0	0.0	0.0	13
NS-05	Inverter House	709401	4869145	2.3	100	76.3	0	0.0	-0.5	0.0	12.7	0.0	0.0	0.0	0.0	12
NS-06	Inverter House	709336	4869029	2.3	100	76.5	0	0.0	-0.5	0.0	12.8	0.0	0.0	0.0	0.0	12
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	76.8	0	0.0	-0.2	0.0	4.3	0.0	0.0	0.0	0.0	11
NS-08	HVAC	709583	4869171	2.5	83	76.7	0	0.0	0.5	0.0	3.9	0.0	0.0	0.0	0.0	2

R18	Residential Dwelling	708746	4870791	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	72.4	0	0.0	-0.7	0.0	11.1	0.0	0.0	0.0	0.0	18
NS-02	Inverter House	709155	4869550	2.3	100	73.3	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-03	Inverter House	709202	4869386	2.3	100	74.4	0	0.0	-0.6	0.0	11.9	0.0	0.0	0.0	0.0	15
NS-04	Inverter House	709258	4869237	2.3	100	75.3	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-05	Inverter House	709401	4869145	2.3	100	76.0	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-06	Inverter House	709336	4869029	2.3	100	76.4	0	0.0	-0.5	0.0	12.8	0.0	0.0	0.0	0.0	12
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	76.3	0	0.0	-0.2	0.0	4.1	0.0	0.0	0.0	0.0	12
NS-08	HVAC	709583	4869171	2.5	83	76.2	0	0.0	0.5	0.0	3.8	0.0	0.0	0.0	0.0	3

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

R19	Residential Dwelling	708976	4870873	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	72.6	0	0.0	-0.7	0.0	11.2	0.0	0.0	0.0	0.0	17
NS-02	Inverter House	709155	4869550	2.3	100	73.5	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-03	Inverter House	709202	4869386	2.3	100	74.5	0	0.0	-0.6	0.0	12.0	0.0	0.0	0.0	0.0	14
NS-04	Inverter House	709258	4869237	2.3	100	75.4	0	0.0	-0.6	0.0	12.3	0.0	0.0	0.0	0.0	13
NS-05	Inverter House	709401	4869145	2.3	100	76.0	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-06	Inverter House	709336	4869029	2.3	100	76.5	0	0.0	-0.5	0.0	12.8	0.0	0.0	0.0	0.0	12
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	76.2	0	0.0	-0.2	0.0	4.1	0.0	0.0	0.0	0.0	12
NS-08	HVAC	709583	4869171	2.5	83	76.1	0	0.0	0.5	0.0	3.7	0.0	0.0	0.0	0.0	3

R20	Vacant Lot	709060	4870901	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	72.7	0	0.0	-0.7	0.0	11.2	0.0	0.0	0.0	0.0	17
NS-02	Inverter House	709155	4869550	2.3	100	73.6	0	0.0	-0.6	0.0	11.6	0.0	0.0	0.0	0.0	16
NS-03	Inverter House	709202	4869386	2.3	100	74.7	0	0.0	-0.6	0.0	12.0	0.0	0.0	0.0	0.0	14
NS-04	Inverter House	709258	4869237	2.3	100	75.5	0	0.0	-0.6	0.0	12.4	0.0	0.0	0.0	0.0	13
NS-05	Inverter House	709401	4869145	2.3	100	76.1	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-06	Inverter House	709336	4869029	2.3	100	76.5	0	0.0	-0.5	0.0	12.8	0.0	0.0	0.0	0.0	11
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	76.2	0	0.0	-0.2	0.0	4.1	0.0	0.0	0.0	0.0	12
NS-08	HVAC	709583	4869171	2.5	83	76.1	0	0.0	0.5	0.0	3.8	0.0	0.0	0.0	0.0	3

