

Technical Report

# Noise Impact Assessment

Coupar Angus Battery Storage – 32MW Solar  
Farm & 16MW BESS

Eco Dev Limited

April 2022



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## Executive Summary

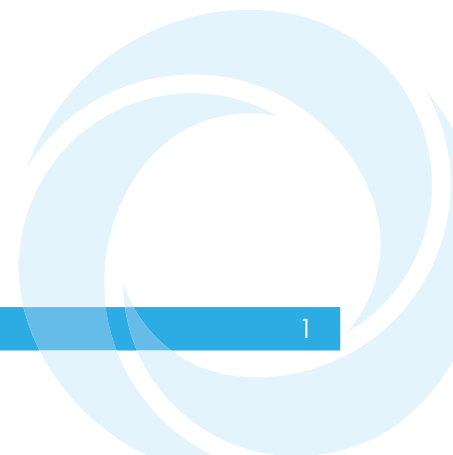
A Noise Impact Assessment has been undertaken for the proposed Coupar Angus Solar energy and Battery Storage facility on Keithick Estate near Coupar Angus, Scotland. Planning Application Reference: 22/00111/SCRN.

The outcome of the Noise Impact Assessment indicates that the level rating level produced by the proposed development in isolation (32MW solar and 16 MW BESS), when the proposed mitigation in this report is implemented, will be marginally above the measured background sound level.

When considering the context, it is anticipated that noise mitigation measures will be required based on the current specification of the site. This is in order to bring noise impacts within a marginal exceedance as stated above and as such, when considering the context, will likely achieve a low impact according to the criteria specified in BS4142:2014.

When considering the cumulative impact concurrently including the related 50 MW BESS site (Planning Application Reference: 22/00004/SCRN) the level rating level produced will be above the measured background sound level at three of the closest receptors to the 50MW BESS site. This will likely achieve an adverse impact according to the criteria specified in BS4142:2014.

BS4142:2014 states that 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.



# 1 Introduction

Atmos Consulting Ltd ('Atmos') has undertaken a Noise Impact Assessment (NIA) on behalf of AE Associates (AE) in support of an application for a proposed Solar and Battery Energy Storage Facility (the 'Proposed Development') on Keithick Estate approximately 1.7km west of Coupar Angus. Planning Application Reference: 22/00111/SCRN.

The site location is illustrated on Figure 1.

The Proposed Development shares a common red line boundary with another development, which is being developed by AE Associates in conjunction with the Proposed Development. As such the potential cumulative noise impact of both developments is considered as a worst-case scenario in the noise modelling.

## 1.1 Description of Development

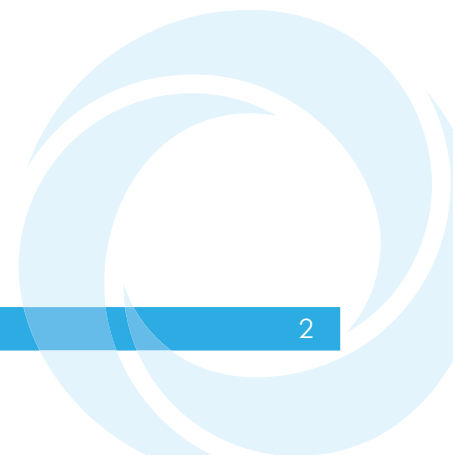
The application seeks consent for the installation of a solar panel site and battery storage system with a generating capacity of up to 32MW solar and 16 MW BESS. The Proposed Development includes the following;

- 6 storage containers each housing batteries and measuring approximately 18.5m x 2.59m x 2.9m height;
- 12 associated inverters and 12 transformers located between and to the side of the containers as shown on the layout plan;
- 1 switchgear Unit and 1 sub-station Building;
- An access track from the road and within the Proposed Development;
- Approximately 2.4m high gates and fencing; and
- Approximately 3m high poles for CCTV cameras and lighting.
- Where necessary 4m noise barriers.

## 1.2 Consultation

The Environmental Health Department at Perth and Kinross Council was contacted in January 2022 proposing that this NIA be undertaken using BS 4142:2014 methodology and that the receptors + monitoring locations used in this report were acceptable.

This was agreed by the Environmental Health Department by email on 17/02/2022.



## 2 Assessment Criteria

Atmos has conducted this NIA in accordance with the British Standard BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'.

This standard describes methods for rating and assessing sound of an industrial or commercial nature which includes:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and / or commercial premises; and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

The procedure detailed in the standard compares the measured or predicted noise level 'the specific noise level' from any of the above detailed noise sources with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.

The specific noise level also acknowledges the following reference time intervals depending upon whether the noise source operates during daytime or night-time periods:

- Daytime (07:00 – 23:00): 1 hour; and
- Night-time (23:00 – 07:00): 15 minutes.

There are a number of 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound level under investigation. These penalties vary in their weighting depending upon the severity of the acoustic feature, as follows:

### **Tonality**

- +2dB: where the tonality is just perceptible;
- +4dB: where the tonality is clearly perceptible; and
- +6dB: where the tonality is highly perceptible.

### **Impulsivity**

- +3dB: where the impulsivity is just perceptible;
- +6dB: where the impulsivity is clearly perceptible; and
- +9dB: where the impulsivity is highly perceptible.

### **Intermittency**

- +3dB: where the intermittency is readily distinctive against the acoustic environment.

In addition to the above acoustic features, there is a penalty for 'other sound characteristics' of +3dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment.

BS4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background sound level can yield the following commentary:

- Typically, the greater this difference (between the rating level and the background sound level), the greater the magnitude of impact;
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context; and
- 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.



### 3 Noise Impact Assessment

A cumulative assessment has been undertaken of both the Proposed Development and the 50MW BESS site operating simultaneously as a worst-case scenario, as both sites are anticipated to be constructed and be operational at the same time. Where rating levels exceed the assigned background sound level, the relative contribution from each site has been determined and discussed.

It is deemed that due to the size of the development and the few and distant surrounding receptors that any assessment of construction noise is to be scoped out.

