

REPORT TITLE:

Stairfoot, Oaks Business Park, Oaks Ln, Barnsley, S71 1HT:

Environmental noise impact assessment.

CLIENT DETAILS:

Noriker Power Ltd.

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Contents

1.	Summary.....	4
2	Introduction	5
3	Environmental Methodology	6
3.1	Perception.....	6
3.2	Legislation and Policy.....	7
3.2.1	BS4142:2014+A1:2019.....	7
4	Noise Survey.....	10
4.1	Baseline Noise Level Survey Details	10
4.2	Equipment	12
4.3	Weather	12
5	Noise from the proposed power plant.....	13
5.1	Calculation assumptions	13
5.1.1	Plant items noise emission.....	13
5.1.2	Items operational period.	14
5.2	Uncertainty in the calculations	15
5.3	Calculation methodology	15
6	Calculation Summary	17
6.1	Day Time Assessment.	17
6.2	Night Time Assessment.....	17
7	Conclusion	18
8	Annex.....	19

Document Status and Revision Schedule

Issue/Revision	Description/Comments	Date	Prepared by	Approved by
-	Checked & Authorised	20/11/20	JCB	MJ
A	Additional noise mitigation information	04/01/21	JCB	MJ

1. Summary

A noise assessment was commissioned by Noriker Power Ltd, in support of the planning application for a proposed power plant located at Oaks Business Park, Oaks Ln, Barnsley, S71 1HT

The assessment has considered the most relevant guidelines and standards, including BS 4142:2014+A1:2019: *Methods for rating and assessing industrial and commercial*.

The assessment of the impact has shown that the calculated specific sound levels are equal to and below the lowest background measured during daytime/night-time, which is an indication of the specific sound source having a low impact at nearest noise sensitive receptors.

2 Introduction

This report provides the noise impact calculation and assessment for the proposed power plant which is going to be located on an open plan space at Oaks Business Park, Oaks Ln, Barnsley, S71 1HT

The figure below includes the location of the proposed power plant and the nearest noise sensitive receptors (R1, R2, and R3).



Figure 1. Power plant location and nearest residential properties.

R1. Hopewell St.

R2. Ashleigh Vale.

R3. Cherry's Road

3 Environmental Methodology

3.1 Perception

Noise is defined as unwanted sound. Human ears are able to respond to sound over the frequency range of about 20 Hz to 20 kHz and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, and is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates to the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear. To help understand the range of noise levels which may be encountered, an indication of the level of some common sounds on the dB(A) scale is given in the table below.

Table 1. Common Sounds on the dB(A) Scale	
dB(A)	Description
140	Threshold of pain
120	Jet take off at 50 metres
100	Maximum noise levels on an underground platform
80	Kerbside of a busy urban street
60	Busy general office
40	Residential area at night
20	Background in a TV and recording studio
0	Threshold of hearing

Furthermore, the perception of noise may be determined by a number of other factors, both acoustic and non-acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time.

In addition, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual receptor. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that corresponds to the response of the human ear is the A-weighting scale. This is widely used for environmental noise

measurement, and the levels are denoted as dB(A) or LAeq, LA90, etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) of a steady source is generally regarded as the minimum difference needed to perceive a change.

3.2 Legislation and Policy

3.2.1 BS4142:2014+A1:2019.

This standard sets out a methodology for the assessment of whether noise from factories, industrial premises or fixed installations and sources of an industrial/commercial nature.

The procedure contained in BS4142 for assessing the impact is to compare the measured or predicted noise level from the source in question, the 'specific noise level', at the assessment position with the correct background noise level for the worst-case time of operation.

Where the noise contains a 'distinguishable, discreet, continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks or clatters), or if the noise is irregular enough to attract attention' then a range of correction factors can be added to the specific noise level as appropriate to obtain the 'rating level'.

As this is a prescriptive report prior to plant installation, overall rating noise levels will be specified for the new installation. Compliance with the rating value will be necessary to provide evidence that significant adverse impact has been avoided as required by the NPSE.

To assess the impact, the measured background noise level is subtracted from the rating noise level. BS4142 states:

The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessment and arriving at decisions, therefore, it is essential to place the sound in context.

Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (See Clause 8) from the rating level (see Clause 9) and consider the following.

- a) Typically the greater the difference, the greater the magnitude of the impact.*
- b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- c) A difference of around 5dB is likely to be an indication of an adverse impact, depending on the context.*
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

- 1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

- 2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that*

would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as;

i) Façade sound insulation treatment

ii) Ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and Acoustic screening.

4 Noise Survey

4.1 Baseline Noise Level Survey Details

Noise measurements were undertaken in free-field conditions between Thursday 12th and Friday 13th November 2020 at 3 different locations. The sound level meters were positioned 1.5 m above ground level (tripod mounted) and 3 metres from any reflective surface. The figure below includes the measurement locations.



Figure 2. Measurement locations.

Noise measurements were made with a calibrated precision grade sound level meter which achieves the requirements of BS EN 61672:2003. The survey was carried out in accordance with the principles of BS 7445:1997 Parts 1-3, 'Description and Measurement of Environmental Noise' and British Standard BS4142: 2014+A1:2019 : Methods for rating and assessing industrial and commercial sound.

The noise assessment locations were representative of the background noise levels at the nearest noise sensitive receptors which have the potential to be affected by the noise emission from the proposed power plant.

Table 2: Typical measured LA90, and LAeq dB levels during survey		
R1		
Time	LAeq (1hr)	LA90(1hr)
Morning: 12/11/2020 09:00:52	46	43
Evening: 12/11/2020 19:00:54	45	41
Night: 13/11/2020 00:00:42	37	34
R2		
Time	LAeq (1hr)	LA90(1hr)
Morning: 12/11/2020 10:20:18	50	42
Evening: 12/11/2020 20:25:24	49	41
Night: 13/11/2020 01:00:30	48	32
R3		
Time	LAeq (1hr)	LA90(1hr)
Morning: 12/11/2020 11:35:10	53	47
Evening: 12/11/2020 21:40:52	40	36
Night: 13/11/2020 02:00:02	35	29

4.2 Equipment

- Svantek precision grade sound level meters. Serial numbers 34937.
- Nor-1251 Calibrator. Serial number 31327.
- Environmental wind shield.