R21	Residential Dwelling	709169	4870926	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	72.8	0	0.0	-0.7	0.0	11.3	0.0	0.0	0.0	0.0	17
NS-02	Inverter House	709155	4869550	2.3	100	73.8	0	0.0	-0.6	0.0	11.7	0.0	0.0	0.0	0.0	16
NS-03	Inverter House	709202	4869386	2.3	100	74.8	0	0.0	-0.6	0.0	12.1	0.0	0.0	0.0	0.0	14
NS-04	Inverter House	709258	4869237	2.3	100	75.6	0	0.0	-0.6	0.0	12.4	0.0	0.0	0.0	0.0	13
NS-05	Inverter House	709401	4869145	2.3	100	76.1	0	0.0	-0.5	0.0	12.6	0.0	0.0	0.0	0.0	12
NS-06	Inverter House	709336	4869029	2.3	100	76.6	0	0.0	-0.5	0.0	12.9	0.0	0.0	0.0	0.0	11
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	76.2	0	0.0	-0.2	0.0	4.1	0.0	0.0	0.0	0.0	12
NS-08	HVAC	709583	4869171	2.5	83	76.1	0	0.0	0.5	0.0	3.7	0.0	0.0	0.0	0.0	3

R22	Residential Dwelling	709481	4870968	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	73.4	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-02	Inverter House	709155	4869550	2.3	100	74.3	0	0.0	-0.6	0.0	11.8	0.0	0.0	0.0	0.0	15
NS-03	Inverter House	709202	4869386	2.3	100	75.1	0	0.0	-0.6	0.0	12.2	0.0	0.0	0.0	0.0	14
NS-04	Inverter House	709258	4869237	2.3	100	75.8	0	0.0	-0.5	0.0	12.5	0.0	0.0	0.0	0.0	13
NS-05	Inverter House	709401	4869145	2.3	100	76.2	0	0.0	-0.5	0.0	12.7	0.0	0.0	0.0	0.0	12
NS-06	Inverter House	709336	4869029	2.3	100	76.8	0	0.0	-0.5	0.0	13.0	0.0	0.0	0.0	0.0	11
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	76.1	0	0.0	-0.2	0.0	4.1	0.0	0.0	0.0	0.0	12
NS-08	HVAC	709583	4869171	2.5	83	76.1	0	0.0	0.5	0.0	3.7	0.0	0.0	0.0	0.0	3

R23	Vacant Lot	709747	4870500	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	71.0	0	0.0	-0.7	0.0	10.6	0.0	0.0	0.0	0.0	20
NS-02	Inverter House	709155	4869550	2.3	100	72.0	0	0.0	-0.7	0.0	11.0	0.0	0.0	0.0	0.0	18
NS-03	Inverter House	709202	4869386	2.3	100	72.9	0	0.0	-0.7	0.0	11.3	0.0	0.0	0.0	0.0	17
NS-04	Inverter House	709258	4869237	2.3	100	73.6	0	0.0	-0.6	0.0	11.6	0.0	0.0	0.0	0.0	16
NS-05	Inverter House	709401	4869145	2.3	100	73.9	0	0.0	-0.6	0.0	11.7	0.0	0.0	0.0	0.0	15
NS-06	Inverter House	709336	4869029	2.3	100	74.7	0	0.0	-0.6	0.0	12.0	0.0	0.0	0.0	0.0	14
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	73.6	0	0.0	-0.3	0.0	3.2	0.0	0.0	0.0	0.0	16
NS-08	HVAC	709583	4869171	2.5	83	73.5	0	0.0	0.3	0.0	3.0	0.0	0.0	0.0	0.0	6

R24	Residential Dwelling	710342	4870379	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	73.7	0	0.0	-0.6	0.0	11.6	0.0	0.0	0.0	0.0	16
NS-02	Inverter House	709155	4869550	2.3	100	74.2	0	0.0	-0.6	0.0	11.8	0.0	0.0	0.0	0.0	15
NS-03	Inverter House	709202	4869386	2.3	100	74.6	0	0.0	-0.6	0.0	12.0	0.0	0.0	0.0	0.0	14
NS-04	Inverter House	709258	4869237	2.3	100	74.9	0	0.0	-0.6	0.0	12.1	0.0	0.0	0.0	0.0	14
NS-05	Inverter House	709401	4869145	2.3	100	74.8	0	0.0	-0.6	0.0	12.1	0.0	0.0	0.0	0.0	14
NS-06	Inverter House	709336	4869029	2.3	100	75.5	0	0.0	-0.6	0.0	12.4	0.0	0.0	0.0	0.0	13
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	74.1	0	0.0	-0.3	0.0	3.4	0.0	0.0	0.0	0.0	15
NS-08	HVAC	709583	4869171	2.5	83	74.1	0	0.0	0.4	0.0	3.1	0.0	0.0	0.0	0.0	6

