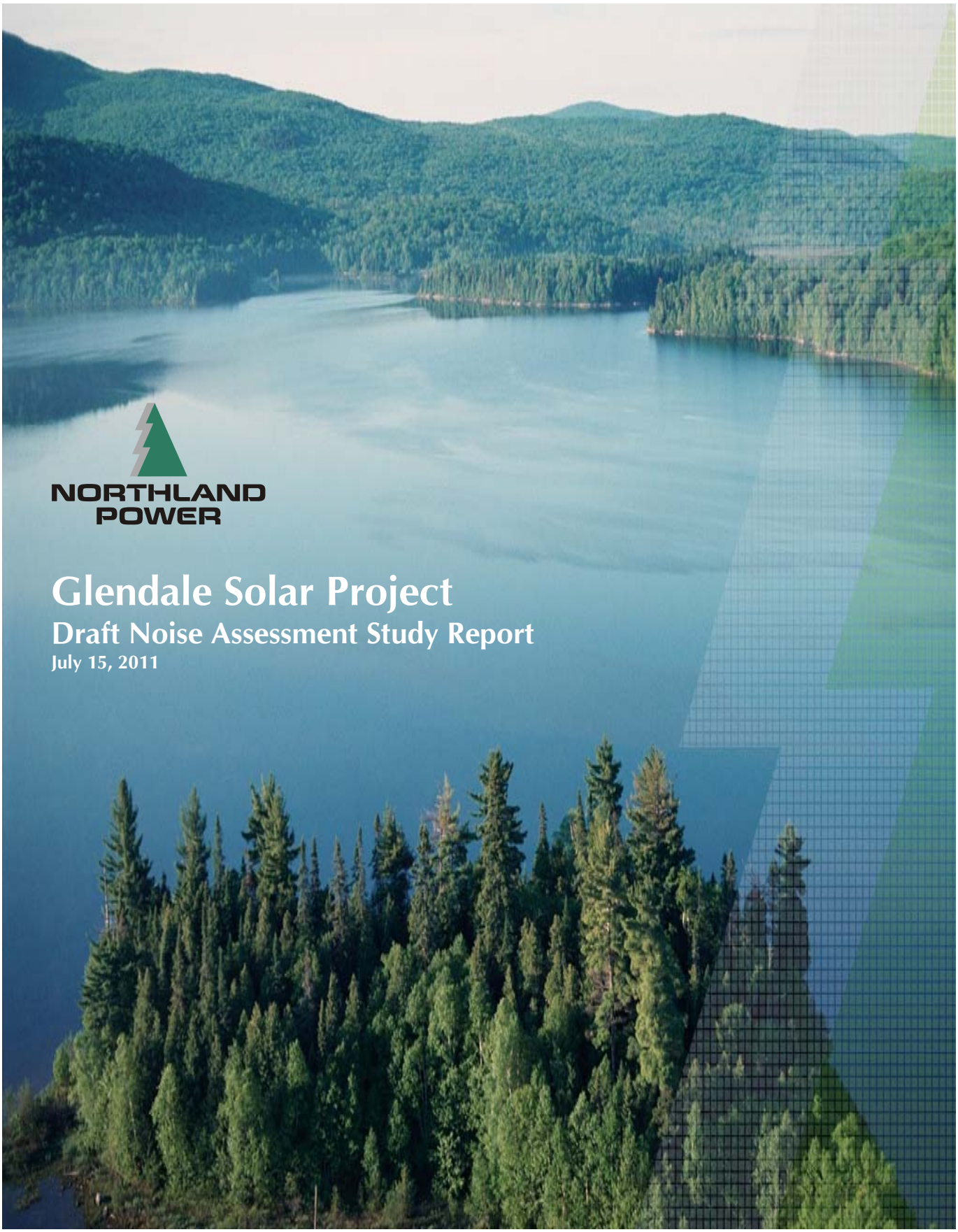

NORTHLAND POWER

Glendale Solar Project

Draft Noise Assessment Study Report

July 15, 2011

Northland Power Inc.
on behalf of
Northland Power Solar
Glendale L.P.
Toronto, Ontario

Draft Noise Assessment Study Report

Glendale Solar Project

H334844-0000-07-124-0213
Rev. 0
July 15, 2011

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Project Report

July 15, 2011

Northland Power Inc.
Glendale Solar Project

Draft Noise Assessment Study Report

Table of Contents

List of Tables

List of Figures

Executive Summary

This report presents the results of the Noise Assessment Study required for Solar Facilities under Ontario Regulation 359/09 and 521/10, as part of the Renewable Energy Approval (REA) Process. Northland Power Solar Glendale L.P. ("Northland") is proposing to develop a 10-Megawatt (MW) solar photovoltaic (PV) project titled Glendale Solar Project (the "Project"). The Project will be located on approximately 45 hectares of land east of the intersection of Headline Road and Boundary Road 7 in the Township of South Glengarry, within the United Counties of Stormont, Dundas and Glengarry, Ontario.

This Draft Noise Assessment Study Report has been prepared based on the document entitled "Basic Comprehensive Certificates of Approval (Air) – User Guide" by the Ontario Ministry of the Environment (MOE, 2004). The sound pressure levels at the points of reception (POR[1]) have been estimated using ISO 9613-2, implemented in the CADNA-A computer code. The performance limits used for verification of compliance correspond to the values for rural areas (45-dBA for day time and 40-dBA for night time). The results presented in this report are based on the best available information at this time. It is the intention that, in the detailed engineering phase of the project, certified noise data based on final plans and designs will confirm the conclusions of this noise impact Assessment study.

The results obtained in this study show that the sound pressure levels at POR will not exceed MOE requirements for rural areas. Any noise issues that might arise during commissioning will be manageable and will be resolved by implementing typical remediation measures such as acoustical barriers and enclosures. It is our intention to verify by field measurements taken on completion of installation and during commissioning that the noise levels at the POR resulting from the Project's operation are within the limits set by the MOE (45-dBA for day time and 40-dBA for night time).

[1] "Point of reception" in the context of this study is equivalent to "noise receptor" as defined in Ontario Regulation 521/10.

1. Introduction

1.1 Project Description

Northland Power Solar Glendale L.P. ("Northland") is proposing to develop a 10-megawatt (MW) solar photovoltaic (PV) project titled Glendale Solar Project (the "Project"). The Project Location[2] is situated on approximately 45 hectares of land east of the intersection of Headline Road and Boundary Road 7 in the Township of South Glengarry, within the United Counties of Stormont, Dundas and Glengarry, Ontario..

The proposed Project is a renewable energy generation facility which will use solar photovoltaic technology to generate electricity. Electricity generated by solar photovoltaic panels will be converted from Direct Current (DC) to Alternating Current (AC) by inverter clusters which will also step-up the voltage to 27.6-kV. A main transformer, located in the substation, will step up the voltage from the clusters to 44-kV prior to being sent to the existing local distribution line. In order to meet the Ontario Power Authority (OPA)'s Feed-In-Tariff (FIT) Program requirements, a specific percentage of equipment will be manufactured in Ontario.

The construction of the Project will begin once the Renewable Energy Approval (REA) has been obtained and a power purchase agreement is finalized with the OPA. The construction period is estimated to be approximately 6 months. Operationally, the anticipated lifespan of the Project will be 30 years.

1.2 Renewable Energy Approval Legislative Requirements

Ontario Regulation 359/09 and 521/10, made under the Environmental Protection Act identify the Renewable Energy Approval (REA) requirements for green energy projects in Ontario. As per Section 4 of the Ontario Regulation 359/09 and its amendment (Ontario Regulation 521/10), ground mounted solar facilities with a name plate capacity greater than 12 kilowatts (kW) are classified as a Class 3 solar facility, and therefore, require an REA.

Section 13 of the Ontario Regulation 359/09 requires proponents of Class 3 solar facilities to complete a Noise Study Report in accordance with Appendix A of the publication "Basic Comprehensive Certificates of Approval (Air) – User Guide, 2004" by the Ministry of the Environment (MOE, 2004).

The Noise Study Report is to include a general description of the facility, sources and points of reception (POR[1]), Assessment of compliance, as well as all the supporting information relevant to the Project. A draft of the Noise Study Report must be made available to the public, the local municipality and identified Aboriginal communities, at least 60 days prior to the final public consultation meeting in accordance with Ontario Regulation 359/09 and 521/10.

2. Facility Description

The Project will utilize photovoltaic (PV) panels installed on fixed racking structures mounted on the ground. The PV panels generate DC electricity which will be converted to AC electricity by inverters.

[2] "Project Location" means, when used in relation to a renewable energy project, a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project and any air space in which a person is engaging in or proposed to engage in the project" [Ontario Regulation 359/09, s. 1 (1)].

The Project layout is based on 7 inverter clusters each one containing two inverters and one medium-voltage (27.6-kV) transformer, and one 10-MVA 44-kV substation transformer. The 27.6-kV power, collected from the inverter clusters, will be stepped-up to 44-kV by the substation transformer prior to being sent to the existing local distribution line.

Since the panels will be ground-mounted and the total nameplate capacity is over 12-kW, the Project is considered to be a Class 3 Solar Facility, according to the classification presented in Ontario Regulation 521/10.

Table 2.1 General Project Description

Project Description	Ground-mounted Solar PV, Class 3
System Nameplate Capacity	10-MW AC
Local Distribution Company	Hydro One Networks Inc.

2.1 Project Location

The Project location will be located on privately owned lands totalling approximately 45 ha. The Project Location is zoned rural in the zoning by law for United Counties of Stormont, Dundas and Glengarry (Schedules A4 and A6). Figure 2.1 shows the site layout plan while the zoning designation plan (Figure A.1) and area location plan (Figure A.2) drawings are included in Appendix A. There are 114 points of reception located within 1.2 km from the Project Site[3] boundary.

For modeling purposes, the vegetation that blocks some of the POR from the sources has not been incorporated.

2.2 Acoustical Environment

The Project Location will be surrounded by farmland, with some forested areas to the west, north and northeast. The background noise levels are expected to be typical of rural areas, classified as a Class 3 based on Publication NPC-232 by the MOE. Some traffic noise, mainly during day hours, is expected from Regional Road 44 (Headline Road/Boundary Road) passing southwest of the facility. There is no airport within a 5-km distance from the Project Location. Cornwall is the closest urban center, which is located about 8 km south of the Project Location. The only large industrial facility within 5 km of the Project area is a gravel quarry, located about 3 km to the southwest.