The sound level meters were calibrated before and after the survey. No significant drift was noted between the two reference checks. Full calibration certificates are available upon requests.

4.3 Weather

In order to evaluate the weather conditions three weather check measurements were undertaken on site (beginning, during, and at the end of the measurement period).

Table 3: Weather conditions				
Time	°C	Wind speed m/s	Relative Humidity %	Wind direction
09:00	11	1.0	73	WSW
19:00	9	0.9	79	S
00:00	7	0.7	81	S

The weather conditions were measured using a Pocket weather tracker KESTREL 4500.

5 Noise from the proposed power plant

The levels used in the calculations were extracted from the M&E technical submittals. To undertake the outdoor sound level calculations Part 2 of ISO 9613 Acoustics -- Attenuation of sound during propagation outdoors -- Part 2: General method of calculation was used. This ISO standard is incorporated in the SoundPLAN v 8.1 software. This software was used to generate outdoor sound levels from the proposed power plant to the nearest noise sensitive receptors and to produce noise contour maps.

The sound pressure levels from the proposed power plant have been assessed with all plant operating constantly.

5.1 Calculation assumptions

5.1.1 Plant items noise emission.

Table 4. Proposed Plan Items		
Item	Number	Sound Levels
Inverters (SMA SCS2900) with attenuator	18	Sound pressure levels at 10 m 58 dBA
Transformers (6MVA)	9	Sound pressure levels at 1 m 65 dBA
HVAC (battery containers)	9 (6 x units /container)	Sound Power LwA 77 dB

The calculations also include the sound mitigation provided by a 4 m acoustic fence located on the southern and eastern side of the power plant. The location is included below.

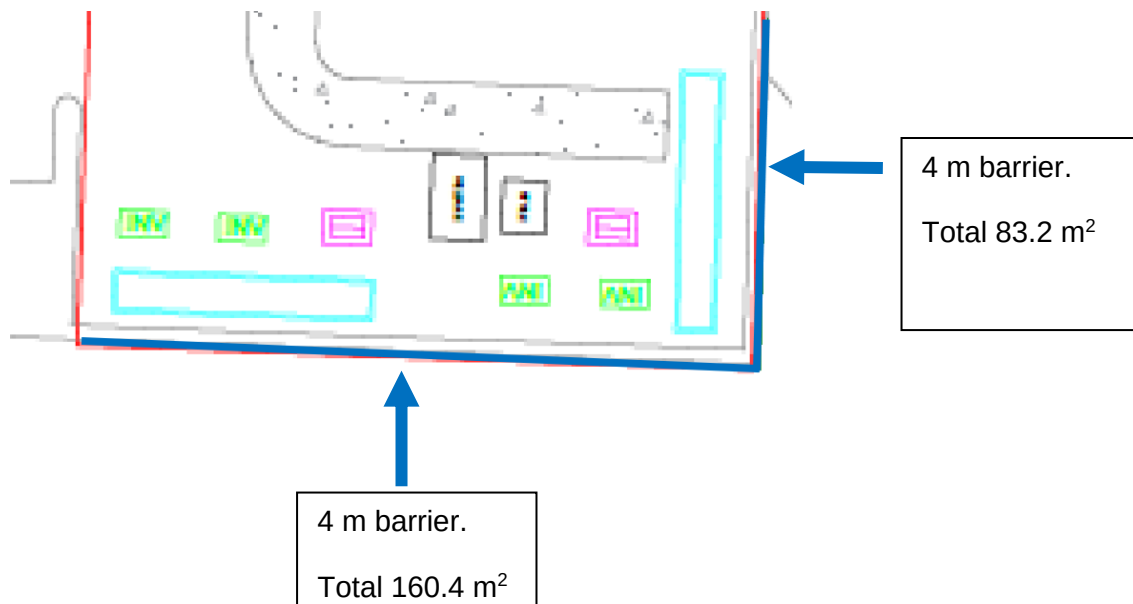


Figure 3. Proposed acoustic barrier location.

5.1.2 Items operational period.

It is considered that the plant units will not operate during the whole day and night. Therefore, based on the reference time interval as per BS4142:2014 recommendation, the following operational time is assumed.

Table 4: Plant units' operational period	
Operational time/Reference time interval Day Time 1 hr	
Inverters (SMA SCS2900)	18 m /hr
Transformers (6MVA)	18 m /hr
HVAC (battery containers)	18 m /hr
Operational time /Reference time interval Night Time 15 m	
Inverters (SMA SCS2900)	5 m/15 m
Transformers (6MVA)	5 m / 15 m
HVAC (battery containers)	5 m /15 m

NOTE 1 For the purposes of BS4142:2014+A1:2019 , daytime is typically between 07:00 h and 23:00 h, and accordingly night-time is between 23:00 h and 07:00 h.

NOTE 2 The shorter reference time interval at night means that short duration sounds with an on time of less than 1 h can lead to a greater specific sound level when determined over the reference

The location of each item on the power plant is included below.