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

R25	Vacant Lot	710511	4869397	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	73.8	0	0.0	-0.6	0.0	11.7	0.0	0.0	0.0	0.0	16
NS-02	Inverter House	709155	4869550	2.3	100	73.7	0	0.0	-0.6	0.0	11.6	0.0	0.0	0.0	0.0	16
NS-03	Inverter House	709202	4869386	2.3	100	73.3	0	0.0	-0.6	0.0	11.5	0.0	0.0	0.0	0.0	16
NS-04	Inverter House	709258	4869237	2.3	100	73.0	0	0.0	-0.7	0.0	11.4	0.0	0.0	0.0	0.0	17
NS-05	Inverter House	709401	4869145	2.3	100	72.1	0	0.0	-0.7	0.0	11.0	0.0	0.0	0.0	0.0	18
NS-06	Inverter House	709336	4869029	2.3	100	72.8	0	0.0	-0.7	0.0	11.3	0.0	0.0	0.0	0.0	17
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	70.5	0	0.0	-0.4	0.0	2.4	0.0	0.0	0.0	0.0	19
NS-08	HVAC	709583	4869171	2.5	83	70.6	0	0.0	0.2	0.0	2.3	0.0	0.0	0.0	0.0	10

R26	Residential Dwelling	709939	4869561	4.5												
Src ID	Src Name	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr
NS-01	Inverter House	709163	4869693	2.3	100	68.9	0	0.0	-0.8	0.0	9.8	0.0	0.0	0.0	0.0	22
NS-02	Inverter House	709155	4869550	2.3	100	68.9	0	0.0	-0.8	0.0	9.8	0.0	0.0	0.0	0.0	22
NS-03	Inverter House	709202	4869386	2.3	100	68.6	0	0.0	-0.8	0.0	9.7	0.0	0.0	0.0	0.0	23
NS-04	Inverter House	709258	4869237	2.3	100	68.6	0	0.0	-0.8	0.0	9.7	0.0	0.0	0.0	0.0	23
NS-05	Inverter House	709401	4869145	2.3	100	67.7	0	0.0	-0.8	0.0	9.4	0.0	0.0	0.0	0.0	24
NS-06	Inverter House	709336	4869029	2.3	100	69.1	0	0.0	-0.8	0.0	9.9	0.0	0.0	0.0	0.0	22
NS-07	Transformer 10 MVA	709594	4869168	2.5	92	65.4	0	0.0	-0.4	0.0	1.5	0.0	0.0	0.0	0.0	26
NS-08	HVAC	709583	4869171	2.5	83	65.5	0	0.0	0.2	0.0	1.4	0.0	0.0	0.0	0.0	16

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl

APPENDIX G

Sample Calculation Results - Octave Band Format

In the following tables of calculation results, the column headings for the various sound attenuation mechanisms follow the terminology of ISO Standard 9613-2. Lx is the A-weighted, one-hour energy-equivalent (or logarithmic-mean impulse) source sound power level, which includes the effects of any source-abatement measures included in the model, and any time-averaging effects for intermittent sources. Lr is the A-weighted, one-hour energy-equivalent (or logarithmic-mean impulse) sound level at the point of reception. The results are presented in terms of full octave band sound levels, at the most impacted off-site point of reception.