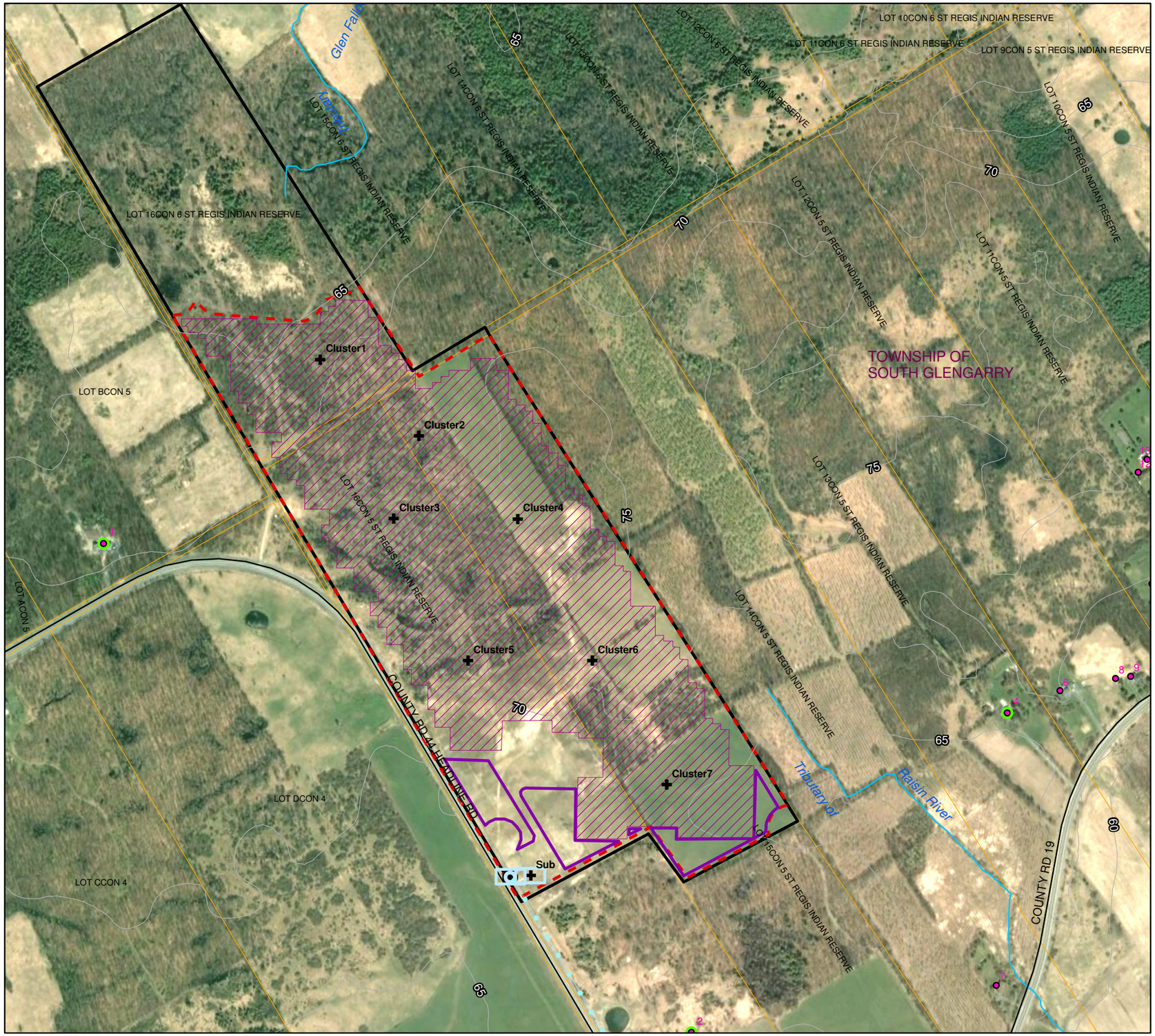
2.3 Life of Project

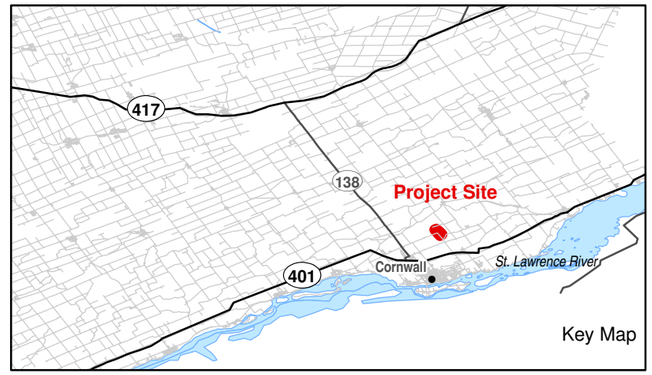
The expected life of the Project is 30 years. At that time (or earlier if the 20-yr power purchase agreement is not extended), the Project will be decommissioned or refurbished depending on market conditions and/or technological changes.

2.4 Operating Hours

Solar PV facilities produce electricity during the day hours, when the sun's rays are collected by the panels. After sunset the facility will not receive solar radiation to generate any electricity. Under these conditions the inverters will not produce any noise and the transformers will be energized, but not in operation (no fans).

[3] Project Site is the complete area owned by the Project but not necessary occupied by the Project infrastructure.





LEGEND

Existing Features

- Road
- Topographic Contour (5m Interval)
- Watercourse
- Lot

Proposed Project Components

- Project Location
- Project Site
- Substation Transformer
- Inverter Cluster
- Noise Receptor
- Representative Noise Receptor
- Laydown Area
- Solar PV Panels
- Transmission Line
- Substation
- Connection Point

0 50 100 200 Metres

NORTH

Scale 1:6,000

Notes:
1. OBM and NRVIS data downloaded from LIO,with permission.
2. Spatial referencing UTM NAD 83.
3. Satellite imagery from Google Earth Pro.

Figure 2.1
Northland Power Solar Glendale L.P.
Glendale Solar Project
Site Layout Plan

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2.5 Approach to the Study

The sound pressure levels at the POR were predicted using procedures from ISO 9613-2, which is a widely used and generally accepted standard for the evaluation of noise impact in environmental Assessments. The sound power level for the inverters was provided by the manufacturer while the sound power level for the transformers was estimated. The software package CADNA-A, which implements ISO-9613-2, was used to predict the noise levels at the closest POR. This numerical modeling software is able to simulate sound sources as well as sound mitigation measures taking into account atmospheric and ground attenuation. The height contours for the site were taken from the Ontario Base Maps (OBM).

3. Noise Source Summary

The main sources of noise from the Project will be seven inverter clusters, each one containing two inverters and one medium-voltage transformer, and a substation containing the main step-up transformer. Northland provided a layout of the solar PV facility (see Figure 2.1). The coordinates of each noise source are presented in Table B.1 of Appendix B.

All noise sources were modeled as non-directional point sources.

Switchgear and a small step-down transformer used for lighting, located at the substation, do not emit any significant noise and consequently have not been considered as sources of noise.

Two operational scenarios were accessed in the study; day time operation (all inverters and transformers in operation) and night time operation (energized transformers).

3.1 Substation Transformer

A 10-MVA step-up transformer that will step-up the 27.6-kV power to 44 kV, required by the local distribution company, will be located in the substation. Since the transformer make and model have not been selected at this point, the sound power levels resulting from the operation of the transformer were evaluated using data from NEMA TR 1-1993 (R2000). This standard provides maximum sound level values for transformers, and manufacturers routinely meet this specification. Hence, the results based on NEMA may slightly overestimate the impact on POR since the actual transformer is expected to be quieter.

The NEMA levels were then converted into frequency spectra using empirical correlations for transformer noise (Crocker, 2007). This calculation is available in Figure B.2 of Appendix B.

Power transformers are considered by the MOE to be tonal noise sources. A 5-dB penalty was added to the sound power spectrum, as recommended by Publication NPC-104, "Sound Level Adjustments" for tonality. Table B.2 in Appendix B shows the frequency spectrum used to model the substation transformer.

3.2 Inverter Clusters

At this stage of the Project, Northland is planning to use inverters manufactured by SMA. Seven inverter clusters will be installed as part of the Project. Each cluster comprises of two SMA Sunny Central 800CP inverters and one medium voltage transformer. A schematic layout with approximate dimensions of such cluster is available in Figure 3.1. The cluster components listed above were modeled as point sources shown in Figure 3.2.

The installed capacity of each Sunny Central 800CP inverter is 800-kW. SMA provided third-octave noise data for the Sunny Central 800CP inverter (Figure B.1 of Appendix B). The provided third octave spectrum was converted to a full octave spectrum and the contribution from two inverters was combined into a single sound power spectrum for use with CADNA-A model (calculations are available in Figure B.3 of Appendix B). A 5-dBA penalty was added to the frequency spectrum, as stipulated in Publication NPC-104, "Sound Level Adjustments," to allow for tonality. The frequency spectrum used to model combined noise emission from the two inverters located next to each other within the same cluster is shown in Table B.2 of Appendix B.

A 1.6-MVA transformer used to step-up the 360-V power from the inverters to 27.6 kV will be located in proximity to the inverters. Since the transformer make and model have not been selected at this point, the sound power levels resulting from the operation of the transformer were evaluated using data from NEMA TR 1-1993 (R2000). The NEMA levels were then converted into frequency spectrum using empirical correlations for transformer noise (Crocker, 2007). This calculation is available in Figure B.4 of Appendix B. Power transformers are considered by the MOE to be tonal noise sources. A 5-dB penalty was added to the sound power spectrum, as recommended by Publication NPC-104, "Sound Level Adjustments" for tonality. Table B.2 in Appendix B shows the frequency spectrum used to model the transformers located in the clusters.

Note also that at night time the facility will not operate. Under these conditions the inverters do not produce noise. The transformers (at the substation and clusters) are energized and make some magnetostrictive noise at a reduced level, but no cooling fans are in operation. To simulate night time operation it was assumed that only the transformers would emit noise at the same sound power level as during day time.

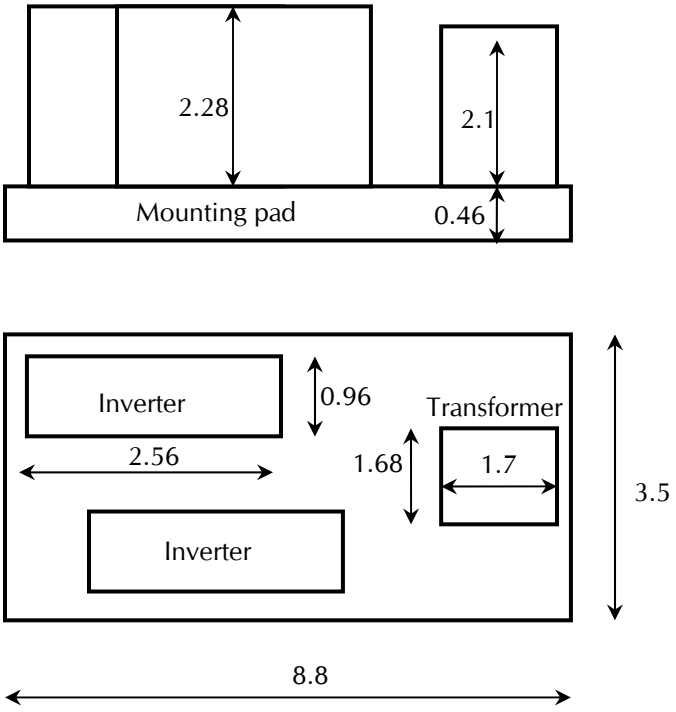

Figure 3.1 Schematic Inverter Cluster Layout
(all dimensions in metres)

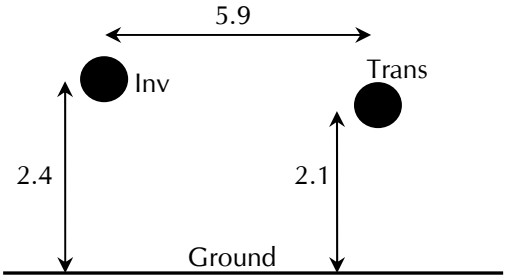

Figure 3.2 Inverter Cluster CADNA-A Acoustical Model

where: Inv = Noise Source Representing Two Sunny Central 800CP Inverters; and Trans = Noise Source Representing 27.6-kV/1.6-MVA Cluster Transformer (all dimensions in metres).

3.3 Noise Summary Table

A summary of the sound sources described above, including sound power level, characteristics and proposed noise control measures, is presented in Table 3.1.

Table 3.1 Noise Source Summary

Source ID	Description	Total Sound Power Level (dBA)	Source Location	Sound Characteristics	Noise Control Measures
Sub	44-kV/10-MVA substation transformer	90.8	O	S-T	U
Inv1	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Inv2	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Inv3	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Inv4	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Inv5	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Inv6	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Inv7	Two Sunny Central 800CP inverters	91.3	O	S-T	U
Trans1	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U
Trans2	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U
Trans3	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U
Trans4	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U
Trans5	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U
Trans6	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U
Trans7	27.6-kV/1.6-MVA cluster transformer	79.7	O	S-T	U

Notes:
1. A 5-dBA penalty is included in this table.
2. Location: Inside building (I), Outside building (O).
3. Sound Characteristics: Steady (S), Tonal (T), Impulsive (I), Quasi-Steady Impulsive (QSI).
4. Noise Control: Silencer (S), Acoustic lining (A), Barrier (B), Lagging (L), Enclosure (E), Other (O), Uncontrolled (U).

4. Point of Reception Summary

The POR used in this study were identified from the OBM and Google Earth Pro imagery (May 2007 and April 2010) within 1.2 km distance from the Project Site boundary.

The total number of POR considered in this study within a 1.2-km distance from the Project Site boundary is 114 (see Figure A.1 and Figure A.2 in Appendix A). Three of these noise receptors, identified in Table 4.1, were chosen as representative receptors for evaluating the noise contribution from each individual source. These three receptors were chosen in order to represent sound pressure levels on three sides of the Project Location. Each receptor was deemed the best representation of a given side. The complete set of results for all 114 noise receptors is provided in Appendix C, including two noise maps from CADNA-A. For this study, the POR elevation above ground is 4.5 m.

Table 4.1 Point of Reception Noise Impact (Day Time)

Source ID	POR 1		POR 2		POR 4	
	Distance (m)	L_{eq} Sound Level (dBA)	Distance (m)	L_{eq} Sound Level (dBA)	Distance (m)	L_{eq} Sound Level (dBA)
Sub	789	15.0	327	29.0	735	21.2
Inv1	417	26.6	1119	12.1	1125	12.1
Inv2	489	25.1	955	13.8	946	13.9
Inv3	428	26.4	864	15.1	936	14.0
Inv4	608	22.1	789	17.2	766	16.3
Inv5	561	22.9	631	22.6	787	16.6
Inv6	736	17.0	560	23.8	607	22.2
Inv7	896	14.5	363	27.9	505	24.0
Trans1	413	15.1	1122	0.1	1130	0.1
Trans2	483	13.6	957	1.9	951	1.9
Trans3	422	14.9	867	3.1	942	2.0
Trans4	603	11.4	791	6.4	771	4.3
Trans5	556	11.5	634	10.9	793	4.4
Trans6	730	5.2	562	12.1	613	10.5
Trans7	891	2.6	363	16.3	511	12.4

5. Mitigation Measures

While the analysis indicates that no mitigation will be required, the noise levels will be verified at the closest POR after the Project goes into service. If measurements indicate a need to reduce sound levels to satisfy MOE criteria, mitigation measures will be installed at the sources.

6. Impact Assessment

The purpose of the acoustic Assessment report is to demonstrate that the facility is in compliance with the noise performance limits. The Project will be located in a Class 3 Area, based on the classification defined in Publication NPC-232 by the MOE. Class 3 area means a rural area with an acoustical environment that is dominated by natural sounds, having little or no traffic, such as an agricultural area.

Table 6.1 shows the performance limits set by the MOE for Class 3 Areas, according to Publication NPC-232.