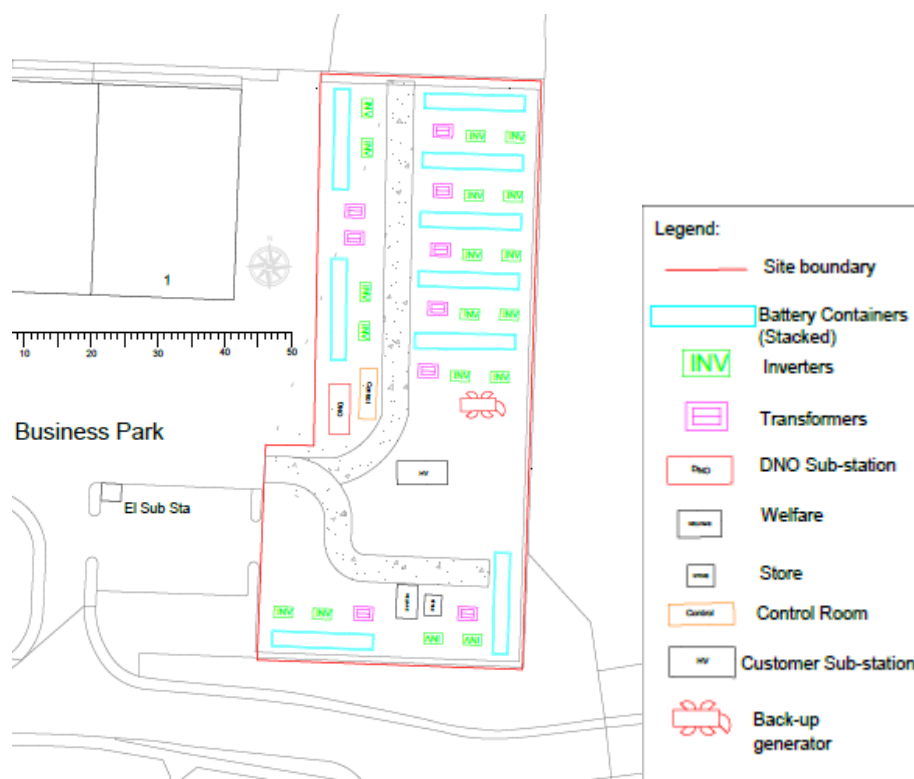


Figure 4. Power plant. Plant items location.

5.2 Uncertainty in the calculations

The following steps were taken to reduce the level of uncertainty within the sound measurements and calculations:

- The sound level meter was immediately calibrated before and after the survey, the difference between the initial calibration value, and the final calibration check of completion of measurements did not exceed ± 0.5 dB.
- The sound emission calculation has been undertaken using sound propagation software.

It is considered that the uncertainty in the results is extremely low due to the following:

- Favourable weather conditions during the background measurements
- The sound emission calculation using appropriate software was verified by Pace Consult Ltd.

5.3 Calculation methodology

The noise impact from the units at nearest residential has been assessed using the methodology described in ISO 9613-2. The ISO 9613 calculates the sound propagation for outdoor noise sources for downwind situations, the equation below is used to evaluate the equivalent continuous downwind sound pressure level, as follows:

$$L_{fT}(DW) = L_w + D_c - A$$

Where: L_w : is the octave-band sound power level.

D_c : is the directivity correction.

A : Attenuation that occurs during propagation.

4.3.1 Calculation of the attenuation terms

Geometrical divergence

Attenuation values are calculated as follow:

$$A_{div} = [20 \lg(d/d_0) + 11] \text{ dB}$$

Where: d : distance from the source to receiver, in meters

d_0 : is the reference distance (1m).

Atmospheric absorption

The attenuation due to atmospheric absorption is given by the following equation:

$$A_{\text{atm}} = \alpha d / 1000$$

Where α is the atmospheric attenuation coefficient, in decibels per kilometer, for each octave band at the mid-band frequency.

Ground Effect

The calculation assumes soft ground $G=1$.

4.3.2 Barrier attenuation

The calculation of the barrier attenuation is calculated as follows:

$$D_z = 10 \log_{10} (3 + (C_2/\lambda) C_3 z K_{\text{met}})$$

For the single diffraction with a regular ground reflection, the formula above can be rewritten in terms of the Fresnel number.

$$A_b = 10 \log_{10} (3 + 10 N K_{\text{met}})$$

The figure below includes the parameters used within the calculation.

Run parameters

Reflection order	3	
Maximal reflection distance to receiver		200 m
Maximal reflection distance to source		50 m
Search radius	5000 m	
Weighting:	dB(A)	
Tolerance:	0.100 dB	
Create ground effect areas from road surfaces:		No
Standards:		
Industry:	ISO 9613-2: 1996	
Air absorption:	ISO 9613	
regular ground effect (chapter 7.3.1), for sources without a spectrum automatically alternative ground effect		
Limitation of screening loss:		
single/multiple	20.0 dB /25.0 dB	
Calculation with side screening:	Yes	
Use Eqn ($A_{\text{bar}}=D_z-\text{Max}(A_{\text{gr}},0)$) instead of Eqn (12) ($A_{\text{bar}}=D_z-A_{\text{gr}}$) for insertion loss		
Evaluate extra path length in vertical plane defined by source and receiver		
Environment:		
Air pressure	1013.3 mbar	
rel. Humidity	70.0 %	
Temperature	10.0 °C	
Meteo. Corr. $C_0(7-23\text{h})[\text{dB}]=0.0$; $C_0(23-7\text{h})[\text{dB}]=0.0$;		
Ignore C_{met} for L_{max} -Industry-Calculation:	No	
Parameter for screening:	$C_2=20.0$	
Dissection parameters:		
Distance to diameter factor	8	
Minimal Distance [m]	1 m	
Max. Difference GND+Diffraction	1.0 dB	
Max. No. of iterations	4	
Attenuation		
Foliage:	ISO 9613-2	
Built up area:	ISO 9613-2	
Industrial site:	ISO 9613-2	

6 Calculation Summary

6.1 Day Time Assessment.

The table below shows the assessment method recommended by BS4142:2014+A1 *Method for rating and assessing industrial and commercial sound* based on the assumptions included in section 4.1. As the calculated levels are low, it is considered that tonality correction is not required.

Table 5: BS4142:2014 Assessment			
Receiver	Calculated Sound Pressure Level	Background sound levels evening L _{A90} dB	Excess of rating over background level
R1	34	41	-7
R2	22	41	-19
R3	27	36	-9

As can be seen from the table above the rating level is below the lowest measured background sound level. Therefore, this is an indication that the specific sound levels have a low impact at nearest noise sensitive receptors.

6.2 Night Time Assessment.

The table below includes the noise assessment during night-time.

Table 6: BS4142:2014 Assessment			
Receiver	Calculated Sound Pressure Level	Background sound levels evening L _{A90} dB	Excess of rating over background level
R1	34	34	0
R2	22	32	-10
R3	27	29	-2

As can be seen from the table above the rating level is equal to and below the lowest measured background sound level. Therefore, this is an indication that the specific sound levels have a low impact at nearest noise sensitive receptors.