R01	Residential Dwelling		709799	4869488	4.5													
Src ID	Src Name	Band	X	Y	Z	Lx	Adiv	K0	Dc	Agnd	Abar	Aatm	Afol	Ahous	Cmet	Refl	Lr	Band
NS-01	Inverter House	32	709163	4869693	2.3	60	67.5	0	0.0	-5.1	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-01	Inverter House	63	709163	4869693	2.3	67	67.5	0	0.0	-5.1	0.0	0.1	0.0	0.0	0.0	0.0	4	63
NS-01	Inverter House	125	709163	4869693	2.3	75	67.5	0	0.0	3.6	0.0	0.3	0.0	0.0	0.0	0.0	4	125
NS-01	Inverter House	250	709163	4869693	2.3	83	67.5	0	0.0	2.9	0.0	0.7	0.0	0.0	0.0	0.0	12	250
NS-01	Inverter House	500	709163	4869693	2.3	89	67.5	0	0.0	-0.9	0.0	1.3	0.0	0.0	0.0	0.0	21	500
NS-01	Inverter House	1000	709163	4869693	2.3	86	67.5	0	0.0	-1.5	0.0	2.4	0.0	0.0	0.0	0.0	18	1000
NS-01	Inverter House	2000	709163	4869693	2.3	91	67.5	0	0.0	-1.5	0.0	6.5	0.0	0.0	0.0	0.0	18	2000
NS-01	Inverter House	4000	709163	4869693	2.3	99	67.5	0	0.0	-1.5	0.0	21.9	0.0	0.0	0.0	0.0	11	4000
NS-01	Inverter House	8000	709163	4869693	2.3	86	67.5	0	0.0	-1.5	0.0	78.1	0.0	0.0	0.0	0.0	--	8000
NS-02	Inverter House	32	709155	4869550	2.3	60	67.2	0	0.0	-5.0	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-02	Inverter House	63	709155	4869550	2.3	67	67.2	0	0.0	-5.0	0.0	0.1	0.0	0.0	0.0	0.0	4	63
NS-02	Inverter House	125	709155	4869550	2.3	75	67.2	0	0.0	3.6	0.0	0.3	0.0	0.0	0.0	0.0	4	125
NS-02	Inverter House	250	709155	4869550	2.3	83	67.2	0	0.0	3.0	0.0	0.7	0.0	0.0	0.0	0.0	12	250
NS-02	Inverter House	500	709155	4869550	2.3	89	67.2	0	0.0	-0.9	0.0	1.2	0.0	0.0	0.0	0.0	21	500
NS-02	Inverter House	1000	709155	4869550	2.3	86	67.2	0	0.0	-1.5	0.0	2.4	0.0	0.0	0.0	0.0	18	1000
NS-02	Inverter House	2000	709155	4869550	2.3	91	67.2	0	0.0	-1.5	0.0	6.3	0.0	0.0	0.0	0.0	19	2000
NS-02	Inverter House	4000	709155	4869550	2.3	99	67.2	0	0.0	-1.5	0.0	21.2	0.0	0.0	0.0	0.0	12	4000
NS-02	Inverter House	8000	709155	4869550	2.3	86	67.2	0	0.0	-1.5	0.0	75.6	0.0	0.0	0.0	0.0	--	8000
NS-03	Inverter House	32	709202	4869386	2.3	60	66.7	0	0.0	-5.0	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-03	Inverter House	63	709202	4869386	2.3	67	66.7	0	0.0	-5.0	0.0	0.1	0.0	0.0	0.0	0.0	5	63
NS-03	Inverter House	125	709202	4869386	2.3	75	66.7	0	0.0	3.4	0.0	0.3	0.0	0.0	0.0	0.0	5	125
NS-03	Inverter House	250	709202	4869386	2.3	83	66.7	0	0.0	3.0	0.0	0.6	0.0	0.0	0.0	0.0	13	250
NS-03	Inverter House	500	709202	4869386	2.3	89	66.7	0	0.0	-0.9	0.0	1.2	0.0	0.0	0.0	0.0	22	500