#### 3.1 Noise Sensitive Receptors

The closest identified existing noise sensitive receptors to the centre of the Proposed Development are as follows:

**Table 1: Noise Sensitive Receptors**

Receptor Name	Receptor Number	Direction from the Proposed Development	Distance (metres)	OS Grid Reference
Kemphill Farmhouse	R1	North east	410m	NO 20632 39848
Kemphill Farm Cottage	R2	North east	600m	NO 20820 39908
Kemphill Farm Building	R3	North East	510m	NO 20748 39859
West Coupar Angus	R4	North East	1,200m	NO 21451 40048
Caddam Cottage 01	R5	East	630m	NO 20923 39432
Caddam Cottage 02	R6	South	550mm	NO 20720 39222
Keithick Biogas Residence	R7	South	1,100m	NO 20920 38681
Keithick Farm Cottage	R8	South	1,000m	NO 20855 38681
Gatehouse	R9	South	1,300m	NO 20812 38383
Keithick Estate 01	R10	South	840m	NO 20173 38762
Keithick Estate 02	R11	South	1,060m	NO 20309 38535
Keithick Estate 03	R12	South	1,050m	NO 20333 38544
Keithick Estate 04	R13	South	1,010m	NO 20069 38602
Keithick Estate 05	R14	South	990m	NO 20041 38640
Keithick Estate 06	R15	South	970m	NO 20096 38646
Keithick Mill	R16	South	1,360m	NO 20106 38248
Brunty Mill	R17	South West	1,450m	NO 19721 38265
Bridge Cottage	R18	West	1,430m	NO 19287 38584
Little Keithick	R19	West	1,270m	NO 19461 38649
North Lodge	R20	West	890m	NO 19709 38931
East Banchory	R21	North	1,310m	NO 19698 40747

Receptor Name	Receptor Number	Direction from the Proposed Development	Distance (metres)	OS Grid Reference
Residence				
Islabank	R22	North	1,370m	NO 20174 40949

For the purpose of assessment, all receptors are considered highly sensitive to any proposed noise sources and will be included in the assessment. However, it is understood that with the exception of R10 all receptors are tied employee properties to the landowner. Whilst Kempfill Farmhouse is noted as a category C listed building, it is understood, based on information from AE Associates, to be derelict. Therefore further consideration of the context and whether it is appropriate for this receptor to be included in assessment should be considered by any decision making authority.

Noise sensitive receptors, noise monitoring locations and noise contours are shown in Figure 2.

Three Old Military Road properties were included in the figure "72350\_NO\_008a\_Noise Sensitive Receptors & Noise Monitoring Locations" however due to the large distance from the Proposed Development they were not included in noise assessment.

### 3.2 Operational Phase

Noise source data for the assessment has been based on information provided by AE Associates. The sound power levels data used in this assessment is the same data used in the 50MW BESS assessment.

Data used for the battery storage containers (i.e. the ventilation/HVAC) has been based on a worst case scenario of the HVAC units mounted to the storage containers externally.

A summary of the 100% operational capacity sound power level data at used in the assessment is shown in Table 2.

BS4142:2014 specifies applicable penalties in relation to tonal, impulsive and intermittent characteristics. From Atmos's experience of noise generated by the proposed plant items, they are likely to produce steady-state noise continuously and tonal, impulsive or intermittent operation is not expected given the nature of the development.

As a result, no penalties have been applied in this assessment as none of the plant items produce the necessary sound characteristics (tonality, impulsivity and ETC) to warrant the application of penalties.

**Table 2: Octave Band Sound Power Levels used in Assessment, dB re 1pW**

Item	Qty	Overall dB (A)	Linear Octave Band Sound Power Level, dB								
			31.5	63	125	250	500	1k	2k	4k	8k
Battery Storage Container with HVAC	6	75	N/A	58	68	62	66	68	68	66	59
Inverter Station	12	84	N/A	53	67	72	77	79	78	78	66
Primary Transformer	-	85	N/A	64	70	77	80	80	75	69	63
Secondary Transformer	12	74	N/A	45	53	69	68	67	66	61	57

Whilst data for a primary transformer has been included in the data supplied, no primary transformer was identified within the site proposals and a secondary transformer was used based upon previous experience ATMOS has with similar sites.

### 3.2.1 32MW Solar and 16MW BESS

The Proposed Development entails the installation of the following equipment with the potential to generate noise. Shown in Table 3 below:

**Table 3: Proposed Equipment – 32MW Solar and 16MW BESS**

Equipment	Number of Units	Height (modelled)	Comments
Battery Storage Container with HVAC	6	2.4m (total)	Modelled as vertical area source
Inverter Station	12	2m	Modelled as a Point source
Transformer	12	2m	Modelled as a Point source

It is assumed that the plant will be operational 24 hours a day 365 days a Year.

### 3.2.2 50MW BESS

This cumulative development entails the installation of the following equipment with the potential to generate noise. Shown in Table 4 below:

**Table 4: Proposed Equipment – 50MW BESS**

Equipment	Number of Units	Height (modelled)	Comments
Battery Storage Container with HVAC	20	2.4m (total)	Modelled as vertical area source
Inverter Station	10	2m	Modelled as a Point source
Transformer	10	2m	Modelled as a Point source

It is assumed that the plant will be operational 24 hours a day 365 days a Year.

### 3.2.3 Noise Modelling Inputs

In order to accurately assess the noise levels associated with the Proposed Development at the closest receptors, a 3D Noise Model has been constructed using the modelling software CadnaA 2021. The following assumptions, inputs and considerations have been included in the model:

- Site Plans, "16 32 rev update" and "Keithick Stirling 50MW BESS EDG\_094\_GA\_01";
- Noise sources have been inputted as point sources for inverters and transformers and vertical area sources for the battery storage containers using the sound pressure, sound power levels and height (where applicable) data provided;
- 1m Digital Terrain Modelling (DTM) data has been used to determine site elevations;
- A reflection order of one has been used in all calculations with a ground absorption of 1 (where 1 is soft ground and 0 is hard ground); and
- Noise levels have been generated using ISO 9613-1 and ISO 9613-2 "Acoustics-Attenuation of sound during propagation outdoors" as included in the CadnaA software.