Full calculations and noise map are included in the Annex.

7 Conclusion

A noise assessment was commissioned by Noriker Power Ltd, in support of the planning application at Oaks Business Park, Oaks Ln, Barnsley, S71 1HT.

The assessment of the impact has shown that the calculated specific sound sources are equal to and below the lowest background measured during daytime and night-time, which is an indication of the specific sound sources having a low impact at nearest noise sensitive receptors.

8 Annex.

Noise Impact assessment.

Source	Source type	Lw dB(A)	S m	Adiv dB	Agr dB	Abar dB	Aatm dB	dLrefl dB	Lr dB(A)
R1									
HVAC Battery Container (1 of 54)	Point	72	258.4	-59.2	2.8	-6.3	0	0.4	10
HVAC Battery Container (2 of 54)	Point	72	254.87	-59.1	2.8	-6.4	0	0.4	10
HVAC Battery Container (3 of 54)	Point	72	251.71	-59	2.8	-6.7	0	0	10
HVAC Battery Container (4 of 54)	Point	72	256.66	-59.2	2.8	-2.1	-0.1	0.2	14
HVAC Battery Container (5 of 54)	Point	72	253.26	-59.1	2.8	-3.4	-0.1	0.2	13
HVAC Battery Container (6 of 54)	Point	72	250.11	-59	2.8	-3.5	-0.1	0.2	13
HVAC Battery Container (7 of 54)	Point	72	253.06	-59.1	2.8	-4.5	0	0	12
HVAC Battery Container (8 of 54)	Point	72	254.6	-59.1	2.8	-5.5	0	0	11
HVAC Battery Container (9 of 54)	Point	72	256.21	-59.2	2.8	-5.8	0	0	10
HVAC Battery Container (10 of 54)	Point	72	249.69	-58.9	2.7	-1.7	-0.1	3.3	18
HVAC Battery Container (11 of 54)	Point	72	251.31	-59	2.8	-3.1	0	1.9	15
HVAC Battery Container (12 of 54)	Point	72	253.1	-59.1	2.8	-3.6	0	2.1	15
HVAC Battery Container (13 of 54)	Point	72	244.64	-58.8	2.7	-4.5	0	0	12
HVAC Battery Container (14 of 54)	Point	72	246.07	-58.8	2.7	-5.7	0	0	11
HVAC Battery Container (15 of 54)	Point	72	247.89	-58.9	2.7	-5.8	0	0	11
HVAC Battery Container (16 of 54)	Point	72	241.26	-58.6	2.7	0	-0.1	2.5	19
HVAC Battery Container (17 of 54)	Point	72	242.99	-58.7	2.7	-2.9	0	1.8	15
HVAC Battery Container (18 of 54)	Point	72	244.9	-58.8	2.7	-3.6	0	2.1	15
HVAC Battery Container (19 of 54)	Point	72	235.83	-58.4	2.6	-4.2	0	0	12
HVAC Battery Container (20 of 54)	Point	72	237.42	-58.5	2.6	-5.6	0	0	11
HVAC Battery Container (21 of 54)	Point	72	239.38	-58.6	2.7	-5.7	0	0	11
HVAC Battery Container (22 of 54)	Point	72	232.62	-58.3	2.6	0	-0.1	2.5	19
HVAC Battery Container (23 of 54)	Point	72	234.42	-58.4	2.6	-2.7	0	1.8	16
HVAC Battery Container (24 of 54)	Point	72	236.46	-58.5	2.6	-3.4	0	2	15
HVAC Battery Container (25 of 54)	Point	72	227.79	-58.1	2.6	-3.3	0	0	14
HVAC Battery Container (26 of 54)	Point	72	229.23	-58.2	2.6	-5.3	0	0	12
HVAC Battery Container (27 of 54)	Point	77	231.16	-58.3	2.6	-5.7	0	0	16
HVAC Battery Container (28 of 54)	Point	72	224.42	-58	2.5	0	-0.1	2.5	19
HVAC Battery Container (29 of 54)	Point	72	226	-58.1	2.5	-2.2	0	1.6	16
HVAC Battery Container (30 of 54)	Point	72	228.25	-58.2	2.6	-3.2	0	2	16
HVAC Battery Container (31 of 54)	Point	72	219.55	-57.8	2.5	-4.4	0	0	13
HVAC Battery Container (32 of 54)	Point	72	221.64	-57.9	2.5	-5.6	0	0	11