Table 6.1 Performance Limits (One-Hour L_{eq}) by Time of Day for Class 3 Areas.

Time of Day	One Hour L_{eq} (dBA) Class 3 Area
07:00 to 19:00	45.0
19:00 to 23:00	40.0
23:00 to 07:00	40.0

The solar facility will be operating during the day light hours, that is, before 19:00 during most days of the year. However, in the summer months the sun may shine until past 21:00, although the inverters will be below 100% loading conditions. As such, during the summer the facility will be operating at the time the applicable performance limit changes from 45-dBA to 40-dBA. Also, the transformers remain energized at night. In order to account for this the noise model assumes that the cluster transformers and substation transformer will be operating 24 hours and compares the impact from the facility with the 40-dBA limit. In reality, the cooling fans will not be in operation at night.

For this study, the overall ground attenuation coefficient was estimated to be 0.7. Appendix D includes a list of all the parameters used in the CADNA-A model to predict the sound pressure levels at the POR.

The modelling does not consider the effect of the solar panels on the predicted sound pressure levels at the points of reception. The solar panels may act as barriers to further reduce noise at the POR.

6.1 Compliance With Performance Limits

Table 6.2 presents the predicted sound pressure levels for the representative POR. The complete set of results is included in Appendix C. Appendix D includes a detailed calculation log of the representative POR with the highest Sound Pressure Level.

Table 6.2 Acoustic Assessment Summary (Day and Night Time).

POR ID	POR Description	Total Sound Level at POR (L_{eq}) Day/Night (dBA)	Verified by Acoustic Audit (Yes/No)	Performance Limit (L_{eq}) Day/Night (dBA)	Compliance With Performance Limit (Yes/No)
1	Existing house - west	32.6/21.8	No	45.0/40.0	Yes
2	Existing house - south	33.1/29.4	No	45.0/40.0	Yes
4	Existing house - east	28.7/22.3	No	45.0/40.0	Yes

The results of this study show that all POR are compliant with MOE guidelines based on the performance limits.

7. Conclusions and Recommendations

For the Glendale Solar Project, the sound pressure levels at the POR have been estimated using the CADNA-A model, based on ISO 9613-2. The performance limits used for comparison correspond to Class 3 areas, with 45-dBA during day time (7:00 a.m. to 7:00 p.m.) and 40-dBA during night time. It has been determined that no mitigation measures are needed for the Project operation.

Based on the results obtained in this study, it is concluded that the sound pressure levels at the POR will be below MOE requirements for Class 3 areas at night time (40 dBA) and day time (45 dBA).

8. References

Ontario Regulation 359/09. Environmental Protection Act. Renewable Energy Approvals Under Part V.0.1 of the Act.

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Ministry of the Environment (MOE). 1997. Noise Assessment Criteria in Land Use Planning. Publication LU-131. Ontario Ministry of the Environment. 12 pp + Annex.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 1 & 2 Areas (Urban). Publication NPC-205. Ontario Ministry of the Environment. 6 pp + Annex.

MOE. 1995. Sound Level Limits for Stationary Sources in Class 3 Areas (Rural). Publication NPC-232. Ontario Ministry of the Environment. 8 pp + Annex.

NEMA. 2000. Standards Publication No. TR 1-1993 (R2000): Transformers, Regulators and Reactors. National Electrical Manufacturers Association. 31 pp. (This reference probably not needed now).

International Organization for Standardization (ISO). Standard 1996-1: Description, Measurement and Assessment of Environmental Noise – Part 1: Basic Quantities and Assessment Procedures.

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

Appendix A

Land Use Zoning Designation Plan and Area Location Plan

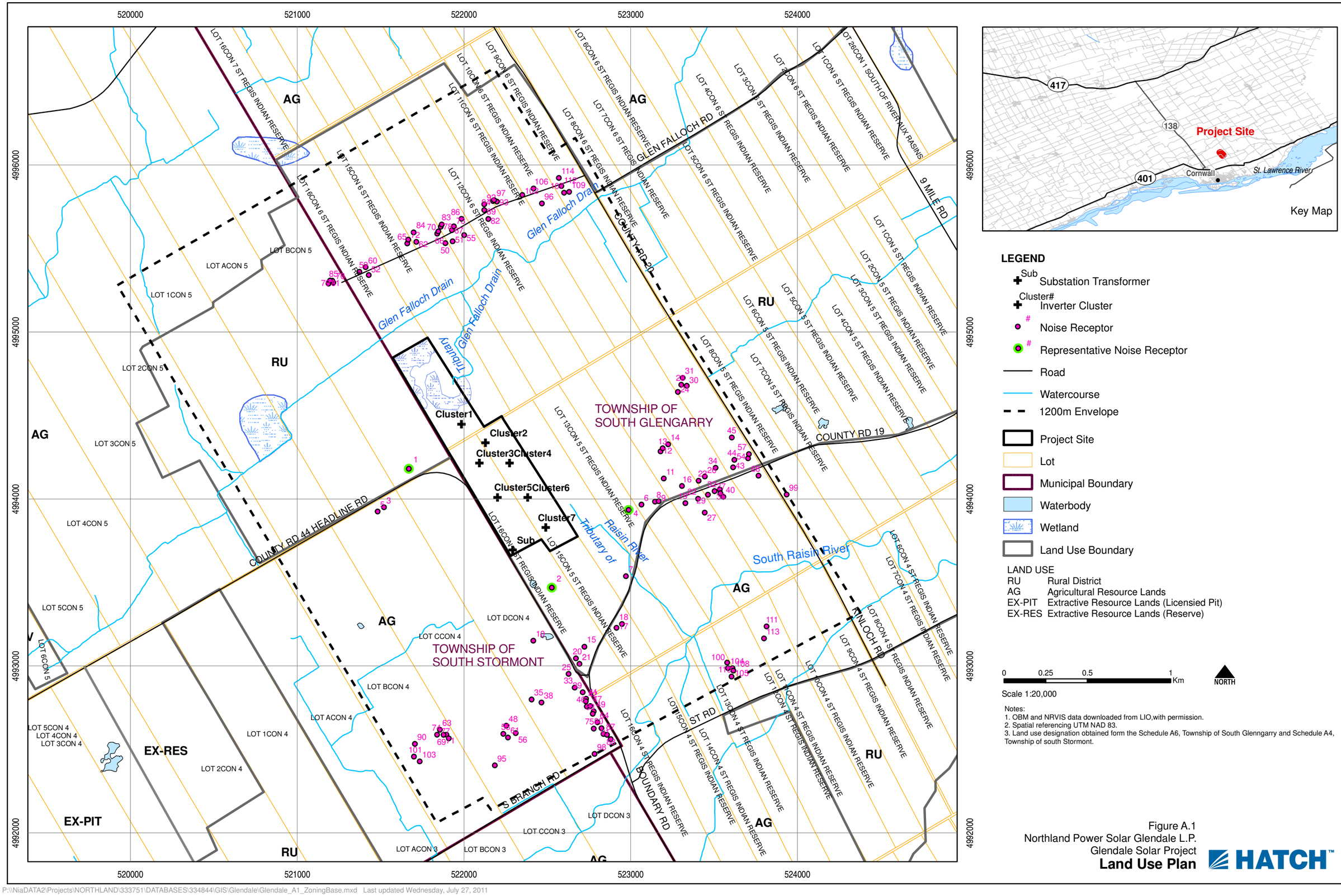

Figure A.1
Northland Power Solar Glendale L.P.
Glendale Solar Project
Land Use Plan

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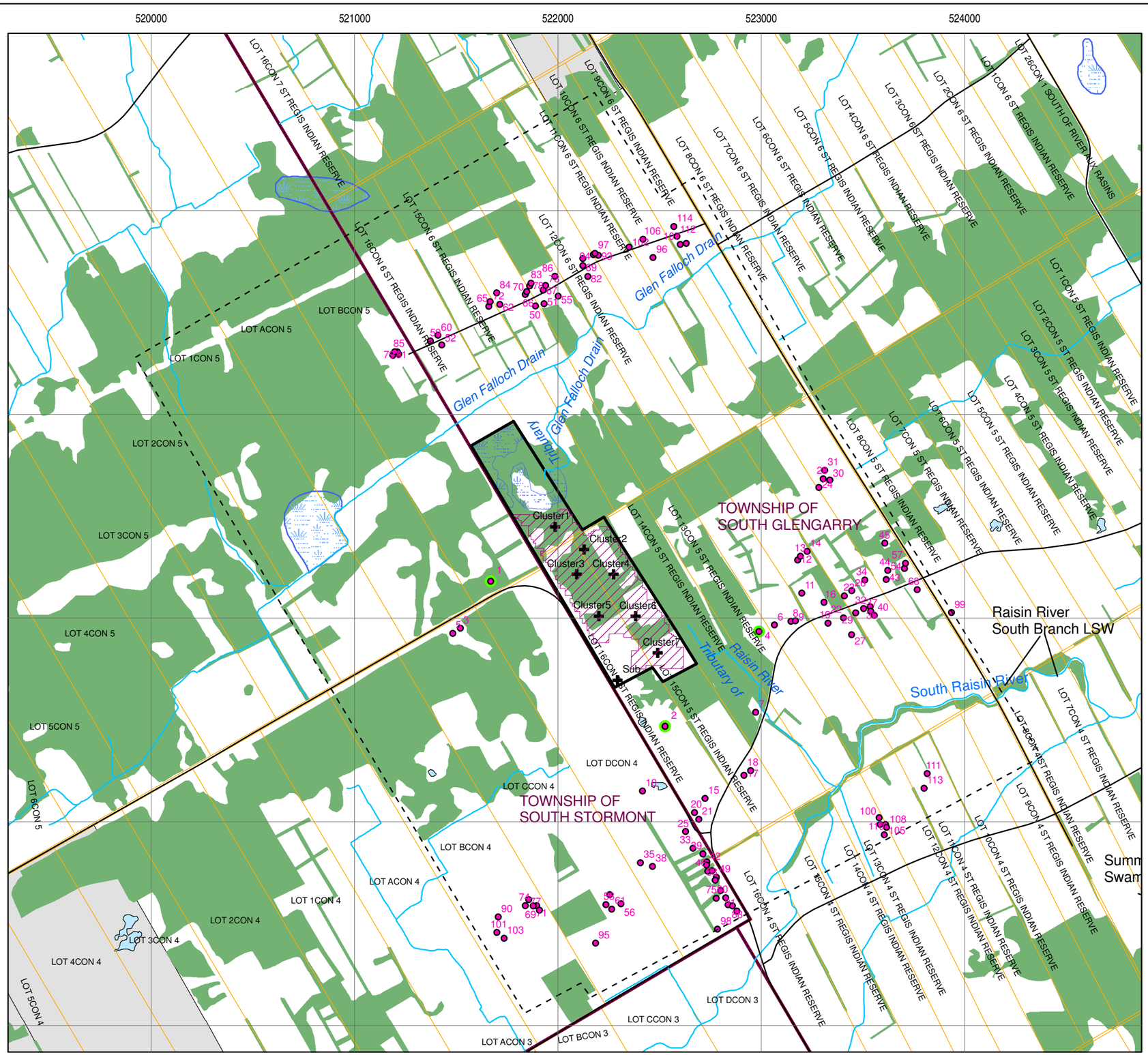

Notes:
1. OBM and NRVIS data downloaded from LIO,with permission.
2. Spatial referencing UTM NAD 83.

Figure A.2
Northland Power Solar Glendale L.P.
Glendale Solar Project
Area Location Plan

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Appendix B

Noise Sources

Table B.1 Point Sources Used in CADNA-A, Includes Tonality Penalty of 5.0-dBA. NAD83 Zone18.

Source ID	Description	Spectra ID	Total Sound Power Level (dBA)		Correction (dBA)		Height (m)	Coordinates (m)		
			Day	Night	Day	Night		X	Y	Z
Sub	44-kV/10-MVA substation transformer	T44kV_10MVA	90.8	90.8	5.0	5.0	3.0	522294	4993696	69.3
Inv1	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	521989	4994449	71.5
Inv2	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	522133	4994337	75.3
Inv3	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	522096	4994217	74.1
Inv4	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	522277	4994216	77.4
Inv5	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	522205	4994010	73.4
Inv6	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	522386	4994010	73.7
Inv7	Two Sunny Central 800CP inverters	SMA_SC800CPX2	91.3	0.0	5.0	0.0	2.4	522494	4993829	68.7
Trans1	27.6-kV/1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	521983	4994449	70.9
Trans2	27.6-kV/1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	522127	4994337	74.9
Trans3	27.6-kV/1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	522090	4994217	73.6
Trans4	27.6-kV /1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	522271	4994216	77.0
Trans5	27.6-kV/1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	522199	4994010	73.1
Trans6	27.6-kV/1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	522380	4994010	73.4
Trans7	27.6-kV/1.6-MVA cluster transformer	T27.6kV_1.6MVA	79.7	79.7	5.0	5.0	2.1	522489	4993829	68.5

Table B.2 Frequency Spectra Used for Modelling the Noise Sources, Not Including Tonality Penalty.