- Noise barriers for the 50Mw BESS site assume an absorptive element on the side facing the BESS units.

### 3.3 Background Sound Monitoring

Background sound measurements were conducted at two locations covering the minimum reference period of one hour day and 15 mins night, as described in BS 41412. Monitoring locations were at locations agreed with the local authority as representative of the nearest noise sensitive properties to the proposed development. Measurements were taken between 12:40 - 15:00 daytime and 23:16 – 00:20 night-time.

A second position was also monitored at night for location/ position 2 approximately 40m southwest, as subjectively there was observed to be a slight difference in the sound climate.

A summary of the noise measurement results from this report are reproduced in Table 5 below.

Approximate locations of the monitoring locations are shown in Figure 2.

**Table 5: Daytime Monitoring Results - Position 1**

Start time/ Duration (hrs:mins:secs)	L <sub>Aeq</sub> (dBA)	L <sub>AF10</sub> (dBA)	L <sub>AF90</sub> (dBA)	L <sub>AFMS-AX</sub> (dBA)
12:41 (1:0:0)	43	43	35	69

Weather Conditions

- Wind Speed – 0 m/s
- Precipitation – 0 mm
- Cloud Cover – 2/8
- Temperature – 5°C

Observations

Noise sources noted at the monitoring location were recorded and are summarised below in order of dominance (i.e. greatest first):

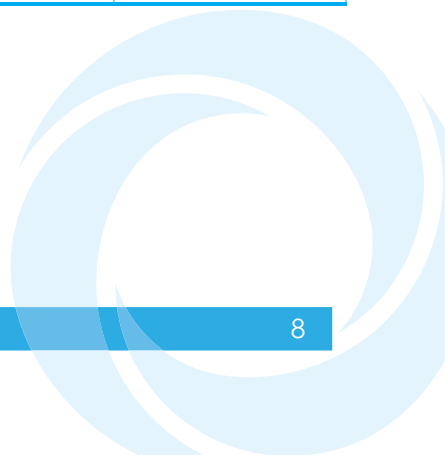
- Biogas Facility hum/rumble - constant
- Surrounding nearby vehicles (thought to be trucks serving the Biogas facility)
- Birdsong
- Distant surrounding road traffic

**Table 6: Daytime Monitoring Results - Position 2**

Start time/ Duration (hrs:mins:secs)	L <sub>Aeq</sub> (dBA)	L <sub>AF10</sub> (dBA)	L <sub>AF90</sub> (dBA)	L <sub>AFMAX</sub> (dBA)
13:56 (1:0:0)	40	42	33	61

Weather Conditions

- Wind Speed – 0m/s
- Precipitation – 0mm
- Cloud Cover – 2/8
- Temperature – 4-5°C



Observations

Noise sources noted at the monitoring location were recorded and are summarised below in order of dominance (i.e. greatest first):

- Birdsong
- Distant surrounding agricultural sounds
- Low hum from Biogas facility

**Table 7: Nighttime Monitoring Results - Position 1**

Start time/ Duration (hrs:mins:secs)	L <sub>Aeq</sub> (dBA)	L <sub>AF10</sub> (dBA)	L <sub>AF90</sub> (dBA)	L <sub>AFMAX</sub> (dBA)
23:16 (0:15:0)	37	40	31	58

Weather Conditions

- Wind Speed – 1-2 m/s, indiscernible direction
- Precipitation – 0 mm
- Cloud Cover – N/A
- Temperature – 2°C

Observations

Noise sources noted at the monitoring location were recorded and are summarised below in order of dominance (i.e. greatest first):

- Biogas facility dominant source – hum
- Distant road traffic
- Nocturnal animal sounds

**Table 8: Nighttime Monitoring Results - Position 2**

Start time/ Duration (hrs:mins:secs)	L <sub>Aeq</sub> (dBA)	L <sub>AF10</sub> (dBA)	L <sub>AF90</sub> (dBA)	L <sub>AFMAX</sub> (dBA)
23:46 (0:15:0)	35	38	32	55
00:05 (0:15:0)	32	34	29	42

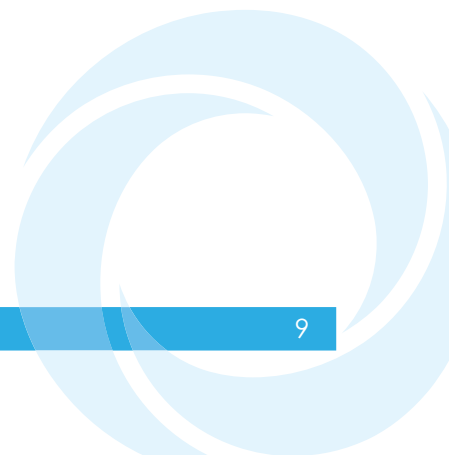
Weather Conditions

- Wind Speed – 1-2m/s from the North
- Precipitation – 0 mm
- Cloud Cover – N/A
- Temperature – 2°C

Observations

Noise sources noted at the monitoring location were recorded and are summarised below in order of dominance (i.e. greatest first):

- Wind in the trees
- Very distant road traffic
- Very Infrequent Intermittent unidentified throb



### 3.3.1 Noise Impact Assessment

#### BS4142 Daytime Assessment

Table 9 below presents the calculated unmitigated noise rating level for the daytime period at R1 – R22. The background data detailed in Section 3.3 was used for the assessment.

The background sound level used for the assessment is the average of the background sound levels for noise monitoring positions 1 and position 2 as the observed sound climate was similar for both.

Figure 2 shows the noise contour map for the daytime period.