HVAC Battery Container (33 of 54)	Point	72	223.26	-58	2.5	-7	0	0	10
HVAC Battery Container (34 of 54)	Point	72	216.48	-57.7	2.5	0	-0.1	2.5	20
HVAC Battery Container (35 of 54)	Point	72	218.64	-57.8	2.5	0	-0.1	2.5	20
HVAC Battery Container (36 of 54)	Point	72	220.07	-57.8	2.5	-1.8	0	1.5	17
HVAC Battery Container (37 of 54)	Point	72	236.84	-58.5	2.6	-2.6	-0.1	1.8	16
HVAC Battery Container (38 of 54)	Point	72	232.39	-58.3	2.6	-3	-0.1	1.9	16
HVAC Battery Container (39 of 54)	Point	72	227.53	-58.1	2.6	-3.3	-0.1	2.1	16
HVAC Battery Container (40 of 54)	Point	72	238.36	-58.5	2.7	-7.4	0	0	9
HVAC Battery Container (41 of 54)	Point	72	233.61	-58.4	2.6	-7.6	0	0	9
HVAC Battery Container (42 of 54)	Point	72	228.87	-58.2	2.6	-7.7	0	0	9
HVAC Battery Container (43 of 54)	Point	72	186.3	-56.4	2.1	-5.4	0	0.3	13
HVAC Battery Container (44 of 54)	Point	72	181.49	-56.2	2	-5.6	0	2.6	15
HVAC Battery Container (45 of 54)	Point	72	177.25	-56	2	-5.6	0	2.5	15
HVAC Battery Container (46 of 54)	Point	72	187.89	-56.5	2.1	-5.7	0	0	12
HVAC Battery Container (47 of 54)	Point	72	183.15	-56.2	2.1	-6.3	0	0	12
HVAC Battery Container (48 of 54)	Point	72	178.59	-56	2	-6.8	0	0	12
HVAC Battery Container (49 of 54)	Point	72	189.91	-56.6	2.2	-11.3	0	0	7
HVAC Battery Container (50 of 54)	Point	72	192.93	-56.7	2.2	-11.5	0	0	6
HVAC Battery Container (51 of 54)	Point	72	195.36	-56.8	2.2	-11.7	0	0	6
HVAC Battery Container (52 of 54)	Point	72	186.87	-56.4	2.1	-11.8	0	2.5	9
HVAC Battery Container (53 of 54)	Point	72	190.2	-56.6	2.2	-11.9	0	2.5	9
HVAC Battery Container (54 of 54)	Point	72	192.55	-56.7	2.2	-12.2	0	2.4	8
Inverter with attenuator (1 of 18)	Point	81	257.83	-59.2	-1.5	-3.7	-2	1.5	16
Inverter with attenuator (5 of 18)	Point	81	246	-58.8	-1.5	0	-3	0	17
Inverter with attenuator (7 of 18)	Point	81	237.79	-58.5	-1.5	-4.3	-2	0	15
Inverter with attenuator (9 of 18)	Point	81	229.52	-58.2	-1.5	0	-2.9	1.9	20
Inverter with attenuator (11 of 18)	Point	81	221.31	-57.9	-1.5	0	-2.8	0	19
Inverter with attenuator (15 of 18)	Point	81	179.42	-56.1	-1.5	-11.1	-0.4	0.2	12
Inverter with attenuator (16 of 18)	Point	81	182.41	-56.2	-1.5	-11.2	-0.4	0.2	12
Inverter with attenuator (17 of 18)	Point	81	194.55	-56.8	-1.5	-17.2	-0.5	3	8
Inverter with attenuator (18 of 18)	Point	81	198.08	-56.9	-1.5	-17	-0.5	0.3	5
Inverter with attenuator (2 of 18)	Point	81	252.71	-59	-1.5	-4.1	-1.7	1.1	15
Inverter with attenuator (3 of 18)	Point	81	233.09	-58.3	-1.5	-3.8	-1.8	1.7	17
Inverter with attenuator (4 of 18)	Point	81	227.97	-58.1	-1.5	-4	-1.8	0.5	16
Inverter with attenuator (6 of 18)	Point	81	248.4	-58.9	-1.5	-9.2	-0.6	2.5	13
Inverter with attenuator (8 of 18)	Point	81	239.83	-58.6	-1.5	-9.2	-0.6	2.4	13
Inverter with attenuator (10 of 18)	Point	81	231.76	-58.3	-1.5	-9.1	-0.6	2.5	14
Inverter with attenuator (12 of 18)	Point	81	223.64	-58	-1.5	-9	-0.6	2.5	14
Inverter with attenuator (13 of 18)	Point	81	213.21	-57.6	-1.5	0	-2.7	1.9	21

Inverter with attenuator(14 of 18)	Point	81	215.81	-57.7	-1.5	0	-2.8	1.9	21
Transformer (1 of 9)	Point	71	244.7	-58.8	2.9	-3.9	0	0	12
Transformer (2 of 9)	Point	71	240.99	-58.6	2.8	-2.2	0	0	13
Transformer (3 of 9)	Point	71	250.48	-59	2.9	-4.5	0	0.1	11
Transformer (4 of 9)	Point	71	242.01	-58.7	2.9	-4.5	0	0	11
Transformer (5 of 9)	Point	71	234	-58.4	2.8	-4.4	0	0.1	12
Transformer (6 of 9)	Point	71	226.26	-58.1	2.7	-4	0	0.1	12
Transformer (7 of 9)	Point	71	218.49	-57.8	2.7	-2.2	0	0.1	14
Transformer (8 of 9)	Point	71	183.07	-56.2	2.3	-5.4	0	0	12
Transformer (9 of 9)	Point	71	191.28	-56.6	2.4	-10.1	0	0	7
			R2						
HVAC Battery Container (1 of 54)	Point	72	365.1	-62.2	3.7	-12.4	0	0	1
HVAC Battery Container (2 of 54)	Point	72	361.31	-62.1	3.6	-12.3	0	0	2
HVAC Battery Container (3 of 54)	Point	72	358.03	-62.1	3.6	-12.2	0	0	2
HVAC Battery Container (4 of 54)	Point	72	366.08	-62.3	3.7	-11.9	0	0	2
HVAC Battery Container (5 of 54)	Point	72	362.38	-62.2	3.6	-11.8	0	0	2
HVAC Battery Container (6 of 54)	Point	72	359.04	-62.1	3.6	-11.6	0	0	2
HVAC Battery Container (7 of 54)	Point	72	377.96	-62.5	3.7	-14.5	-0.1	0	-1
HVAC Battery Container (8 of 54)	Point	72	376.39	-62.5	3.7	-15.8	-0.1	0	-2
HVAC Battery Container (9 of 54)	Point	72	374.73	-62.5	3.7	-16.2	-0.1	0	-3
HVAC Battery Container (10 of 54)	Point	72	374.86	-62.5	3.7	-13.5	-0.1	1.2	1
HVAC Battery Container (11 of 54)	Point	72	373.21	-62.4	3.7	-14.9	-0.1	1.6	0
HVAC Battery Container (12 of 54)	Point	72	371.7	-62.4	3.7	-15.6	-0.1	1.9	0
HVAC Battery Container (13 of 54)	Point	72	369.72	-62.3	3.7	-14.4	-0.1	0	-1
HVAC Battery Container (14 of 54)	Point	72	368.02	-62.3	3.7	-15.8	-0.1	0	-2
HVAC Battery Container (15 of 54)	Point	72	366.42	-62.3	3.7	-16.3	-0.1	0	-3
HVAC Battery Container (16 of 54)	Point	72	366.65	-62.3	3.7	-12.7	-0.1	1.1	2
HVAC Battery Container (17 of 54)	Point	72	365.08	-62.2	3.7	-14.9	-0.1	1.6	1
HVAC Battery Container (18 of 54)	Point	72	363.47	-62.2	3.6	-15.6	-0.1	1.9	0
HVAC Battery Container (19 of 54)	Point	72	361.26	-62.1	3.6	-13.5	0	0	0
HVAC Battery Container (20 of 54)	Point	72	359.58	-62.1	3.6	-15.7	-0.1	0	-2
HVAC Battery Container (21 of 54)	Point	72	358.02	-62.1	3.6	-16.2	-0.1	0	-2
HVAC Battery Container (22 of 54)	Point	72	358.2	-62.1	3.6	-11.7	0	0.9	3
HVAC Battery Container (23 of 54)	Point	72	356.66	-62	3.6	-15.1	-0.1	1.7	1
HVAC Battery Container (24 of 54)	Point	72	355.11	-62	3.6	-15.7	-0.1	1.9	0
HVAC Battery Container (25 of 54)	Point	72	353.36	-62	3.6	-14.3	0	0	0
HVAC Battery Container (26 of 54)	Point	72	351.68	-61.9	3.6	-15.3	-0.1	0	-1
HVAC Battery Container (27 of 54)	Point	77	349.75	-61.9	3.6	-16.2	-0.1	0	3
HVAC Battery Container (28 of 54)	Point	72	349.98	-61.9	3.6	-13.7	0	1.4	2