Spectra ID	Octave Spectrum (dBA)										
	31.5	63	125	250	500	1000	2000	4000	8000	A	lin
SMA_SC800CPX2		63.1	73.9	80.5	82.3	78.7	74.1	65.0	72.7	86.3	95.0
T27.6kV_1.6MVA	31.9	51.1	63.2	65.7	71.1	68.3	64.5	59.3	50.2	74.7	83.3
T44kV_10MVA	43.0	62.2	74.3	76.8	82.2	79.4	75.6	70.4	61.3	85.8	94.4

SC 720CP-10 / SC 760CP-10 / SC 800CP-10

Economic

- Direct deployment in the field due to outdoor enclosure
- Simplified shipping without concrete substation

Efficient

- Full nominal power at ambient temperatures up to 50 °C
- 10 % additional power for constant operation at ambient temperatures up to 25 °C

Flexible

- Powerful grid management functions (including LVRT)
- DC voltage range configurable

Reliable

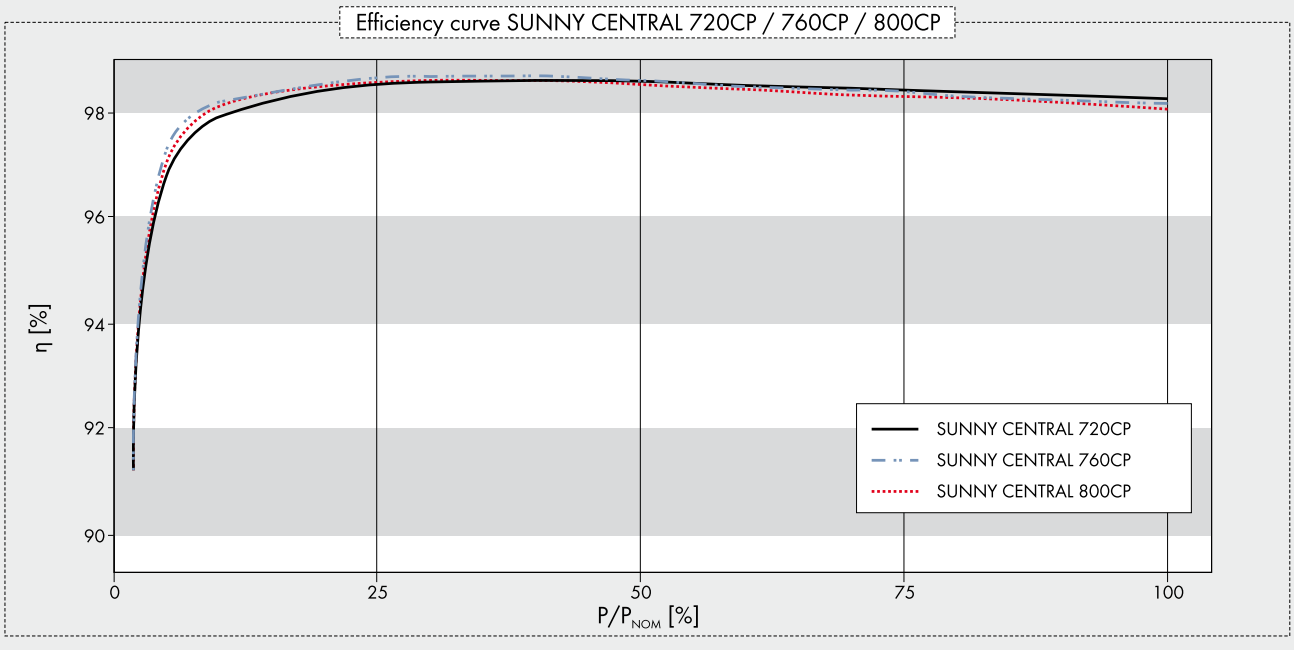
- Easy and safe installation due to a separate connection area
- Optional: extended input voltage range up to 1,100 V

SUNNY CENTRAL 720CP / 760CP / 800CP

High performance as standard

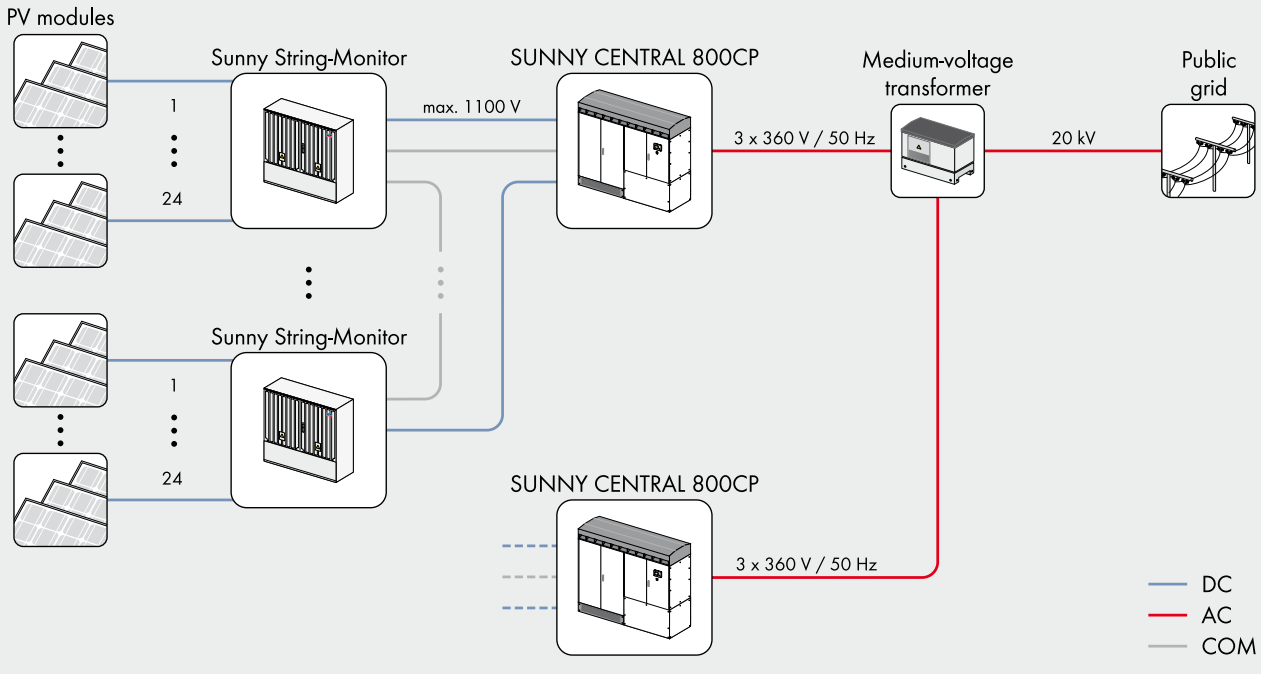
The completely new design of the Sunny Central CP series saves you real money. The compact and weatherproof enclosure is easy to load and transport and can be installed almost anywhere – there is no need for heavy protective concrete substations any longer. The innovative cooling concept OptiCool allows it to operate at full nominal power with ambient temperatures up to 50 °C. With the powerful grid management functions you are perfectly prepared for today's utility requirements as well as those still to come. The intelligent power management is the most important feature: in continuous operation, the Sunny Central 800CP can feed 880 kVA to the grid at ambient temperatures of up to 25 °C – that's 10 % more than the rated nominal power.

Technical data	Sunny Central 720CP	Sunny Central 760CP	Sunny Central 800CP
Input Data			
MPP voltage range	515 V – 820 V [3] [5]	545 V – 820 V [3] [5]	570 V – 820 V [3] [5]
Max. DC voltage		1000 V / 1100 V [1] Optional	
Max. DC current	1400 A	1400 A	1400 A
Number of DC inputs		9 fused inputs	
Output Values			
Nominal AC output @ 50 °C	720 kVA	760 kVA	800 kVA
Continuous AC power @ 25 °C	792 kVA	836 kVA	880 kVA
Max. AC current	1411 A	1411 A	1411 A
Nominal AC-current	1283 A	1283 A	1283 A
Nominal AC-voltage ±10 %	324 V	342 V	360 V
AC grid frequency 50 Hz	●	●	●
AC grid frequency 60 Hz	●	●	●
Power factor (cos φ)		0.9 leading ... 0.9 lagging	
Max. THD	< 3 %	< 3 %	< 3 %
Power consumption			
Internal consumption in operation	< 1500 W [4]	< 1500 W [4]	< 1500 W [4]
Standby consumption	< 100 W	< 100 W	< 100 W
External auxiliary voltage	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz
Dimensions and Weight			
Dimensions (W / H / D) in mm	2562 / 2279 / 956	2562 / 2279 / 956	2562 / 2279 / 956
Weight	1800 kg	1800 kg	1800 kg
Efficiency [2]			
Max. efficiency	98.6 %	98.6 %	98.6 %
Euro ETA	98.4 %	98.4 %	98.4 %
CEC-eta	98.4 %	98.4 %	98.4 %
Protection Rating and Ambient Conditions			
Protection rating (as per IEC 60529)	IP54	IP54	IP54
Protection rating (as per IEC 60721-3-3) Ambient conditions: fixed location, with protection against wind and weather	• Classification of chemically active substances: 3C2 • Classification of mechanically active substances: 3S2		
Operation temperature range	–20 °C ... +50 °C	–20 °C ... +50 °C	–20 °C ... +50 °C
Rel. humidity	15 % ... 95 %	15 % ... 95 %	15 % ... 95 %
Fresh air consumption	3000 m³/h	3000 m³/h	3000 m³/h
Max. altitude above sea level	2000 m	2000 m	2000 m

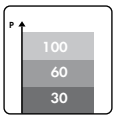


	Sunny Central 720CP	Sunny Central 760CP	Sunny Central 800CP
Features			
Sunny WebBox	●	●	●
Communication	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)
Communication with Sunny String-Monitor	RS485	RS485	RS485
LCD graphic display	●	●	●
Enclosure color	RAL 9016	RAL 9016	RAL 9016
Color of base	RAL 7005	RAL 7005	RAL 7005
Color of roof	RAL 7004	RAL 7004	RAL 7004
Ground fault monitoring / insulation monitoring	●	●	●
Circuit breaker AC side	●	●	●
Motor driven load disconnection switch on DC side	●	●	●
AC overvoltage protector	●	●	●
DC overvoltage protector	●	●	●
Overvoltage protectors for auxiliary supply	●	●	●
Certificates / Listings			
EMC	EN 61000-6-2 EN 61000-6-4		
CE conformity	●	●	●
BDEW-MSRL / FGW / TR8 [6]	●	●	●
RD 1633 / 2000	●	●	●
Arrêté du 23 / 04 / 08	●	●	●
● Standard features ❍ Optional features – Not available			
Type name	SC 720CP-10	SC 760CP-10	SC 800CP-10

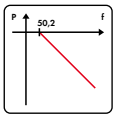
1) Startup at DC voltage < 1000 V
2) Efficiency measured without internal power supply
3) Further AC voltages, DC voltages and power classes can be configured (For detailed information see Technical Information „Innovations_CP“ at www.SMA.de)
4) Internal consumption at nominal power
5) At 1.05 $U_{AC,nom}$ and cos φ= 1
6) With complete dynamic grid support



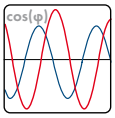
POWERFUL GRID MANAGEMENT FUNCTIONS



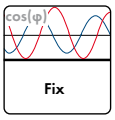
Remote controlled power reduction in case of grid overload
In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



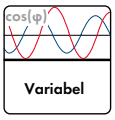
Frequency-dependent control of active power
As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



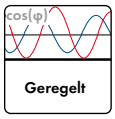
Static voltage support based on reactive power
To stabilize the grid voltage, SMA inverters feed reactive power (leading or lagging) into the grid. Three different modes are available:



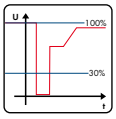
a) Fixed definition of the reactive power by the grid operator
The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{leading}$= 0.90 and $\cos(\varphi)_{lagging}$= 0.90.



b) Definition of a dynamic setpoint of the reactive power by the utility operator
The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{leading}$= 0.90 und $\cos(\varphi)_{lagging}$= 0.90. It is transmitted either through a communication unit the evaluation can e.g. be evaluated and processed by the SMA Power Reducer Box.



c) Control of the reactive power over a characteristic curve
The reactive power or the phase shift is controlled by a pre-defined characteristic curve – depending on the active power fed into the grid or the grid voltage.



Limited Dynamic Grid Support
The inverter continues to feed to the grid after short term voltage drops – as long as the grid voltage is within a defined voltage window.

Dynamic Grid Support
LVRT (Low-Voltage Ride Through): The inverter stays connected to the grid during voltage drops and supports the grid by feeding reactive power.