NS-03	Inverter House	1000	709202	4869386	2.3	86	66.7	0	0.0	-1.5	0.0	2.2	0.0	0.0	0.0	0.0	19	1000
NS-03	Inverter House	2000	709202	4869386	2.3	91	66.7	0	0.0	-1.5	0.0	5.9	0.0	0.0	0.0	0.0	20	2000
NS-03	Inverter House	4000	709202	4869386	2.3	99	66.7	0	0.0	-1.5	0.0	19.9	0.0	0.0	0.0	0.0	14	4000
NS-03	Inverter House	8000	709202	4869386	2.3	86	66.7	0	0.0	-1.5	0.0	70.8	0.0	0.0	0.0	0.0	--	8000
NS-04	Inverter House	32	709258	4869237	2.3	60	66.5	0	0.0	-4.9	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-04	Inverter House	63	709258	4869237	2.3	67	66.5	0	0.0	-5.0	0.0	0.1	0.0	0.0	0.0	0.0	5	63
NS-04	Inverter House	125	709258	4869237	2.3	75	66.5	0	0.0	3.4	0.0	0.3	0.0	0.0	0.0	0.0	5	125
NS-04	Inverter House	250	709258	4869237	2.3	83	66.5	0	0.0	3.0	0.0	0.6	0.0	0.0	0.0	0.0	13	250
NS-04	Inverter House	500	709258	4869237	2.3	89	66.5	0	0.0	-0.9	0.0	1.2	0.0	0.0	0.0	0.0	22	500
NS-04	Inverter House	1000	709258	4869237	2.3	86	66.5	0	0.0	-1.5	0.0	2.2	0.0	0.0	0.0	0.0	19	1000
NS-04	Inverter House	2000	709258	4869237	2.3	91	66.5	0	0.0	-1.5	0.0	5.8	0.0	0.0	0.0	0.0	20	2000
NS-04	Inverter House	4000	709258	4869237	2.3	99	66.5	0	0.0	-1.5	0.0	19.5	0.0	0.0	0.0	0.0	14	4000
NS-04	Inverter House	8000	709258	4869237	2.3	86	66.5	0	0.0	-1.5	0.0	69.7	0.0	0.0	0.0	0.0	--	8000
NS-05	Inverter House	32	709401	4869145	2.3	60	65.4	0	0.0	-4.8	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-05	Inverter House	63	709401	4869145	2.3	67	65.4	0	0.0	-4.8	0.0	0.1	0.0	0.0	0.0	0.0	6	63
NS-05	Inverter House	125	709401	4869145	2.3	75	65.4	0	0.0	3.2	0.0	0.2	0.0	0.0	0.0	0.0	6	125
NS-05	Inverter House	250	709401	4869145	2.3	83	65.4	0	0.0	3.0	0.0	0.6	0.0	0.0	0.0	0.0	14	250
NS-05	Inverter House	500	709401	4869145	2.3	89	65.4	0	0.0	-0.8	0.0	1.0	0.0	0.0	0.0	0.0	23	500
NS-05	Inverter House	1000	709401	4869145	2.3	86	65.4	0	0.0	-1.4	0.0	1.9	0.0	0.0	0.0	0.0	20	1000
NS-05	Inverter House	2000	709401	4869145	2.3	91	65.4	0	0.0	-1.4	0.0	5.1	0.0	0.0	0.0	0.0	22	2000
NS-05	Inverter House	4000	709401	4869145	2.3	99	65.4	0	0.0	-1.4	0.0	17.2	0.0	0.0	0.0	0.0	18	4000
NS-05	Inverter House	8000	709401	4869145	2.3	86	65.4	0	0.0	-1.4	0.0	61.4	0.0	0.0	0.0	0.0	--	8000
NS-06	Inverter House	32	709336	4869029	2.3	60	67.3	0	0.0	-5.0	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-06	Inverter House	63	709336	4869029	2.3	67	67.3	0	0.0	-5.0	0.0	0.1	0.0	0.0	0.0	0.0	4	63