**Table 9: Calculation of Rating Level at Receptor for Daytime Period**

Receptors	Calculated 1hr Specific Noise Level LAeq,t (dB)	Penalty Rating	Calculated Rating Level, LA, r (dB)	Background Sound Level LA90,1hr (dB)	Difference +/- (dB)
R1	44	0	44	34	+10
R2	41	0	41	34	+7
R3*	53	0	53	34	+19
R4	20	0	20	34	-14
R5	28	0	28	34	-6
R6	36	0	36	34	2
R7	21	0	21	34	-13
R8	22	0	22	34	-12
R9	17	0	17	34	-17
R10	22	0	22	34	-12
R11	20	0	20	34	-14
R12	20	0	20	34	-14
R13	19	0	19	34	-15
R14	19	0	19	34	-15
R15	19	0	19	34	-15
R16	9	0	9	34	-25
R17	9	0	9	34	-25
R18	14	0	14	34	-20
R19	16	0	16	34	-18
R20	20	0	20	34	-14
R21	15	0	15	34	-19
R22	15	0	15	34	-19

\*Kemphill Farm Building (R3) is understood to be a derelict property

This shows that the rating level will exceed the background for the daytime period as a result of the Proposed Developments cumulative noise emissions at receptors R1, R2, R3\* and R6. It significantly exceeds the background level at R1 and R3\*. Therefore, consideration of mitigation measures is required.

### BS4142:2014 Night-Time Assessment

Figure 2 shows the noise contour map for the night-time period. The noise model predictions of the specific noise levels at the receptors are the same as the daytime levels due to the 24hr operation of the facility. The receivers were set at the same height as for the daytime assessment.

Table 10 presents the calculated unmitigated noise rating level for the night-time period at the receptors. The background sound level used for the assessment is the average of the background sound levels for position 1 and position 2 as the observed sound climate was similar for both.

**Table 10: Calculation of Rating Level at Receptor for Night-time Period**

Receptors	Calculated 1hr Specific Noise Level LAeq,t (dB)	Penalty Rating	Calculated Rating Level, LA, r (dB)	Background Sound Level LA90,1hr (dB)	Difference +/- (dB)
R1	44	0	44	31	+13
R2	41	0	41	31	+10
R3*	53	0	53	31	+22
R4	20	0	20	31	-11
R5	28	0	28	31	-3
R6	36	0	36	31	5
R7	21	0	21	31	-10
R8	22	0	22	31	-9
R9	17	0	17	31	-14
R10	22	0	22	31	-9
R11	20	0	20	31	-11
R12	20	0	20	31	-11
R13	19	0	19	31	-12
R14	19	0	19	31	-12
R15	19	0	19	31	-12
R16	9	0	9	31	-22
R17	9	0	9	31	-22
R18	14	0	14	31	-17
R19	16	0	16	31	-15
R20	20	0	20	31	-11
R21	15	0	15	31	-16
R22	15	0	15	31	-16

This shows that the rating level will significantly exceed the background for the daytime period as a result of the Proposed Developments cumulative noise emissions at receptors R1, R2, R3\* and R6. Therefore, consideration of mitigation measures is required.

Analysis of the contributing noise generating items at each receptor exceeding the background level revealed the following:

- The noise levels at R6 are dominated by the noise from equipment related to the 32MW solar + 16 MW BESS site. The noise levels produced by the 50MW BESS site do not contribute to the exceedance of the rating level at this receptor.

- The noise levels at receptors R1, R2 and R3\* are dominated by the noise from the equipment related to the 50MW BESS site. The noise levels produced by the 32MW solar + 16 MW BESS site do not contribute to the exceedance of the rating level at these receptors.

Therefore, mitigation in relation to R6 is only required for the 32MW Solar + 16MW BESS site and vice versa. Following this, mitigation in relation to R1, R2 and R3\* would only be required to address the 50MW BESS noise emissions.

### 3.3.2 Assessment (Mitigated)

#### BS4142 Daytime Assessment

Table 11 presents the calculated mitigated noise rating level for the daytime period at R1 – R22. The background data detailed in Section 3.3 was used for the assessment. As before a penalty rating has not been applied as none of the noise producing equipment is expected to produce acoustic characteristics such as tonality, impulsivity etc. The background sound level used for the assessment is the average of the background sound levels for position 1 and position 2 as the observed sound climate was similar for both.

Recommended mitigation is in the form of an acoustic barrier around various perimeter areas of the site(s). The client has provided a proposed proprietary noise barrier spec being of 4m in height. It is recommended that any noise barrier installed is of minimum mass of 12kg/m<sup>2</sup>. Recommendations of mitigation have used a combination of 4.5m high and 4m high sections, along with a 2m high barrier around the perimeter of the most affected property. For the purposes of predictions and due to the propriety nature of the barrier, the side facing the battery storage units has been assumed as absorptive.

**Table 11: Calculation of Mitigated Rating Level at Receptor for Daytime Period**

Receptors	Calculated 1hr Specific Noise Level LAeq,t (dB)	Penalty Rating	Calculated Rating Level, LA, r (dB)	Background Sound Level LA90,1hr (dB)	Difference +/- (dB)
R1	37	0	37	34	+3
R2	34	0	34	34	0
R3*	53	0	53	34	+19
R4	20	0	20	34	-15
R5	28	0	28	34	-6
R6	32	0	32	34	-2
R7	21	0	21	34	-13
R8	22	0	22	34	-12
R9	17	0	17	34	-17
R10	22	0	22	34	-12
R11	19	0	19	34	-15
R12	20	0	20	34	-14
R13	18	0	18	34	-16
R14	18	0	18	34	-16



Receptors	Calculated 1hr Specific Noise Level LAeq,t (dB)	Penalty Rating	Calculated Rating Level, LA, r (dB)	Background Sound Level LA90,1hr (dB)	Difference +/- (dB)
R15	19	0	19	34	-15
R16	8	0	8	34	-26
R17	8	0	8	34	-27
R18	14	0	14	34	-20
R19	15	0	15	34	-19
R20	20	0	20	34	-14
R21	15	0	15	34	-19
R22	15	0	15	34	-19

This shows that the rating level will exceed the background for the daytime period as a result of the Proposed Development cumulative noise emissions at receptors R1 and R3\*. It moderately exceeds the background level at R1. A difference of 3dB at R1 is indicative of a minor adverse effect depending on the context.

### BS4142:2014 Night-Time Assessment

Figure 2 shows the noise contour map for the night-time period. The noise model predictions of the specific noise levels at the receptors are the same as the daytime levels due to the 24hr operation of the facility. The receivers were set at the same height as for the daytime assessment.