HVAC Battery Container (29 of 54)	Point	72	348.59	-61.8	3.6	-14.4	0	1.5	1
HVAC Battery Container (30 of 54)	Point	72	346.78	-61.8	3.6	-15.5	-0.1	1.8	1
HVAC Battery Container (31 of 54)	Point	72	344.04	-61.7	3.6	-14.5	0	0	0
HVAC Battery Container (32 of 54)	Point	72	342.06	-61.7	3.6	-15.4	0	0	-1
HVAC Battery Container (33 of 54)	Point	72	340.8	-61.6	3.6	-16.2	-0.1	0	-2
HVAC Battery Container (34 of 54)	Point	72	341.07	-61.6	3.6	-10.4	0	1.8	6
HVAC Battery Container (35 of 54)	Point	72	339.11	-61.6	3.6	-11	0	1.9	5
HVAC Battery Container (36 of 54)	Point	72	337.55	-61.6	3.6	-14.5	0	1.6	2
HVAC Battery Container (37 of 54)	Point	72	344.72	-61.7	3.6	-11.1	0	0	3
HVAC Battery Container (38 of 54)	Point	72	339.88	-61.6	3.6	-10.7	0	0	4
HVAC Battery Container (39 of 54)	Point	72	334.63	-61.5	3.6	-10	0	0	5
HVAC Battery Container (40 of 54)	Point	72	343.91	-61.7	3.6	-11.5	0	0	3
HVAC Battery Container (41 of 54)	Point	72	338.78	-61.6	3.6	-11.2	0	0	3
HVAC Battery Container (42 of 54)	Point	72	333.67	-61.5	3.6	-10.8	0	0	4
HVAC Battery Container (43 of 54)	Point	72	312.21	-60.9	3.5	-5.9	0	0.1	9
HVAC Battery Container (44 of 54)	Point	72	307.24	-60.7	3.5	-6.2	0	0.1	9
HVAC Battery Container (45 of 54)	Point	72	302.76	-60.6	3.5	-6.9	0	0	8
HVAC Battery Container (46 of 54)	Point	72	310.95	-60.8	3.5	-4.3	-0.1	0.1	11
HVAC Battery Container (47 of 54)	Point	72	306.27	-60.7	3.5	-4.6	-0.1	0.2	11
HVAC Battery Container (48 of 54)	Point	72	301.69	-60.6	3.4	-5.3	0	2.4	12
HVAC Battery Container (49 of 54)	Point	72	294.51	-60.4	3.4	-16.3	0	0	-1
HVAC Battery Container (50 of 54)	Point	72	292.46	-60.3	3.4	-17.2	0	0	-2
HVAC Battery Container (51 of 54)	Point	72	291.04	-60.3	3.4	-17.4	0	0	-2
HVAC Battery Container (52 of 54)	Point	72	291.43	-60.3	3.4	-16.5	0	2.1	1
HVAC Battery Container (53 of 54)	Point	72	289.39	-60.2	3.4	-17.4	0	2.2	0
HVAC Battery Container (54 of 54)	Point	72	287.95	-60.2	3.4	-17.7	0	2.2	0
Inverter with attenuator (1 of 18)	Point	81	368.79	-62.3	-1.6	-18.4	-1	0.5	-2
Inverter with attenuator (5 of 18)	Point	81	372.19	-62.4	-1.6	-19.2	-1.2	0.8	-3
Inverter with attenuator (7 of 18)	Point	81	363.72	-62.2	-1.6	-20.3	-1.3	1	-4
Inverter with attenuator (9 of 18)	Point	81	355.37	-62	-1.6	-20.2	-1.2	1	-3
Inverter with attenuator (11 of 18)	Point	81	347.04	-61.8	-1.6	-20	-1.2	1	-3
Inverter with attenuator (15 of 18)	Point	81	299.88	-60.5	-1.5	-10.8	-0.6	0.1	7
Inverter with attenuator (16 of 18)	Point	81	297.54	-60.5	-1.5	-11	-0.6	0	7
Inverter with attenuator (17 of 18)	Point	81	294.96	-60.4	-1.5	-21.6	-1.5	0.3	-4
Inverter with attenuator (18 of 18)	Point	81	293.27	-60.3	-1.5	-21.7	-1.5	0.2	-4
Inverter with attenuator (2 of 18)	Point	81	363.42	-62.2	-1.6	-18.3	-1	0.5	-2
Inverter with attenuator (3 of 18)	Point	81	342.59	-61.7	-1.6	-16.8	-0.9	0.3	0
Inverter with attenuator (4 of 18)	Point	81	337.08	-61.5	-1.6	-16.3	-0.9	0.2	1
Inverter with attenuator (6 of 18)	Point	81	370.26	-62.4	-1.6	-21	-1.5	1.2	-4