NS-06	Inverter House	125	709336	4869029	2.3	75	67.3	0	0.0	3.6	0.0	0.3	0.0	0.0	0.0	0.0	4	125
NS-06	Inverter House	250	709336	4869029	2.3	83	67.3	0	0.0	3.0	0.0	0.7	0.0	0.0	0.0	0.0	12	250
NS-06	Inverter House	500	709336	4869029	2.3	89	67.3	0	0.0	-0.9	0.0	1.3	0.0	0.0	0.0	0.0	21	500
NS-06	Inverter House	1000	709336	4869029	2.3	86	67.3	0	0.0	-1.5	0.0	2.4	0.0	0.0	0.0	0.0	18	1000
NS-06	Inverter House	2000	709336	4869029	2.3	91	67.3	0	0.0	-1.5	0.0	6.3	0.0	0.0	0.0	0.0	19	2000
NS-06	Inverter House	4000	709336	4869029	2.3	99	67.3	0	0.0	-1.5	0.0	21.3	0.0	0.0	0.0	0.0	12	4000
NS-06	Inverter House	8000	709336	4869029	2.3	86	67.3	0	0.0	-1.5	0.0	76.1	0.0	0.0	0.0	0.0	--	8000
NS-07	Transformer 10 MVA	63	709594	4869168	2.5	68	62.6	0	0.0	-4.3	0.0	0.0	0.0	0.0	0.0	0.0	10	63
NS-07	Transformer 10 MVA	125	709594	4869168	2.5	81	62.6	0	0.0	2.7	0.0	0.2	0.0	0.0	0.0	0.0	15	125
NS-07	Transformer 10 MVA	250	709594	4869168	2.5	83	62.6	0	0.0	3.1	0.0	0.4	0.0	0.0	0.0	0.0	17	250
NS-07	Transformer 10 MVA	500	709594	4869168	2.5	88	62.6	0	0.0	-0.8	0.0	0.7	0.0	0.0	0.0	0.0	26	500
NS-07	Transformer 10 MVA	1000	709594	4869168	2.5	86	62.6	0	0.0	-1.3	0.0	1.4	0.0	0.0	0.0	0.0	23	1000
NS-07	Transformer 10 MVA	2000	709594	4869168	2.5	82	62.6	0	0.0	-1.3	0.0	3.7	0.0	0.0	0.0	0.0	17	2000
NS-07	Transformer 10 MVA	4000	709594	4869168	2.5	77	62.6	0	0.0	-1.3	0.0	12.4	0.0	0.0	0.0	0.0	3	4000
NS-07	Transformer 10 MVA	8000	709594	4869168	2.5	68	62.6	0	0.0	-1.3	0.0	44.4	0.0	0.0	0.0	0.0	--	8000
NS-08	HVAC	32	709583	4869171	2.5	40	62.7	0	0.0	-4.4	0.0	0.0	0.0	0.0	0.0	0.0	--	32
NS-08	HVAC	63	709583	4869171	2.5	53	62.7	0	0.0	-4.4	0.0	0.1	0.0	0.0	0.0	0.0	--	63
NS-08	HVAC	125	709583	4869171	2.5	69	62.7	0	0.0	2.7	0.0	0.2	0.0	0.0	0.0	0.0	4	125
NS-08	HVAC	250	709583	4869171	2.5	78	62.7	0	0.0	3.1	0.0	0.4	0.0	0.0	0.0	0.0	12	250
NS-08	HVAC	500	709583	4869171	2.5	78	62.7	0	0.0	-0.8	0.0	0.7	0.0	0.0	0.0	0.0	16	500
NS-08	HVAC	1000	709583	4869171	2.5	77	62.7	0	0.0	-1.3	0.0	1.4	0.0	0.0	0.0	0.0	14	1000
NS-08	HVAC	2000	709583	4869171	2.5	73	62.7	0	0.0	-1.3	0.0	3.7	0.0	0.0	0.0	0.0	8	2000
NS-08	HVAC	4000	709583	4869171	2.5	69	62.7	0	0.0	-1.3	0.0	12.6	0.0	0.0	0.0	0.0	--	4000
NS-08	HVAC	8000	709583	4869171	2.5	59	62.7	0	0.0	-1.3	0.0	44.9	0.0	0.0	0.0	0.0	--	8000

Where: Lr = Lx - Adiv + K0 + Dc - Agnd - Abar - Aatm - Afol - Ahous + Cmet + Refl