Table 12 presents the calculated noise rating level for the night-time period at the receptors. A penalty rating has not been applied as none of the noise producing equipment is expected to produce acoustic characteristics such as tonality, impulsivity and ETC. The background sound level used for the assessment is the average of the background sound levels for position 1 and position 2 as the observed sound climate was similar for both.

**Table 12: Calculation of Mitigated Rating Level at Receptor for Night-time Period**

Receptors	Calculated 1hr Specific Noise Level LAeq,t (dB)	Penalty Rating	Calculated Rating Level, LA, r (dB)	Background Sound Level LA90,1hr (dB)	Difference +/- (dB)
R1	37	0	37	31	+6
R2	34	0	34	31	+3
R3*	53	0	53	31	+22
R4	20	0	20	31	-12
R5	28	0	28	31	-3
R6	32	0	32	31	+1
R7	21	0	21	31	-10
R8	22	0	22	31	-9
R9	17	0	17	31	-14
R10	22	0	22	31	-9
R11	19	0	19	31	-12
R12	20	0	20	31	-11

Receptors	Calculated 1hr Specific Noise Level LAeq,t (dB)	Penalty Rating	Calculated Rating Level, LA, r (dB)	Background Sound Level LA90,1hr (dB)	Difference +/- (dB)
R13	18	0	18	31	-13
R14	18	0	18	31	-13
R15	19	0	19	31	-12
R16	8	0	8	31	-23
R17	8	0	8	31	-24
R18	14	0	14	31	-17
R19	15	0	15	31	-16
R20	20	0	20	31	-11
R21	15	0	15	31	-16
R22	15	0	15	31	-16

This shows that the rating level will exceed the background for the night-time period as a result of the Proposed Development cumulative noise emissions, at receptors R1, R2, R3 and R6. The rating level significantly exceeds the background level at R3\*. An exceedance of 1dB at R6 is not expected to be perceivable. A difference of 6dB at R1 is indicative of a significant adverse effect depending on the context.

### NR Curve - Night-Time Assessment

Since predicted night-time levels within amenity space exceed the measured background sound level, with mitigation implemented, an NR assessment has been undertaken to inform the indoor levels at night from the operational plant. It should be noted that this is in relation to the exceedances at R1-R3 which are solely attributed to the noise from the 50Mw BESS.

An NR assessment has been performed on R1 and R2. The results of which are shown below in Table 13.

**Table 13: NR Assessment**

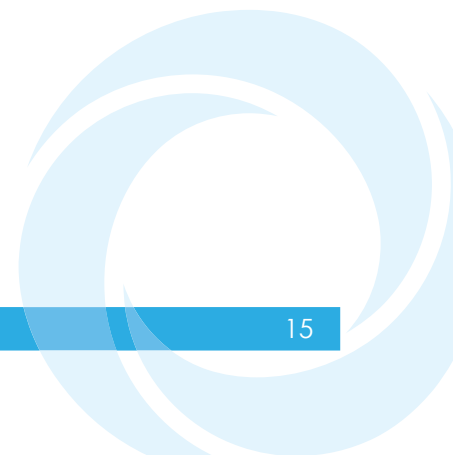
Freq (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
R1- Night - External	-78.1	16.8	26.8	22.4	29.4	31	28.2	23.4	-0.1
R2 – Night - External	-79.9	15.2	25.3	20.5	28.7	29.8	26.5	20.9	-3.7
<b>Open window Attenuation</b> ((Open Window: :))	<b>0</b>	<b>23</b>	<b>15</b>	<b>12</b>	<b>21</b>	<b>10</b>	<b>15</b>	<b>14</b>	<b>14</b>
R1 – Night (internal) vs NR20	-147.1	-57.4	-27.6	-20.2	-15.4	+1.0	-3.6	-5.0	-26.7
R2 - Night (internal) vs NR20	-148.9	-59.0	-29.1	-22.1	-16.1	-0.2	-5.3	-7.5	-30.3
R1 – Night (internal) vs NR25	-150.5	-61.4	-32.0	-24.9	-20.3	-4.0	-8.7	-10.1	-31.9
R2 - Night (internal) vs NR25	-152.3	-63.0	-33.5	-26.8	-21.0	-5.2	-10.4	-12.6	-35.5

It can be observed that both properties meet NR25 and only R1 exceeds NR20 by 1 dB at 1000Hz, with R2 meeting the NR20 criteria. R1 meets NR21.

The NR Assessment has been performed at ground floor level for both properties. It is unclear if 1<sup>st</sup> floor sleeping accommodation is present however when assessed R1 meets NR25 at first floor level assuming an open window.

While the internal levels do not meet NR20, NR25 is a typical criterion for steady industrial type sound internally in a residential setting. Further, the context of any exceedances should be considered, such as the level of exceedance, absolute sound levels, level and type of occupancy and financial involvement.

In this scenario it is not generally expected likely that the levels predicted internally will cause disturbance.



## 4 Conclusion

An assessment of noise emissions and associated impacts on nearby receptors has been carried out for the proposed solar and battery storage facility on Keithick Estate, near Coupar Angus.

A cumulative modelling and assessment exercise which includes the accompanying 50MW BESS site has been undertaken to inform about the likely real world noise impacts.

A noise model has been compiled to determine predicted noise levels resulting from the operation of the site at the surrounding receptors. A noise impact assessment has been undertaken in-line with BS 4142, in order to characterise the noise environment at the Proposed Development representative of the surrounding receptors, with and without the Proposed Development being present.

The outcome of the NIA indicates that the noise rating level produced by the Proposed Development with the proposed mitigation implemented, will fall below the measured background sound level at the majority of receptors and is an indication of a low impact in-line BS4142:2014.

However, when cumulative impacts are considered, rating levels at receptors R1, R2 and R3 are above background, which may be an indication of an adverse impact. Kempmill Farm Building (R3) is understood to be a derelict property and therefore has been excluded from assessment conclusions.

The noise rating level at Caddam Cottage (R6) is marginally above background with mitigation in place at both sites. The exceedance is 1dB which is likely to be imperceptible. Analysis of the relative contributions from each site at this receptor conclude that the level at R6 is dominated by the noise from the inverters at the Proposed Development (32MW & 16MEBESS). The 50 MW BESS site does not contribute to the noise level here, with or without mitigation.