Terz-midle-frequency [kHz]	Soundpower-level L_{xpA} [dB_A]500kW	Soundpower-level L_{xpA} [dB_A]640kW	Soundpower-level L_{xpA} [dB_A]720kW	Soundpower-level L_{xpA} [dB_A]760kW	Soundpower level L_{xpA} [dB_A]800kW
0,05	63,30	55,30	57,70	67,00	56,50
0,063	60,80	53,10	56,80	63,20	54,00
0,08	63,90	56,30	56,50	59,50	55,20
0,1	64,10	66,20	65,00	66,50	68,10
0,125	65,70	64,50	60,60	65,20	62,00
0,16	72,30	65,80	65,50	63,20	66,40
0,2	67,30	64,60	66,80	64,90	67,80
0,25	66,10	76,20	77,50	70,80	72,40
0,315	78,40	79,80	77,70	82,20	75,10
0,4	73,70	73,90	73,90	72,80	66,70
0,5	77,80	78,70	77,70	77,40	74,70
0,63	78,90	78,90	74,60	77,40	77,00
0,8	70,60	72,50	74,10	70,60	72,00
1	72,20	71,00	70,00	68,90	67,90
1,25	72,40	72,00	71,50	70,80	71,80
1,6	67,30	68,30	76,70	68,60	68,50
2	69,30	66,30	66,50	67,20	65,30
2,5	65,10	66,80	64,60	64,80	63,90
3,15	62,60	64,30	65,00	63,20	61,00
4,0	53,50	54,20	54,70	52,30	53,80
5,0	51,30	49,50	50,50	51,20	49,80
6,3	68,90	72,60	73,50	73,50	69,70

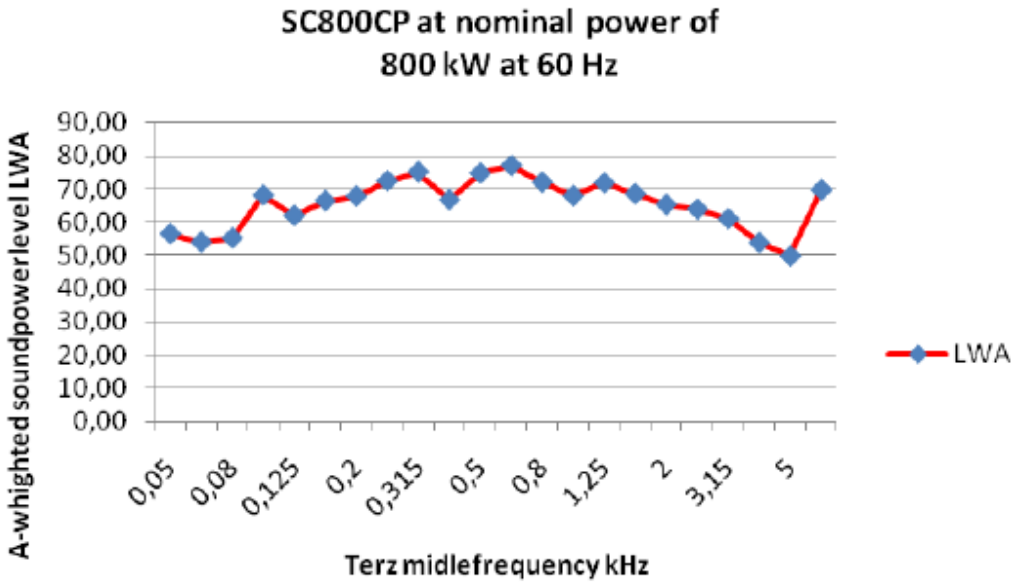


Figure B.1 SC800CP Inverter Sound Power Level as Provided by SMA. Note that the Header in the Table above Represents Various Inverter Models of CS###CP Series.

Estimated Frequency Spectra for Transformers

Transformer - 44kV/10MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20)

Average LpA	68 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2
Estimated surface area	35 m^2	Can be assumed, 25% of change will produce a difference of 1 dB on Lw, try to estimate on the high side

Correction factors are in dB

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Notes
C1	-11.0	-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0	Outdoors, indoors in mechanical room over 140 m^3
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	Indoors
C3	-11	-2	3	2	2	-4	-9	-14	-21	Serious Noise Problems

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

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	82.4	88.4	90.4	85.4	85.4	79.4	74.4	69.4	62.4	**94.5**
C2 based [dB]	82.4	91.4	96.4	91.4	91.4	82.4	74.4	69.4	62.4	**99.5**
C3 based [dB]	82.4	91.4	96.4	95.4	95.4	89.4	84.4	79.4	72.4	**101.5**

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	43.0	52.0	57.0
63	-26.2	62.2	65.2	65.2
125	-16.1	74.3	80.3	80.3
250	-8.6	76.8	82.8	86.8
500	-3.2	82.2	88.2	92.2
1000	0	79.4	82.4	89.4
2000	1.2	75.6	75.6	85.6
4000	1	70.4	70.4	80.4
8000	-1.1	61.3	61.3	71.3
LwA [dBA]		**85.8**	**90.8**	**95.6**

Used in the study

Figure B.2 Sound Power Level Calculation for 44-kV/10-MVA Substation Transformer.

Sound Power Level Calculation for SMA Sunny Central 800CP, 100% LOAD

Third octave, as provided		
Freq #	Freq (Hz)	LwA (dBA)
1	25	
2	31.5	
3	40	
4	50	56.5
5	63	54.0
6	80	55.2
7	100	68.1
8	125	62.0
9	160	66.4
10	200	67.8
11	250	72.4
12	315	75.1
13	400	66.7
14	500	74.7
15	630	77.0
16	800	72.0
17	1000	67.9
18	1250	71.8
19	1600	68.5
20	2000	65.3
21	2500	63.9
22	3150	61.0
23	4000	53.8
24	5000	49.8
25	6300	69.7
26	8000	
27	10000	
	Total LwA	**83.3**

Full octave, as used in CADNA-A model			
Freq #	Freq (Hz)	LwA 1 inverter (dBA)	LwA 2 inverters (dBA)
	31.5		
5	63	60.1	63.1
8	125	70.9	73.9
11	250	77.5	80.5
14	500	79.3	82.3
17	1000	75.7	78.7
20	2000	71.1	74.1
23	4000	62.0	65.0
26	8000	69.7	72.7
	Total LwA	**83.3**	**86.3**

$$10\log\left(10^{\frac{56.5}{10}}+10^{\frac{54.0}{10}}+10^{\frac{55.2}{10}}\right)=60.1dBA$$

$$10\log\left(10^{\frac{60.1}{10}}+10^{\frac{60.1}{10}}\right)=63.1dBA$$

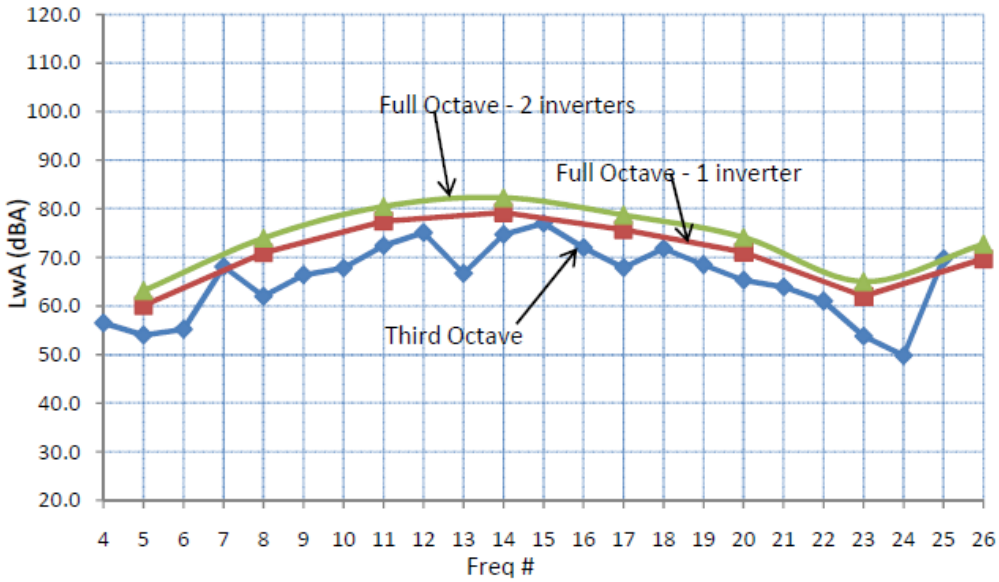


Figure B.3 Sound Power Level Calculation for SMA Sunny Central 800CP, 100% LOAD.

Estimated Frequency Spectra for Transformers

Transformer - 27.6kV/1.6MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20)

Average LpA	61 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2
Estimated surface area	13.52 m^2	Can be assumed, 25% of change will produce a difference of 1 dB on Lw, try to estimate on the high side

Correction factors are in dB

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Notes
C1	-11.0	-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0	Outdoors, indoors in mechanical room over 140 m^3
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	Indoors
C3	-11	-2	3	2	2	-4	-9	-14	-21	Serious Noise Problems

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

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	71.3	77.3	79.3	74.3	74.3	68.3	63.3	58.3	51.3	**83.4**
C2 based [dB]	71.3	80.3	85.3	80.3	80.3	71.3	63.3	58.3	51.3	**88.4**
C3 based [dB]	71.3	80.3	85.3	84.3	84.3	78.3	73.3	68.3	61.3	**90.4**

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	31.9	40.9	45.9
63	-26.2	51.1	54.1	54.1
125	-16.1	63.2	69.2	69.2
250	-8.6	65.7	71.7	75.7
500	-3.2	71.1	77.1	81.1
1000	0	68.3	71.3	78.3
2000	1.2	64.5	64.5	74.5
4000	1	59.3	59.3	69.3
8000	-1.1	50.2	50.2	60.2
LwA [dBA]		**74.7**	**79.6**	**84.5**

Used in the study

Figure B.4 Sound Power Level Calculation for 27.6-kV/1.6-MVA Cluster Transformer.

Appendix C

Sound Pressure Levels for Points of Reception and Noise Maps from CADNA-A

Table C.1 Calculated Sound Pressure Levels at POR (shaded rows correspond to representative POR). Existing = Existing dwelling. NAD83 Zone18.

ID	Description	Total Sound Pressure Level		Performance Limit		Height (m)	Coordinates			Min dist to source (m)
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)		X (m)	Y (m)	Z (m)	
1	existing	32.6	21.8	45.0	40.0	4.5	521670	4994180	73.6	413
2	existing	33.1	29.4	45.0	40.0	4.5	522528	4993468	69.5	327
3	existing	29.3	18.9	45.0	40.0	4.5	521521	4993950	74.5	629
4	existing	28.7	22.3	45.0	40.0	4.5	522989	4993934	71.6	505
5	existing	28.7	18.4	45.0	40.0	4.5	521483	4993925	74.5	674
6	existing	27.6	21.2	45.0	40.0	4.5	523066	4993966	74.5	587
7	existing	27.7	21.5	45.0	40.0	4.5	522973	4993537	67.8	561
8	existing	24.4	16.3	45.0	40.0	4.5	523147	4993984	71.9	670
9	existing	23.7	15.6	45.0	40.0	4.5	523169	4993987	71.5	692
10	existing	28.3	24.4	45.0	40.0	4.5	522417	4993151	69.5	559
11	existing	23.2	15.1	45.0	40.0	4.5	523200	4994122	74.2	763
12	existing	24.7	15.3	45.0	40.0	4.5	523180	4994284	79.5	823
13	existing	24.5	15.0	45.0	40.0	4.5	523193	4994303	79.5	844
14	existing	23.5	14.5	45.0	40.0	4.5	523226	4994327	79.5	885
15	existing	22.9	17.3	45.0	40.0	4.5	522724	4993115	65.3	724
16	existing	23.1	15.1	45.0	40.0	4.5	523309	4994077	74.5	851
17	existing	22.5	16.2	45.0	40.0	4.5	522916	4993228	64.5	734
18	existing	22.3	16.0	45.0	40.0	4.5	522949	4993251	63.5	736
19	existing	24.3	18.2	45.0	40.0	4.5	523329	4993975	72.6	847
20	existing	24.2	17.6	45.0	40.0	4.5	522673	4993045	66.4	754
21	existing	23.0	16.3	45.0	40.0	4.5	522694	4993012	65.2	793
22	existing	23.5	17.4	45.0	40.0	4.5	523405	4994001	74.0	926
23	existing	21.9	13.4	45.0	40.0	4.5	523409	4994109	74.5	956
24	existing	20.6	11.6	45.0	40.0	4.5	523284	4994641	74.9	1092
25	existing	21.5	15.8	45.0	40.0	4.5	522629	4992951	65.5	817
26	existing	20.7	12.7	45.0	40.0	4.5	523446	4994134	75.0	999
27	existing	21.7	17.0	45.0	40.0	4.5	523445	4993918	68.7	954
28	existing	20.2	11.2	45.0	40.0	4.5	523305	4994684	74.5	1129
29	existing	22.9	16.8	45.0	40.0	4.5	523465	4994026	74.5	990
30	existing	20.0	11.0	45.0	40.0	4.5	523338	4994678	74.1	1156
31	existing	20.0	10.9	45.0	40.0	4.5	523313	4994725	73.5	1154
32	existing	21.8	16.2	45.0	40.0	4.5	523504	4994047	74.5	1032
33	existing	20.5	14.5	45.0	40.0	4.5	522665	4992870	64.5	906
34	existing	20.9	15.6	45.0	40.0	4.5	523510	4994187	76.6	1076
35	existing	22.5	15.6	45.0	40.0	4.5	522407	4992799	66.5	905
36	existing	21.5	15.9	45.0	40.0	4.5	523536	4994056	74.4	1066
37	existing	20.8	12.9	45.0	40.0	4.5	523539	4994034	73.0	1064
38	existing	20.6	14.4	45.0	40.0	4.5	522466	4992781	65.3	932
39	existing	21.3	14.3	45.0	40.0	4.5	522714	4992842	64.5	953
40	existing	19.7	11.9	45.0	40.0	4.5	523557	4994013	70.8	1078