Inverter with attenuator (8 of 18)	Point	81	361.57	-62.2	-1.6	-21	-1.4	1	-4
Inverter with attenuator (10 of 18)	Point	81	353.36	-62	-1.6	-20.9	-1.4	1.2	-4
Inverter with attenuator (12 of 18)	Point	81	344.68	-61.7	-1.6	-20.6	-1.3	1.1	-3
Inverter with attenuator (13 of 18)	Point	81	337.98	-61.6	-1.6	-19.4	-1	1.8	-1
Inverter with attenuator(14 of 18)	Point	81	335.83	-61.5	-1.6	-20	-1.1	8.4	5
Transformer (1 of 9)	Point	71	353.59	-62	3.7	-11.5	0	0	2
Transformer (2 of 9)	Point	71	349.74	-61.9	3.7	-11.2	0	0	2
Transformer (3 of 9)	Point	71	369.25	-62.3	3.8	-16.1	-0.1	0	-3
Transformer (4 of 9)	Point	71	360.55	-62.1	3.8	-16	-0.1	0	-3
Transformer (5 of 9)	Point	71	352.24	-61.9	3.7	-16	-0.1	0	-3
Transformer (6 of 9)	Point	71	344.01	-61.7	3.7	-15.8	-0.1	0	-2
Transformer (7 of 9)	Point	71	334.83	-61.5	3.7	-14.7	0	0.1	-1
Transformer (8 of 9)	Point	71	303.17	-60.6	3.6	-5.1	0	0	9
Transformer (9 of 9)	Point	71	297.37	-60.5	3.6	-16	0	0	-2
					R3				
HVAC Battery Container (1 of 54)	Point	72	537.67	-65.6	3.8	-3.2	-0.1	0	7
HVAC Battery Container (2 of 54)	Point	72	540.92	-65.7	3.8	-3.8	-0.1	0	7
HVAC Battery Container (3 of 54)	Point	72	543.68	-65.7	3.8	-4	-0.1	0	7
HVAC Battery Container (4 of 54)	Point	72	535.52	-65.6	3.8	-4.5	-0.1	0.2	6
HVAC Battery Container (5 of 54)	Point	72	538.74	-65.6	3.8	-4.5	-0.1	0.2	6
HVAC Battery Container (6 of 54)	Point	72	541.62	-65.7	3.8	-4.5	-0.1	0.2	6
HVAC Battery Container (7 of 54)	Point	72	518.62	-65.3	3.8	-4.4	-0.1	2.5	9
HVAC Battery Container (8 of 54)	Point	72	521.22	-65.3	3.8	-4.4	-0.1	2.5	9
HVAC Battery Container (9 of 54)	Point	72	524.03	-65.4	3.8	-4.5	-0.1	2.5	9
HVAC Battery Container (10 of 54)	Point	72	521.29	-65.3	3.8	-4.1	-0.1	0	7
HVAC Battery Container (11 of 54)	Point	72	523.98	-65.4	3.8	-5.1	-0.1	0	6
HVAC Battery Container (12 of 54)	Point	72	526.62	-65.4	3.8	-5.1	-0.1	0	6
HVAC Battery Container (13 of 54)	Point	72	525.92	-65.4	3.8	-4.4	-0.1	2.5	9
HVAC Battery Container (14 of 54)	Point	72	528.54	-65.5	3.8	-2.4	-0.1	1.7	10
HVAC Battery Container (15 of 54)	Point	72	531.25	-65.5	3.8	-3.1	-0.1	1.9	10
HVAC Battery Container (16 of 54)	Point	72	528.58	-65.5	3.8	-3.7	-0.1	0	7
HVAC Battery Container (17 of 54)	Point	72	531.1	-65.5	3.8	-5.3	-0.1	0	5
HVAC Battery Container (18 of 54)	Point	72	533.8	-65.5	3.8	-5.6	-0.1	0	5
HVAC Battery Container (19 of 54)	Point	72	533.45	-65.5	3.8	-4.5	-0.1	2.5	9
HVAC Battery Container (20 of 54)	Point	72	535.98	-65.6	3.8	-2.2	-0.1	1.6	10
HVAC Battery Container (21 of 54)	Point	72	538.57	-65.6	3.8	-3.2	-0.1	1.9	9
HVAC Battery Container (22 of 54)	Point	72	536.18	-65.6	3.8	-3.6	-0.1	0	7
HVAC Battery Container (23 of 54)	Point	72	538.57	-65.6	3.8	-5.4	-0.1	0	5
HVAC Battery Container (24 of 54)	Point	72	541.13	-65.7	3.8	-6.4	-0.1	0	4