The rating level of the cumulative impact of the Proposed Developments at receptors R1, R2 and R3 exceeds the background noise level even with the proposed mitigation at the 50MW BESS site in place. However, only two of these are significant exceedances, Kempmill Farmhouse (R1) and Kempmill Farm Building (R3). However, it should be considered that the Proposed Development in relation to this report (32MW Solar & 16MW BESS site) does not contribute to these exceedances, therefore no further assessment or mitigation further to those already incorporated is necessary at this site.

Although not influenced by the noise emission from the proposed development (32MW Solar & 16MW BESS), an additional assessment against NR 20 and 25 criteria at the relevant properties (R1 and R2) has also been performed to understand the potential impact, due to the cumulative impact of the 50MW BESS site.

This concluded that in all cases NR25 can be met, however NR20 criteria is exceeded by R1 by 1dB at ground floor level.

Although when cumulative levels are considered, the background sound levels is exceeded, this is driven solely by noise levels emitted by the 50MW BESS site and not the 32MW Solar & 16MW BESS. Therefore considering the context the proposed development is predicted to have a low impact

In a scenario where receptors R1 and R2 are not determined to be sensitive receptors it is unlikely noise mitigation measures at the Proposed Development will be necessary.

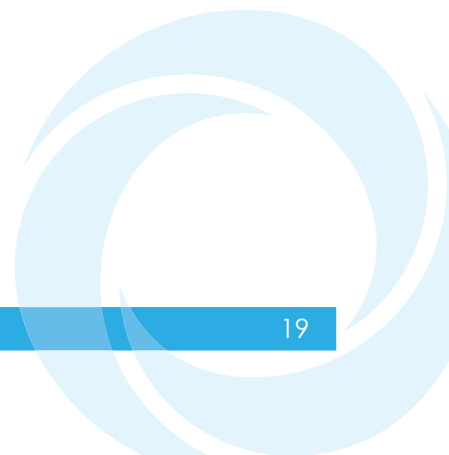
BS4142:2014 states that the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact. Where the rating level does not exceed the background, this is an indication of the specific sound source having a low impact, depending on the context.

## 5 References

Open Window: . (n.d.). NANR116: 'OPEN/CLOSED WINDOW RESEARCH' SOUND INSULATION THROUGH VENTILATED DOMESTIC WINDOWS.

## Appendices

### Appendix A. Figures



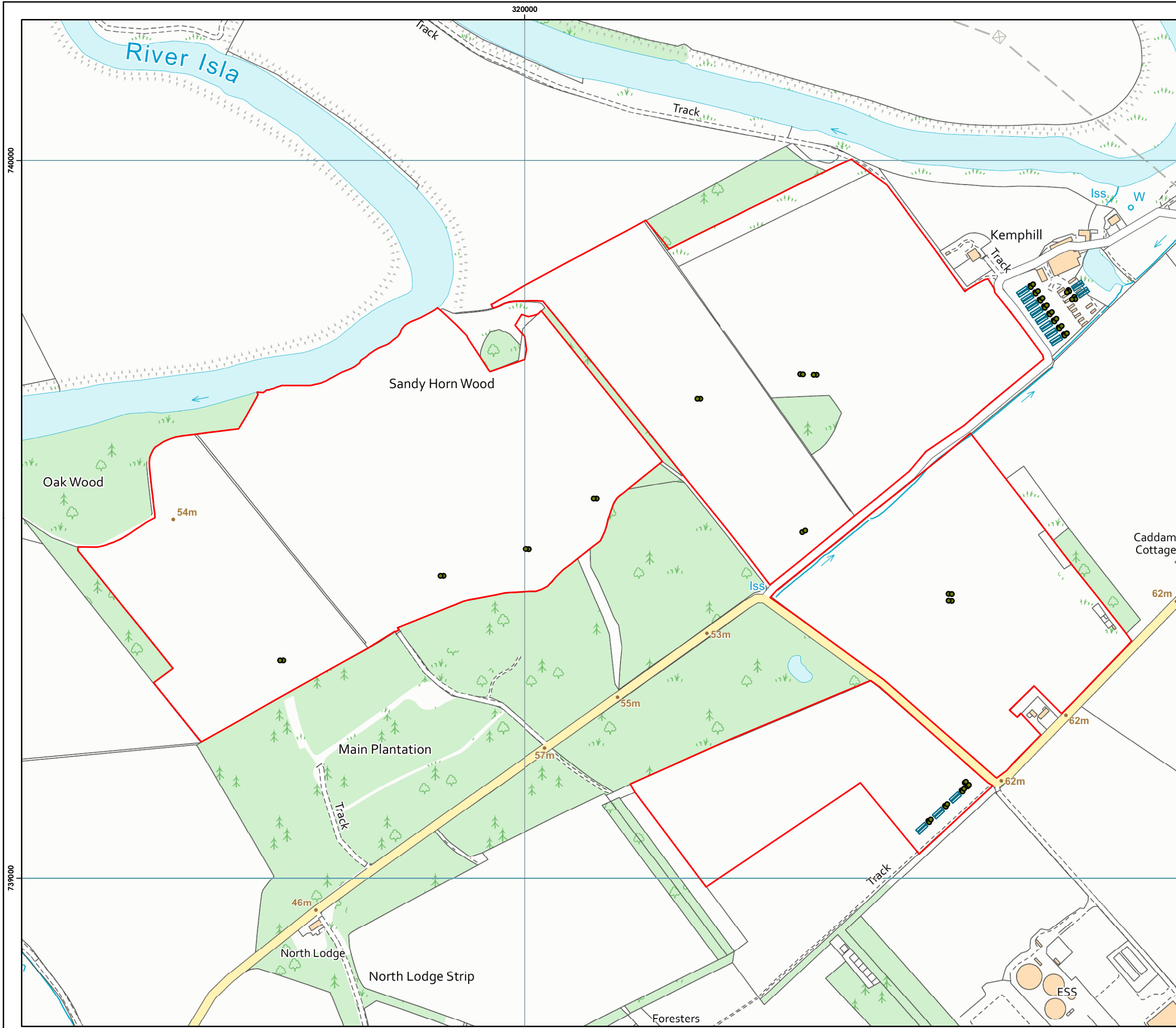
# Coupar Angus Battery and Solar Farm

## AE Associates

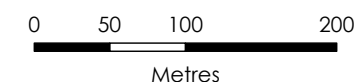
Figure 1  
Site Layout and Noise Sources