ID	Description	Total Sound Pressure Level		Performance Limit		Height (m)	Coordinates			Min dist to source (m)
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)		X (m)	Y (m)	Z (m)	
41	existing	19.6	13.5	45.0	40.0	4.5	522734	4992803	62.6	996
42	existing	19.5	13.3	45.0	40.0	4.5	522732	4992788	62.3	1009
43	existing	19.2	11.1	45.0	40.0	4.5	523615	4994189	76.1	1177
44	existing	19.9	14.6	45.0	40.0	4.5	523623	4994234	77.4	1199
45	existing	20.6	14.4	45.0	40.0	4.5	523608	4994368	79.5	1237
46	existing	19.2	13.0	45.0	40.0	4.5	522738	4992757	61.2	1040
47	existing	19.1	13.0	45.0	40.0	4.5	522759	4992760	60.5	1046
48	existing	23.1	18.0	45.0	40.0	4.5	522255	4992642	69.0	1056
49	existing	18.8	12.6	45.0	40.0	4.5	522780	4992728	59.5	1084
50	existing	21.1	10.3	45.0	40.0	4.5	521890	4995532	74.4	1087
51	existing	21.0	10.3	45.0	40.0	4.5	521933	4995543	73.6	1095
52	existing	21.7	10.9	45.0	40.0	4.5	521430	4995341	69.5	1050
53	existing	18.7	12.5	45.0	40.0	4.5	522774	4992713	59.5	1095
54	existing	18.4	10.2	45.0	40.0	4.5	523705	4994243	76.1	1279
55	existing	20.6	10.0	45.0	40.0	4.5	522002	4995580	73.0	1131
56	existing	18.8	12.7	45.0	40.0	4.5	522311	4992597	65.9	1100
57	existing	18.3	10.1	45.0	40.0	4.5	523710	4994269	76.5	1292
58	existing	22.7	17.5	45.0	40.0	4.5	522237	4992593	68.4	1105
59	existing	21.3	10.5	45.0	40.0	4.5	521374	4995360	70.6	1096
60	existing	21.3	10.5	45.0	40.0	4.5	521411	4995387	70.6	1099
61	existing	19.1	13.4	45.0	40.0	4.5	522265	4992571	66.6	1126
62	existing	21.2	10.4	45.0	40.0	4.5	521715	4995540	74.5	1123
63	existing	18.4	12.2	45.0	40.0	4.5	521857	4992618	66.0	1164
64	existing	18.3	11.9	45.0	40.0	4.5	522801	4992662	59.5	1152
65	existing	21.2	10.3	45.0	40.0	4.5	521660	4995530	74.4	1128
66	existing	20.6	10.2	45.0	40.0	4.5	521840	4995588	74.5	1149
67	existing	20.4	9.7	45.0	40.0	4.5	521928	4995610	74.5	1162
68	existing	17.9	9.6	45.0	40.0	4.5	523767	4994139	69.5	1310
69	existing	18.0	11.7	45.0	40.0	4.5	521896	4992588	64.7	1178
70	existing	20.5	10.1	45.0	40.0	4.5	521847	4995602	74.5	1161
71	existing	18.0	11.7	45.0	40.0	4.5	521879	4992587	64.9	1185
72	existing	21.0	10.2	45.0	40.0	4.5	521667	4995553	74.5	1148
73	existing	20.2	9.6	45.0	40.0	4.5	521940	4995632	74.5	1184
74	existing	18.0	11.6	45.0	40.0	4.5	521840	4992588	65.2	1198
75	existing	18.1	11.7	45.0	40.0	4.5	522779	4992624	59.5	1177
76	existing	21.8	11.0	45.0	40.0	4.5	521217	4995295	74.2	1142
77	existing	17.9	11.6	45.0	40.0	4.5	521910	4992566	64.5	1194
78	existing	20.2	9.5	45.0	40.0	4.5	521861	4995630	74.5	1188
79	existing	21.7	10.9	45.0	40.0	4.5	521211	4995306	74.4	1154
80	existing	17.7	11.5	45.0	40.0	4.5	522826	4992627	59.5	1195
81	existing	21.7	10.8	45.0	40.0	4.5	521189	4995289	73.7	1157
82	existing	19.7	9.2	45.0	40.0	4.5	522147	4995676	72.6	1238
83	existing	20.1	9.4	45.0	40.0	4.5	521868	4995644	74.5	1200
84	existing	20.7	9.9	45.0	40.0	4.5	521699	4995596	74.5	1182

ID	Description	Total Sound Pressure Level		Performance Limit		Height (m)	Coordinates			Min dist to source (m)
		Day (dBA)	Night (dBA)	Day (dBA)	Night (dBA)		X (m)	Y (m)	Z (m)	
85	existing	21.6	10.8	45.0	40.0	4.5	521198	4995307	74.2	1163
86	existing	19.7	7.4	45.0	40.0	4.5	521986	4995677	74.5	1229
87	existing	17.4	11.2	45.0	40.0	4.5	522838	4992592	59.5	1231
88	existing	17.3	11.1	45.0	40.0	4.5	522859	4992587	59.5	1245
89	existing	19.2	6.9	45.0	40.0	4.5	522123	4995730	74.5	1288
90	existing	17.2	10.7	45.0	40.0	4.5	521707	4992533	64.5	1303
91	existing	17.1	10.8	45.0	40.0	4.5	522881	4992562	59.5	1278
92	existing	19.0	6.6	45.0	40.0	4.5	522123	4995765	74.5	1323
93	existing	18.7	6.4	45.0	40.0	4.5	522199	4995781	73.0	1348
94	existing	18.8	6.4	45.0	40.0	4.5	522175	4995784	74.5	1348
95	existing	16.7	10.6	45.0	40.0	4.5	522186	4992404	62.3	1297
96	existing	18.3	5.7	45.0	40.0	4.5	522469	4995770	72.1	1405
97	existing	18.7	6.4	45.0	40.0	4.5	522182	4995790	74.1	1355
98	existing	16.7	10.4	45.0	40.0	4.5	522785	4992473	59.5	1319
99	existing	16.7	8.5	45.0	40.0	4.5	523936	4994027	59.6	1455
100	existing	17.5	10.0	45.0	40.0	4.5	523580	4993020	61.0	1354
101	existing	16.3	10.0	45.0	40.0	4.5	521701	4992457	64.5	1374
102	existing	18.3	5.9	45.0	40.0	4.5	522351	4995821	73.7	1419
103	existing	16.2	9.9	45.0	40.0	4.5	521736	4992428	63.8	1386
104	existing	17.3	9.8	45.0	40.0	4.5	523585	4992987	60.8	1378
105	existing	16.8	9.6	45.0	40.0	4.5	523612	4992987	61.4	1399
106	existing	17.6	5.3	45.0	40.0	4.5	522419	4995859	74.5	1474
107	existing	17.0	4.7	45.0	40.0	4.5	522602	4995834	73.4	1514
108	existing	16.8	9.5	45.0	40.0	4.5	523617	4992972	61.4	1412
109	existing	16.8	4.6	45.0	40.0	4.5	522632	4995839	72.1	1531
110	existing	16.9	9.4	45.0	40.0	4.5	523606	4992936	61.1	1426
111	existing	16.7	9.2	45.0	40.0	4.5	523816	4993236	64.5	1449
112	existing	17.1	4.5	45.0	40.0	4.5	522586	4995874	74.5	1545
113	existing	16.3	9.0	45.0	40.0	4.5	523801	4993165	64.5	1465
114	existing	16.8	4.2	45.0	40.0	4.5	522570	4995922	74.5	1584

Sub Substation Transformer

Cluster# Inverter Cluster

Noise Receptor

Representative Noise Receptor

From 40 to 45 dBA

From 45 to 50 dBA

From 50 to 55 dBA

From 55 to 60 dBA

Over 60 dBA

Project Site

Northland Power Solar Glendale L.P.

Glendale Solar Project – Noise Map at 4.5m – Day Time

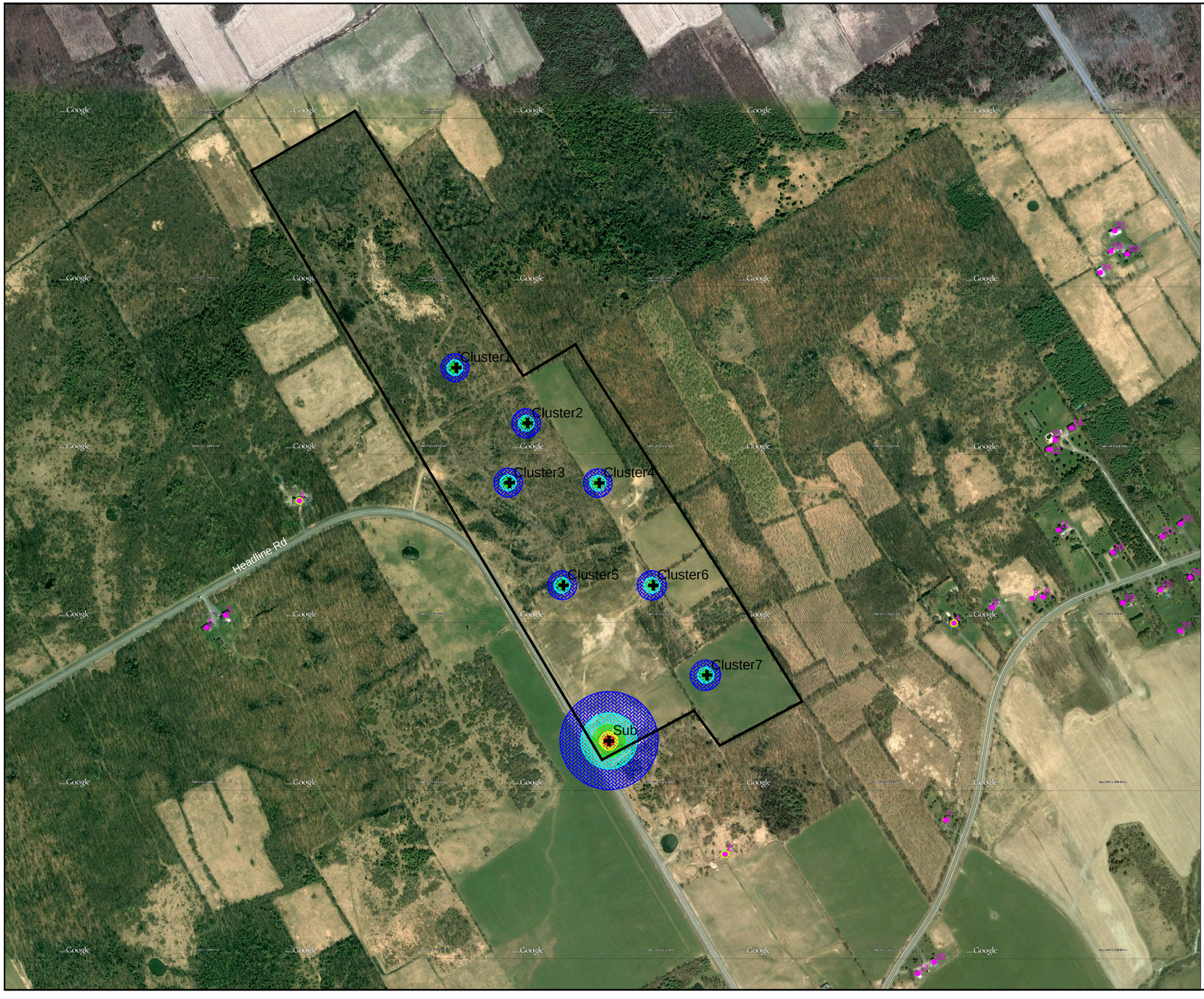
0 120 240 360 480 600 m

SCALE 1:7,500

Figure C.1

HATCH™

Rev 1.01



Sub Substation Transformer

Cluster# Inverter Cluster

Noise Receptor

Representative Noise Receptor

From 40 to 45 dBA

From 45 to 50 dBA

From 50 to 55 dBA

From 55 to 60 dBA

Over 60 dBA

Project Site

Northland Power Solar Glendale L.P.