HVAC Battery Container (25 of 54)	Point	72	540.59	-65.6	3.8	-4.5	-0.1	0.2	6
HVAC Battery Container (26 of 54)	Point	72	543	-65.7	3.8	-2.2	-0.1	1.6	10
HVAC Battery Container (27 of 54)	Point	77	545.91	-65.7	3.8	-3.3	-0.1	1.9	14
HVAC Battery Container (28 of 54)	Point	72	543.69	-65.7	3.8	-3.3	-0.1	0	7
HVAC Battery Container (29 of 54)	Point	72	545.74	-65.7	3.8	-5.1	-0.1	0	5
HVAC Battery Container (30 of 54)	Point	72	548.57	-65.8	3.9	-5.8	-0.1	0	5
HVAC Battery Container (31 of 54)	Point	72	549.41	-65.8	3.9	-4.5	-0.2	2.5	8
HVAC Battery Container (32 of 54)	Point	72	552.26	-65.8	3.9	-2.7	-0.1	1.7	10
HVAC Battery Container (33 of 54)	Point	72	554.21	-65.9	3.9	-3.2	-0.1	1.9	9
HVAC Battery Container (34 of 54)	Point	72	552.12	-65.8	3.9	-4.1	-0.1	0	6
HVAC Battery Container (35 of 54)	Point	72	554.91	-65.9	3.9	-5.7	-0.1	0	5
HVAC Battery Container (36 of 54)	Point	72	557.13	-65.9	3.9	-5.9	-0.1	0	4
HVAC Battery Container (37 of 54)	Point	72	554.14	-65.9	3.9	-2.2	-0.1	1.6	10
HVAC Battery Container (38 of 54)	Point	72	558.4	-65.9	3.9	-2.3	-0.1	1.7	10
HVAC Battery Container (39 of 54)	Point	72	563.03	-66	3.9	-2.8	-0.1	1.8	9
HVAC Battery Container (40 of 54)	Point	72	555.78	-65.9	3.9	-4.1	-0.1	0.1	6
HVAC Battery Container (41 of 54)	Point	72	560.24	-66	3.9	-5.5	-0.1	0.1	5
HVAC Battery Container (42 of 54)	Point	72	564.7	-66	3.9	-6.1	-0.1	0.1	4
HVAC Battery Container (43 of 54)	Point	72	578.99	-66.2	3.9	-2.2	-0.1	0.1	8
HVAC Battery Container (44 of 54)	Point	72	583.77	-66.3	3.9	-3	-0.1	1.7	9
HVAC Battery Container (45 of 54)	Point	72	588.12	-66.4	3.9	-3.6	-0.1	1.9	8
HVAC Battery Container (46 of 54)	Point	72	580.53	-66.3	3.9	-2.3	-0.1	0	8
HVAC Battery Container (47 of 54)	Point	72	584.98	-66.3	3.9	-3.9	-0.1	0	6
HVAC Battery Container (48 of 54)	Point	72	589.36	-66.4	3.9	-4.9	-0.1	0	5
HVAC Battery Container (49 of 54)	Point	72	598.89	-66.5	3.9	-4.6	-0.1	2.6	8
HVAC Battery Container (50 of 54)	Point	72	601.85	-66.6	3.9	-1.3	-0.1	1.4	10
HVAC Battery Container (51 of 54)	Point	72	604.07	-66.6	3.9	-1.7	-0.1	1.5	9
HVAC Battery Container (52 of 54)	Point	72	601.67	-66.6	3.9	-3.8	-0.1	0.1	6
HVAC Battery Container (53 of 54)	Point	72	604.64	-66.6	3.9	-6.6	-0.1	3.1	6
HVAC Battery Container (54 of 54)	Point	72	606.81	-66.7	3.9	-6.8	-0.1	3.1	6
Inverter with attenuator (1 of 18)	Point	81	532.53	-65.5	-1.5	-1.2	-5.6	0.3	7
Inverter with attenuator (5 of 18)	Point	81	523.33	-65.4	-1.5	-0.5	-5.7	0	8
Inverter with attenuator (7 of 18)	Point	81	531.07	-65.5	-1.5	-0.6	-5.8	0	7
Inverter with attenuator (9 of 18)	Point	81	538.69	-65.6	-1.5	-0.7	-5.8	0	7
Inverter with attenuator (11 of 18)	Point	81	546.36	-65.7	-1.5	-0.8	-5.9	0	7
Inverter with attenuator (15 of 18)	Point	81	591.38	-66.4	-1.5	-9.2	-1	1.4	4
Inverter with attenuator (16 of 18)	Point	81	594.26	-66.5	-1.5	-2.9	-4.6	1.7	7
Inverter with attenuator (17 of 18)	Point	81	599.46	-66.5	-1.5	-3.9	-3.8	2	7
Inverter with attenuator (18 of 18)	Point	81	602.28	-66.6	-1.5	-4	-3.8	1.9	7

Inverter with attenuator (2 of 18)	Point	81	537.15	-65.6	-1.5	-1.6	-5.3	1.9	9
Inverter with attenuator (3 of 18)	Point	81	555.34	-65.9	-1.5	-4.9	-2.5	2.1	8
Inverter with attenuator (4 of 18)	Point	81	560.22	-66	-1.5	-5.6	-2.2	2.2	8
Inverter with attenuator (6 of 18)	Point	81	526.6	-65.4	-1.5	-8.6	-0.8	1.9	6
Inverter with attenuator (8 of 18)	Point	81	534.36	-65.5	-1.5	-8.3	-0.9	1.9	6
Inverter with attenuator (10 of 18)	Point	81	541.74	-65.7	-1.5	-8.6	-0.9	1.9	6
Inverter with attenuator (12 of 18)	Point	81	549.74	-65.8	-1.5	-9	-0.9	2	6
Inverter with attenuator (13 of 18)	Point	81	554.95	-65.9	-1.5	-1.1	-5.7	0	7
Inverter with attenuator (14 of 18)	Point	81	558.02	-65.9	-1.5	-9.2	-0.8	0	3
Transformer (1 of 9)	Point	71	546.23	-65.7	3.9	-1.4	-0.1	0	8
Transformer (2 of 9)	Point	71	549.54	-65.8	3.9	-1.6	-0.1	0	8
Transformer (3 of 9)	Point	71	528.69	-65.5	3.9	-3.9	-0.1	0	6
Transformer (4 of 9)	Point	71	536.39	-65.6	3.9	-4.1	-0.1	0	6
Transformer (5 of 9)	Point	71	543.82	-65.7	3.9	-4.2	-0.1	0	5
Transformer (6 of 9)	Point	71	551.29	-65.8	3.9	-4.3	-0.1	0	5
Transformer (7 of 9)	Point	71	559.9	-66	3.9	-4.6	-0.1	0	5
Transformer (8 of 9)	Point	71	588.3	-66.4	4	-4.3	-0.1	0	5
Transformer (9 of 9)	Point	71	596.02	-66.5	4	-4.6	-0.1	0	4

The figure below includes the legend of the acoustic parameters used in the calculations.

Legend

Source		Source name
Source type		Type of source (point, line, area)
Lw	dB(A)	Sound power level per unit
S	m	Distance source - receiver
Adiv	dB	Mean attenuation due to geometrical spreading
Agr	dB	Mean attenuation due to ground effect
Abar	dB	Mean attenuation due to screening
Aatm	dB	Mean attenuation due to air absorption
dLrefl	dB	Level increase due to reflections
Lr	dB(A)	Assessed level of time slice

The figure below includes the noise map of the study area.