### Key

- Site boundary
- Battery Storage Container Locations
- Inverter and Transformer Locations



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# Coupar Angus Battery and Solar Farm

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Figure 2  
Unmitigated Noise Contours

### Key

- Site boundary
- Inverter and Transformer Locations
- Battery Storage Container Locations
- 33kv Substation Building

Unmitigated noise levels  $L_{eq}$  dB(A) - 1.5m height

Predicted Noise Level dB(A)

- 20 - 25 dB(A)
- 25 - 30 dB(A)
- 30 - 35 dB(A)
- 35 - 40 dB(A)
- 40 - 45 dB(A)
- 45 - 50 dB(A)
- 50 - 55 dB(A)
- 55 - 60 dB(A)
- 60 - 65 dB(A)
- 65 - 70 dB(A)
- >70 dB(A)

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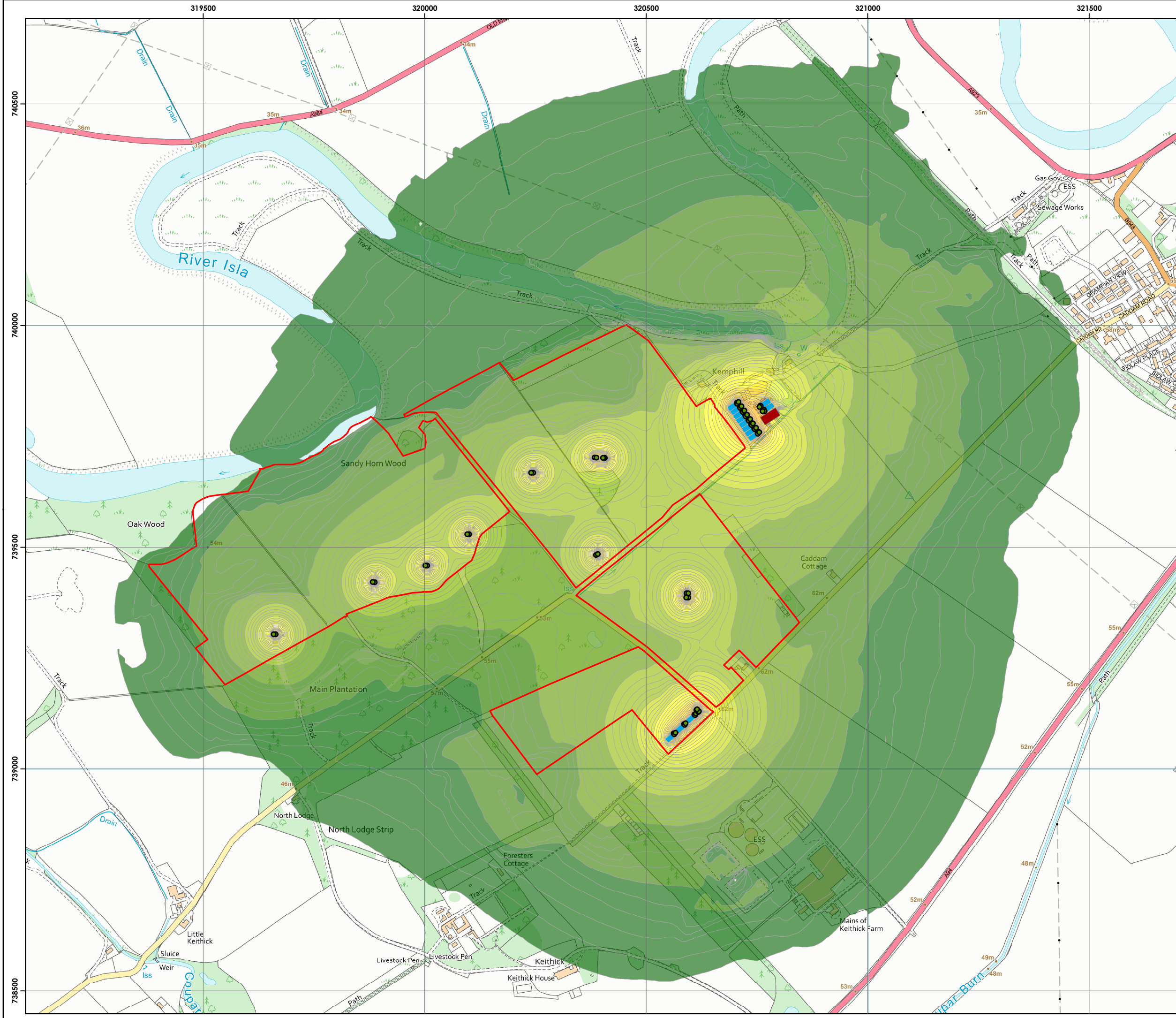