Glendale Solar Project – Noise Map at 4.5m – Night Time

0 120 240 360 480 600 m

SCALE 1:7,500

Figure C.2

HATCH™

Rev 1.01

Appendix D

CADNA-A Sample Calculations

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	2000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	0.00
Night-time Penalty (dB)	0.00
DTM	
Standard Height (m)	0.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	1
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (°C)	10
rel. Humidity (%)	70
Ground Absorption G	0.70
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03)	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Receiver
Name: Receptors - existing
ID: 2.0
X: 522527.60
Y: 4993467.87
Z: 69.50

Point Source, ISO 9613, Name: "Sub", ID: "Sub"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522293.53	4993696.41	69.33	0	32	48.0	48.0	0.0	0.0	61.3	0.0	-3.9	0.0	0.0	0.0	0.0	-0.0	-9.4	-9.4
2	522293.53	4993696.41	69.33	0	63	67.2	67.2	0.0	0.0	61.3	0.0	-3.9	0.0	0.0	0.0	0.0	-0.0	9.8	9.8
3	522293.53	4993696.41	69.33	0	125	79.3	79.3	0.0	0.0	61.3	0.1	2.8	0.0	0.0	0.0	0.0	-0.0	15.1	15.1
4	522293.53	4993696.41	69.33	0	250	81.8	81.8	0.0	0.0	61.3	0.3	2.5	0.0	0.0	0.0	0.0	-0.0	17.7	17.7
5	522293.53	4993696.41	69.33	0	500	87.2	87.2	0.0	0.0	61.3	0.6	-1.0	0.0	0.0	0.0	0.0	-0.0	26.3	26.3
6	522293.53	4993696.41	69.33	0	1000	84.4	84.4	0.0	0.0	61.3	1.2	-1.2	0.0	0.0	0.0	0.0	-0.0	23.1	23.1
7	522293.53	4993696.41	69.33	0	2000	80.6	80.6	0.0	0.0	61.3	3.2	-1.2	0.0	0.0	0.0	0.0	-0.0	17.3	17.3
8	522293.53	4993696.41	69.33	0	4000	75.4	75.4	0.0	0.0	61.3	10.7	-1.2	0.0	0.0	0.0	0.0	-0.0	4.6	4.6
9	522293.53	4993696.41	69.33	0	8000	66.3	66.3	0.0	0.0	61.3	38.2	-1.2	0.0	0.0	0.0	0.0	-0.0	-32.0	-32.0

Point Source, ISO 9613, Name: "Inv1", ID: "Inv1"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	521989.12	4994448.66	71.49	0	63	68.1	-88.0	0.0	0.0	72.0	0.1	-5.4	0.0	0.0	10.2	0.0	-0.0	-8.8	-88.0
2	521989.12	4994448.66	71.49	0	125	78.9	-88.0	0.0	0.0	72.0	0.5	4.3	0.0	0.0	0.5	0.0	-0.0	1.7	-88.0
3	521989.12	4994448.66	71.49	0	250	85.5	-88.0	0.0	0.0	72.0	1.2	2.9	0.0	0.0	1.9	0.0	-0.0	7.6	-88.0
4	521989.12	4994448.66	71.49	0	500	87.3	-88.0	0.0	0.0	72.0	2.2	-0.9	0.0	0.0	5.7	0.0	-0.0	8.4	-88.0
5	521989.12	4994448.66	71.49	0	1000	83.7	-88.0	0.0	0.0	72.0	4.1	-1.6	0.0	0.0	6.4	0.0	-0.0	2.9	-88.0
6	521989.12	4994448.66	71.49	0	2000	79.1	-88.0	0.0	0.0	72.0	10.8	-1.6	0.0	0.0	6.4	0.0	-0.0	-8.5	-88.0
7	521989.12	4994448.66	71.49	0	4000	70.0	-88.0	0.0	0.0	72.0	36.7	-1.6	0.0	0.0	6.4	0.0	-0.0	-43.4	-88.0
8	521989.12	4994448.66	71.49	0	8000	77.7	-88.0	0.0	0.0	72.0	130.8	-1.6	0.0	0.0	6.4	0.0	-0.0	-129.8	-88.0

Point Source, ISO 9613, Name: "Inv2", ID: "Inv2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522132.90	4994337.03	75.28	0	63	68.1	-88.0	0.0	0.0	70.6	0.1	-5.3	0.0	0.0	10.1	0.0	-0.0	-7.4	-88.0
2	522132.90	4994337.03	75.28	0	125	78.9	-88.0	0.0	0.0	70.6	0.4	4.1	0.0	0.0	0.6	0.0	-0.0	3.1	-88.0
3	522132.90	4994337.03	75.28	0	250	85.5	-88.0	0.0	0.0	70.6	1.0	2.9	0.0	0.0	1.8	0.0	-0.0	9.2	-88.0
4	522132.90	4994337.03	75.28	0	500	87.3	-88.0	0.0	0.0	70.6	1.8	-0.9	0.0	0.0	5.6	0.0	-0.0	10.1	-88.0
5	522132.90	4994337.03	75.28	0	1000	83.7	-88.0	0.0	0.0	70.6	3.5	-1.6	0.0	0.0	6.3	0.0	-0.0	4.9	-88.0
6	522132.90	4994337.03	75.28	0	2000	79.1	-88.0	0.0	0.0	70.6	9.2	-1.6	0.0	0.0	6.2	0.0	-0.0	-5.3	-88.0
7	522132.90	4994337.03	75.28	0	4000	70.0	-88.0	0.0	0.0	70.6	31.3	-1.6	0.0	0.0	6.0	0.0	-0.0	-36.2	-88.0
8	522132.90	4994337.03	75.28	0	8000	77.7	-88.0	0.0	0.0	70.6	111.6	-1.6	0.0	0.0	5.5	0.0	-0.0	-108.3	-88.0

Point Source, ISO 9613, Name: "Inv3", ID: "Inv3"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522096.33	4994216.64	74.05	0	63	68.1	-88.0	0.0	0.0	69.7	0.1	-5.3	0.0	0.0	10.0	0.0	-0.0	-6.5	-88.0
2	522096.33	4994216.64	74.05	0	125	78.9	-88.0	0.0	0.0	69.7	0.4	4.0	0.0	0.0	0.7	0.0	-0.0	4.1	-88.0
3	522096.33	4994216.64	74.05	0	250	85.5	-88.0	0.0	0.0	69.7	0.9	3.0	0.0	0.0	1.7	0.0	-0.0	10.2	-88.0
4	522096.33	4994216.64	74.05	0	500	87.3	-88.0	0.0	0.0	69.7	1.7	-0.9	0.0	0.0	5.4	0.0	-0.0	11.4	-88.0
5	522096.33	4994216.64	74.05	0	1000	83.7	-88.0	0.0	0.0	69.7	3.2	-1.6	0.0	0.0	5.8	0.0	-0.0	6.6	-88.0
6	522096.33	4994216.64	74.05	0	2000	79.1	-88.0	0.0	0.0	69.7	8.4	-1.6	0.0	0.0	5.1	0.0	-0.0	-2.5	-88.0
7	522096.33	4994216.64	74.05	0	4000	70.0	-88.0	0.0	0.0	69.7	28.3	-1.6	0.0	0.0	3.3	0.0	-0.0	-29.8	-88.0
8	522096.33	4994216.64	74.05	0	8000	77.7	-88.0	0.0	0.0	69.7	101.0	-1.6	0.0	0.0	1.6	0.0	-0.0	-93.0	-88.0

Point Source, ISO 9613, Name: "Inv4", ID: "Inv4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522277.25	4994216.24	77.40	0	63	68.1	-88.0	0.0	0.0	68.9	0.1	-5.2	0.0	0.0	9.8	0.0	-0.0	-5.6	-88.0
2	522277.25	4994216.24	77.40	0	125	78.9	-88.0	0.0	0.0	68.9	0.3	3.9	0.0	0.0	0.6	0.0	-0.0	5.2	-88.0
3	522277.25	4994216.24	77.40	0	250	85.5	-88.0	0.0	0.0	68.9	0.8	3.0	0.0	0.0	1.2	0.0	-0.0	11.6	-88.0
4	522277.25	4994216.24	77.40	0	500	87.3	-88.0	0.0	0.0	68.9	1.5	-0.9	0.0	0.0	4.3	0.0	-0.0	13.4	-88.0

Point Source, ISO 9613, Name: "Inv4", ID: "Inv4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
5	522277.25	4994216.24	77.40	0	1000	83.7	-88.0	0.0	0.0	68.9	2.9	-1.5	0.0	0.0	3.1	0.0	-0.0	10.3	-88.0
6	522277.25	4994216.24	77.40	0	2000	79.1	-88.0	0.0	0.0	68.9	7.6	-1.6	0.0	0.0	1.6	0.0	-0.0	2.5	-88.0
7	522277.25	4994216.24	77.40	0	4000	70.0	-88.0	0.0	0.0	68.9	25.9	-1.6	0.0	0.0	1.6	0.0	-0.0	-24.8	-88.0
8	522277.25	4994216.24	77.40	0	8000	77.7	-88.0	0.0	0.0	68.9	92.2	-1.6	0.0	0.0	1.6	0.0	-0.0	-83.5	-88.0

Point Source, ISO 9613, Name: "Inv5", ID: "Inv5"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522204.98	4994010.10	73.40	0	63	68.1	-88.0	0.0	0.0	67.0	0.1	-5.0	0.0	0.0	0.0	0.0	-0.0	6.0	-88.0
2	522204.98	4994010.10	73.40	0	125	78.9	-88.0	0.0	0.0	67.0	0.3	3.5	0.0	0.0	0.0	0.0	-0.0	8.1	-88.0
3	522204.98	4994010.10	73.40	0	250	85.5	-88.0	0.0	0.0	67.0	0.7	3.0	0.0	0.0	0.0	0.0	-0.0	14.8	-88.0
4	522204.98	4994010.10	73.40	0	500	87.3	-88.0	0.0	0.0	67.0	1.2	-0.8	0.0	0.0	0.0	0.0	-0.0	19.9	-88.0
5	522204.98	4994010.10	73.40	0	1000	83.7	-88.0	0.0	0.0	67.0	2.3	-1.5	0.0	0.0	0.0	0.0	-0.0	15.9	-88.0
6	522204.98	4994010.10	73.40	0	2000	79.1	-88.0	0.0	0.0	67.0	6.1	-1.5	0.0	0.0	0.0	0.0	-0.0	7.5	-88.0
7	522204.98	4994010.10	73.40	0	4000	70.0	-88.0	0.0	0.0	67.0	20.7	-1.5	0.0	0.0	0.0	0.0	-0.0	-16.2	-88.0
8	522204.98	4994010.10	73.40	0	8000	77.7	-88.0	0.0	0.0	67.0	73.8	-1.5	0.0	0.0	0.0	0.0	-0.0	-61.5	-88.0

Point Source, ISO 9613, Name: "Inv6", ID: "Inv6"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522386.13	4994010.02	73.70	0	63	68.1	-88.0	0.0	0.0	66.0	0.1	-4.9	0.0	0.0	0.0	0.0	-0.0	7.0	-88.0
2	522386.13	4994010.02	73.70	0	125	78.9	-88.0	0.0	0.0	66.0	0.2	3.3	0.0	0.0	0.0	0.0	-0.0	9.4	-88.0
3	522386.13	4994010.02	73.70	0	250	85.5	-88.0	0.0	0.0	66.0	0.6	3.1	0.0	0.0	0.0	0.0	-0.0	15.9	-88.0
4	522386.13	4994010.02	73.70	0	500	87.3	-88.0	0.0	0.0	66.0	1.1	-0.8	0.0	0.0	0.0	0.0	-0.0	21.0	-88.0
5	522386.13	4994010.02	73.70	0	1000	83.7	-88.0	0.0	0.0	66.0	2.0	-1.5	0.0	0.0	0.0	0.0	-0.0	17.1	-88.0
6	522386.13	4994010.02	73.70	0	2000	79.1	-88.0	0.0	0.0	66.0	5.4	-1.5	0.0	0.0	0.0	0.0	-0.0	9.2	-88.0
7	522386.13	4994010.02	73.70	0	4000	70.0	-88.0	0.0	0.0	66.0	18.4	-1.5	0.0	0.0	0.0	0.0	-0.0	-12.9	-88.0
8	522386.13	4994010.02	73.70	0	8000	77.7	-88.0	0.0	0.0	66.0	65.5	-1.5	0.0	0.0	0.0	0.0	-0.0	-52.3	-88.0

Point Source, ISO 9613, Name: "Inv7", ID: "Inv7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522494.48	4993829.05	68.71	0	63	68.1	-88.0	0.0	0.0	62.2	0.0	-4.3	0.0	0.0	0.0	0.0	-0.0	10.2	-88.0
2	522494.48	4993829.05	68.71	0	125	78.9	-88.0	0.0	0.0	62.2	0.2	2.6	0.0	0.0	0.0	0.0	-0.0	14.0	-88.0
3	522494.48	4993829.05	68.71	0	250	85.5	-88.0	0.0	0.0	62.2	0.4	3.3	0.0	0.0	0.0	0.0	-0.0	19.7	-88.0
4	522494.48	4993829.05	68.71	0	500	87.3	-88.0	0.0	0.0	62.2	0.7	-0.6	0.0	0.0	0.0	0.0	-0.0	25.0	-88.0
5	522494.48	4993829.05	68.71	0	1000	83.7	-88.0	0.0	0.0	62.2	1.3	-1.3	0.0	0.0	0.0	0.0	-0.0	21.4	-88.0
6	522494.48	4993829.05	68.71	0	2000	79.1	-88.0	0.0	0.0	62.2	3.5	-1.3	0.0	0.0	0.0	0.0	-0.0	14.7	-88.0
7	522494.48	4993829.05	68.71	0	4000	70.0	-88.0	0.0	0.0	62.2	11.9	-1.3	0.0	0.0	0.0	0.0	-0.0	-2.8	-88.0
8	522494.48	4993829.05	68.71	0	8000	77.7	-88.0	0.0	0.0	62.2	42.4	-1.3	0.0	0.0	0.0	0.0	-0.0	-25.6	-88.0