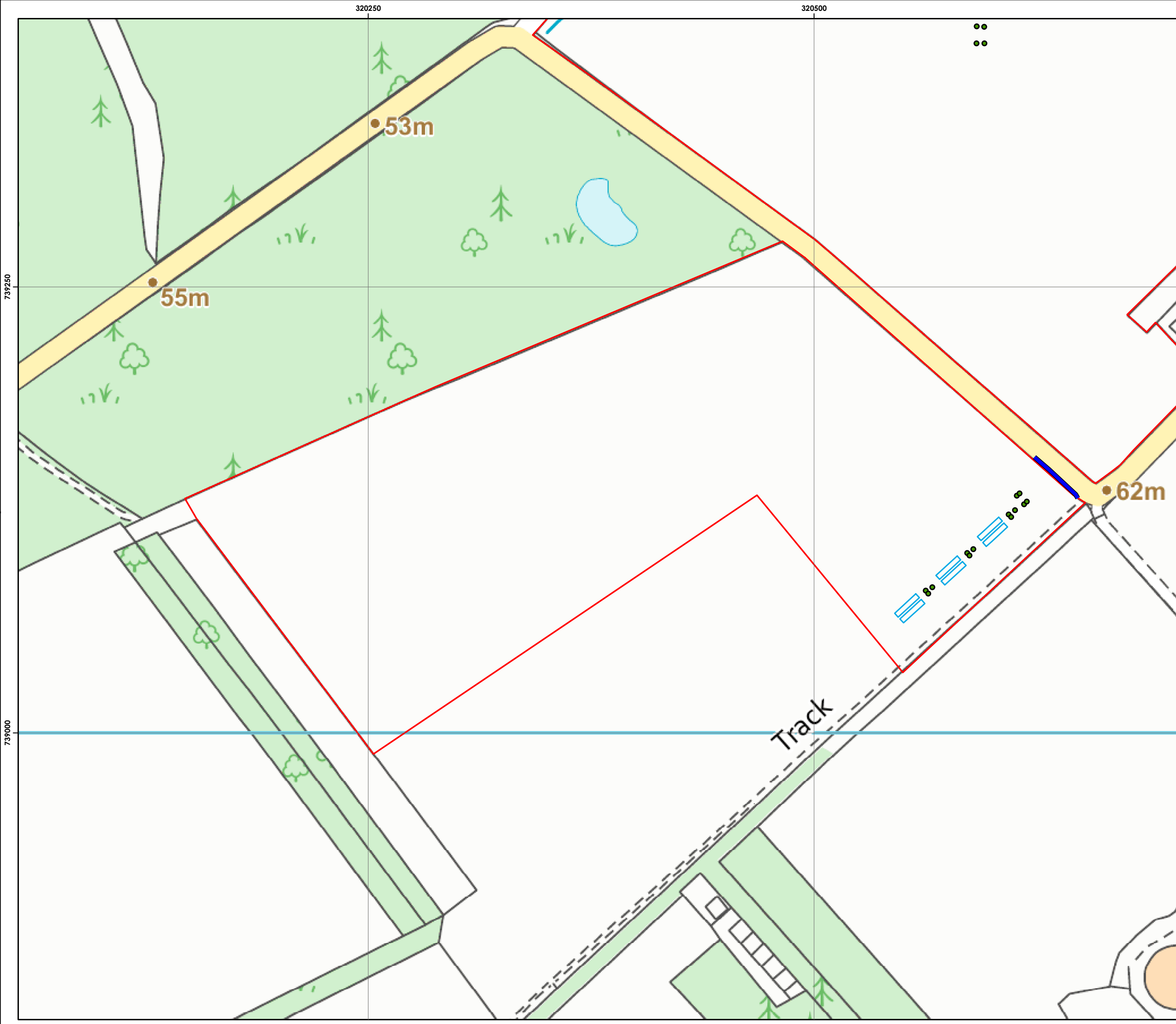
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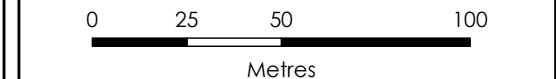
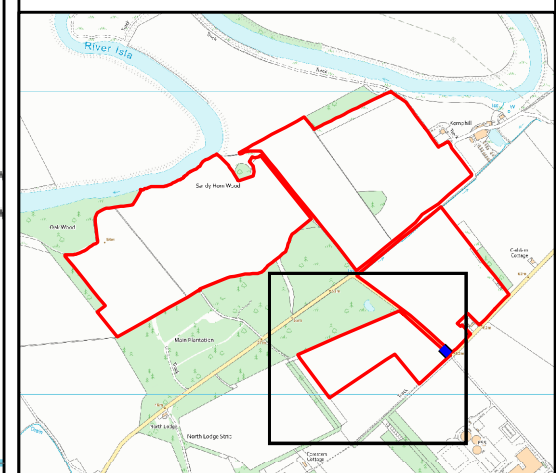


# Coupar Angus Battery and Solar Farm

## AE Associates

Figure 3  
Noise Mitigation

- Key**
- Site boundary
  - Proposed Noise Barrier
  - Inverter and Transformer Locations
  - Battery Storage Container Locations
  - 33kv Substation Building



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# Coupar Angus Battery and Solar Farm

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




Figure 4  
Mitigated Noise Contours

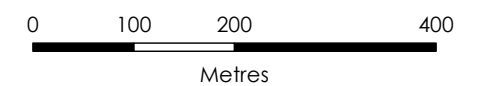
### Key

-  Site boundary
-  Proposed Noise Barrier Locations
-  Inverter and Transformer Locations
-  Battery Storage Container Locations
-  33kv Substation Building

Mitigated noise levels  $L_{eq}$   
dB(A) - 1.5m height

Predicted Noise Level dB(A)

-  20 - 25 dB(A)
-  25 - 30 dB(A)
-  30 - 35 dB(A)
-  35 - 40 dB(A)
-  40 - 45 dB(A)
-  45 - 50 dB(A)
-  50 - 55 dB(A)
-  55 - 60 dB(A)
-  60 - 65 dB(A)
-  65 - 70 dB(A)
-  >70 dB(A)



Scale @ A3:  
1:7,500

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## Appendix B. Sound Power Levels

**Table 4: Noise Emitting Plant – A-Weighted Sound Power Levels and Spectra**

Plant	Octave Band Frequency Hz, level in dB(A)								Total level dB(A)
	63	125	250	500	1k	2k	4k	8k	
Battery container HVAC unit, dB(A)	58	68	62	66	68	68	66	59	75
Secondary transformer, dB(A)	45	53	69	68	67	66	61	57	74
Inverter, dB(A)	53	67	72	77	79	78	78	66	84
Primary 132/33 kV transformer, dB(A)	64	70	77	80	80	75	69	63	85

It should be noted that in the model it is assumed that all plant is operating simultaneously as a worst case. This is unlikely to occur in practice, and as such noise emitted by the Development is likely to be lower than the levels predicted in this assessment.

The Development can operate both day and night and therefore is assessed against both daytime and night-time criteria.