Point Source, ISO 9613, Name: "Trans1", ID: "Trans1"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	521983.22	4994448.66	70.87	0	32	36.9	36.9	0.0	0.0	72.0	0.0	-5.5	0.0	0.0	10.2	0.0	-0.0	-39.9	-39.9
2	521983.22	4994448.66	70.87	0	63	56.1	56.1	0.0	0.0	72.0	0.1	-5.5	0.0	0.0	10.2	0.0	-0.0	-20.8	-20.8
3	521983.22	4994448.66	70.87	0	125	68.2	68.2	0.0	0.0	72.0	0.5	4.4	0.0	0.0	0.4	0.0	-0.0	-9.0	-9.0
4	521983.22	4994448.66	70.87	0	250	70.7	70.7	0.0	0.0	72.0	1.2	3.4	0.0	0.0	1.4	0.0	-0.0	-7.2	-7.2
5	521983.22	4994448.66	70.87	0	500	76.1	76.1	0.0	0.0	72.0	2.2	-0.4	0.0	0.0	5.1	0.0	-0.0	-2.8	-2.8
6	521983.22	4994448.66	70.87	0	1000	73.3	73.3	0.0	0.0	72.0	4.1	-1.6	0.0	0.0	6.3	0.0	-0.0	-7.6	-7.6
7	521983.22	4994448.66	70.87	0	2000	69.5	69.5	0.0	0.0	72.0	10.8	-1.6	0.0	0.0	6.4	0.0	-0.0	-18.1	-18.1
8	521983.22	4994448.66	70.87	0	4000	64.3	64.3	0.0	0.0	72.0	36.8	-1.6	0.0	0.0	6.4	0.0	-0.0	-49.2	-49.2
9	521983.22	4994448.66	70.87	0	8000	55.2	55.2	0.0	0.0	72.0	131.1	-1.6	0.0	0.0	6.4	0.0	-0.0	-152.7	-152.7

Point Source, ISO 9613, Name: "Trans2", ID: "Trans2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522127.00	4994337.03	74.87	0	32	36.9	36.9	0.0	0.0	70.6	0.0	-5.4	0.0	0.0	10.2	0.0	-0.0	-38.5	-38.5
2	522127.00	4994337.03	74.87	0	63	56.1	56.1	0.0	0.0	70.6	0.1	-5.4	0.0	0.0	10.2	0.0	-0.0	-19.4	-19.4
3	522127.00	4994337.03	74.87	0	125	68.2	68.2	0.0	0.0	70.6	0.4	4.3	0.0	0.0	0.5	0.0	-0.0	-7.6	-7.6
4	522127.00	4994337.03	74.87	0	250	70.7	70.7	0.0	0.0	70.6	1.0	3.4	0.0	0.0	1.4	0.0	-0.0	-5.7	-5.7
5	522127.00	4994337.03	74.87	0	500	76.1	76.1	0.0	0.0	70.6	1.9	-0.3	0.0	0.0	5.1	0.0	-0.0	-1.1	-1.1
6	522127.00	4994337.03	74.87	0	1000	73.3	73.3	0.0	0.0	70.6	3.5	-1.6	0.0	0.0	6.3	0.0	-0.0	-5.5	-5.5

Point Source, ISO 9613, Name: "Trans2", ID: "Trans2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
7	522127.00	4994337.03	74.87	0	2000	69.5	69.5	0.0	0.0	70.6	9.3	-1.6	0.0	0.0	6.3	0.0	-0.0	-15.1	-15.1
8	522127.00	4994337.03	74.87	0	4000	64.3	64.3	0.0	0.0	70.6	31.4	-1.6	0.0	0.0	6.2	0.0	-0.0	-42.3	-42.3
9	522127.00	4994337.03	74.87	0	8000	55.2	55.2	0.0	0.0	70.6	111.9	-1.6	0.0	0.0	6.0	0.0	-0.0	-131.7	-131.7

Point Source, ISO 9613, Name: "Trans3", ID: "Trans3"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522090.43	4994216.64	73.64	0	32	36.9	36.9	0.0	0.0	69.8	0.0	-5.3	0.0	0.0	10.1	0.0	-0.0	-37.6	-37.6
2	522090.43	4994216.64	73.64	0	63	56.1	56.1	0.0	0.0	69.8	0.1	-5.3	0.0	0.0	10.1	0.0	-0.0	-18.5	-18.5
3	522090.43	4994216.64	73.64	0	125	68.2	68.2	0.0	0.0	69.8	0.4	4.1	0.0	0.0	0.6	0.0	-0.0	-6.6	-6.6
4	522090.43	4994216.64	73.64	0	250	70.7	70.7	0.0	0.0	69.8	0.9	3.4	0.0	0.0	1.3	0.0	-0.0	-4.6	-4.6
5	522090.43	4994216.64	73.64	0	500	76.1	76.1	0.0	0.0	69.8	1.7	-0.3	0.0	0.0	4.9	0.0	-0.0	0.1	0.1
6	522090.43	4994216.64	73.64	0	1000	73.3	73.3	0.0	0.0	69.8	3.2	-1.5	0.0	0.0	5.9	0.0	-0.0	-4.0	-4.0
7	522090.43	4994216.64	73.64	0	2000	69.5	69.5	0.0	0.0	69.8	8.4	-1.6	0.0	0.0	5.6	0.0	-0.0	-12.6	-12.6
8	522090.43	4994216.64	73.64	0	4000	64.3	64.3	0.0	0.0	69.8	28.4	-1.6	0.0	0.0	4.6	0.0	-0.0	-36.8	-36.8
9	522090.43	4994216.64	73.64	0	8000	55.2	55.2	0.0	0.0	69.8	101.3	-1.6	0.0	0.0	1.6	0.0	-0.0	-115.9	-115.9

Point Source, ISO 9613, Name: "Trans4", ID: "Trans4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522271.35	4994216.24	77.03	0	32	36.9	36.9	0.0	0.0	69.0	0.0	-5.3	0.0	0.0	9.9	0.0	-0.0	-36.8	-36.8
2	522271.35	4994216.24	77.03	0	63	56.1	56.1	0.0	0.0	69.0	0.1	-5.3	0.0	0.0	9.8	0.0	-0.0	-17.5	-17.5
3	522271.35	4994216.24	77.03	0	125	68.2	68.2	0.0	0.0	69.0	0.3	4.0	0.0	0.0	0.4	0.0	-0.0	-5.4	-5.4
4	522271.35	4994216.24	77.03	0	250	70.7	70.7	0.0	0.0	69.0	0.8	3.4	0.0	0.0	0.4	0.0	-0.0	-3.0	-3.0
5	522271.35	4994216.24	77.03	0	500	76.1	76.1	0.0	0.0	69.0	1.5	-0.3	0.0	0.0	3.1	0.0	-0.0	2.8	2.8
6	522271.35	4994216.24	77.03	0	1000	73.3	73.3	0.0	0.0	69.0	2.9	-1.5	0.0	0.0	1.5	0.0	-0.0	1.4	1.4
7	522271.35	4994216.24	77.03	0	2000	69.5	69.5	0.0	0.0	69.0	7.6	-1.6	0.0	0.0	1.6	0.0	-0.0	-7.1	-7.1
8	522271.35	4994216.24	77.03	0	4000	64.3	64.3	0.0	0.0	69.0	25.9	-1.6	0.0	0.0	1.6	0.0	-0.0	-30.6	-30.6
9	522271.35	4994216.24	77.03	0	8000	55.2	55.2	0.0	0.0	69.0	92.5	-1.6	0.0	0.0	1.6	0.0	-0.0	-106.2	-106.2

Point Source, ISO 9613, Name: "Trans5", ID: "Trans5"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522199.08	4994010.10	73.07	0	32	36.9	36.9	0.0	0.0	67.0	0.0	-5.1	0.0	0.0	0.0	0.0	-0.0	-25.1	-25.1
2	522199.08	4994010.10	73.07	0	63	56.1	56.1	0.0	0.0	67.0	0.1	-5.1	0.0	0.0	0.0	0.0	-0.0	-6.0	-6.0
3	522199.08	4994010.10	73.07	0	125	68.2	68.2	0.0	0.0	67.0	0.3	3.5	0.0	0.0	0.0	0.0	-0.0	-2.6	-2.6
4	522199.08	4994010.10	73.07	0	250	70.7	70.7	0.0	0.0	67.0	0.7	3.5	0.0	0.0	0.0	0.0	-0.0	-0.5	-0.5
5	522199.08	4994010.10	73.07	0	500	76.1	76.1	0.0	0.0	67.0	1.2	-0.2	0.0	0.0	0.0	0.0	-0.0	8.1	8.1
6	522199.08	4994010.10	73.07	0	1000	73.3	73.3	0.0	0.0	67.0	2.3	-1.5	0.0	0.0	0.0	0.0	-0.0	5.4	5.4
7	522199.08	4994010.10	73.07	0	2000	69.5	69.5	0.0	0.0	67.0	6.1	-1.5	0.0	0.0	0.0	0.0	-0.0	-2.1	-2.1
8	522199.08	4994010.10	73.07	0	4000	64.3	64.3	0.0	0.0	67.0	20.8	-1.5	0.0	0.0	0.0	0.0	-0.0	-22.0	-22.0
9	522199.08	4994010.10	73.07	0	8000	55.2	55.2	0.0	0.0	67.0	74.1	-1.5	0.0	0.0	0.0	0.0	-0.0	-84.4	-84.4

Point Source, ISO 9613, Name: "Trans6", ID: "Trans6"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522380.23	4994010.02	73.38	0	32	36.9	36.9	0.0	0.0	66.0	0.0	-4.9	0.0	0.0	0.0	0.0	-0.0	-24.2	-24.2
2	522380.23	4994010.02	73.38	0	63	56.1	56.1	0.0	0.0	66.0	0.1	-4.9	0.0	0.0	0.0	0.0	-0.0	-5.0	-5.0
3	522380.23	4994010.02	73.38	0	125	68.2	68.2	0.0	0.0	66.0	0.2	3.3	0.0	0.0	0.0	0.0	-0.0	-1.3	-1.3
4	522380.23	4994010.02	73.38	0	250	70.7	70.7	0.0	0.0	66.0	0.6	3.5	0.0	0.0	0.0	0.0	-0.0	0.6	0.6
5	522380.23	4994010.02	73.38	0	500	76.1	76.1	0.0	0.0	66.0	1.1	-0.2	0.0	0.0	0.0	0.0	-0.0	9.2	9.2
6	522380.23	4994010.02	73.38	0	1000	73.3	73.3	0.0	0.0	66.0	2.1	-1.4	0.0	0.0	0.0	0.0	-0.0	6.7	6.7
7	522380.23	4994010.02	73.38	0	2000	69.5	69.5	0.0	0.0	66.0	5.4	-1.5	0.0	0.0	0.0	0.0	-0.0	-0.4	-0.4
8	522380.23	4994010.02	73.38	0	4000	64.3	64.3	0.0	0.0	66.0	18.4	-1.5	0.0	0.0	0.0	0.0	-0.0	-18.6	-18.6
9	522380.23	4994010.02	73.38	0	8000	55.2	55.2	0.0	0.0	66.0	65.7	-1.5	0.0	0.0	0.0	0.0	-0.0	-75.0	-75.0

Point Source, ISO 9613, Name: "Trans7", ID: "Trans7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	522488.58	4993829.05	68.51	0	32	36.9	36.9	0.0	0.0	62.2	0.0	-4.4	0.0	0.0	0.0	0.0	-0.0	-20.9	-20.9
2	522488.58	4993829.05	68.51	0	63	56.1	56.1	0.0	0.0	62.2	0.0	-4.4	0.0	0.0	0.0	0.0	-0.0	-1.8	-1.8
3	522488.58	4993829.05	68.51	0	125	68.2	68.2	0.0	0.0	62.2	0.2	2.5	0.0	0.0	0.0	0.0	-0.0	3.3	3.3
4	522488.58	4993829.05	68.51	0	250	70.7	70.7	0.0	0.0	62.2	0.4	3.7	0.0	0.0	0.0	0.0	-0.0	4.4	4.4

Point Source, ISO 9613, Name: "Trans7", ID: "Trans7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
5	522488.58	4993829.05	68.51	0	500	76.1	76.1	0.0	0.0	62.2	0.7	-0.0	0.0	0.0	0.0	0.0	-0.0	13.2	13.2
6	522488.58	4993829.05	68.51	0	1000	73.3	73.3	0.0	0.0	62.2	1.3	-1.2	0.0	0.0	0.0	0.0	-0.0	11.0	11.0
7	522488.58	4993829.05	68.51	0	2000	69.5	69.5	0.0	0.0	62.2	3.5	-1.3	0.0	0.0	0.0	0.0	-0.0	5.1	5.1
8	522488.58	4993829.05	68.51	0	4000	64.3	64.3	0.0	0.0	62.2	11.9	-1.3	0.0	0.0	0.0	0.0	-0.0	-8.5	-8.5
9	522488.58	4993829.05	68.51	0	8000	55.2	55.2	0.0	0.0	62.2	42.5	-1.3	0.0	0.0	0.0	0.0	-0.0	-48.2	-48.2