

NoiseAssess

Acoustics, Noise and Vibration Consultants

Project: **Proposed Battery Energy Storage Scheme (BESS)**
Land east of Cellarhead sub-station, Mill Lane, Wetley Rocks, ST9.

Scope of Report **Assessment of operational noise impact on the nearest residential properties**

Client: Sirius Planning

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1.0 INTRODUCTION

- 1.1 This noise assessment has been commissioned by Sirius Planning in relation to a planning application for the installation of a Battery Energy Storage Scheme (BESS) on land to the east of the Cellarhead sub-station, Mill Lane, Wetley Rocks ST9. The site is in a mainly rural / agricultural area, to the north of Cellarhead / Werrington and to the west of Wetley Rocks. The site location is shown on Figures 1 and 2. An indicative draft layout is shown on Figure 3.
- 1.2 This report relates to the potential impact of the operational noise arising from the running of the plant when assessed at the nearest residential receptors.
- 1.3 The residential receptor used in this assessment is marked R on Figure 2 and is the closest residential property to the site. This location is also representative of other residential properties in the Rownall Hall area to the east of the site. Other properties to the north and south of the site are further away and therefore the noise impact will be lower than at the location assessed.

2.0 CRITERIA

BS4142

2.1 The noise impact of commercial/industrial noise sources on existing residential properties is normally assessed in accordance with BS4142¹.

2.2 The scope of BS4142 is given in the extract below.

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

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

The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident."

2.3 The standard compares sound from industrial / commercial sources with the background sound level. The standard states in Clause 9.1 that "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level". Such features are taken into account by adding a correction to the specific sound level depending on the extent to which the distinguishing acoustic characteristics will attract attention. The standard states the following in Clause 9.2:

"Tonality: For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone that is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible".

- "Impulsivity: A correction of up to 9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible."
- "Note 2: If characteristics likely to affect perception and response are present in the specific sound, within the same reference period, then the applicable corrections ought normally to be added arithmetically. However, if a single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics."
- "Intermittency: When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied".
- "Other sound characteristics: Where the specific sound features characteristics that are neither tonal, nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied."

2.4 BS4142 provides guidance on the assessment of impacts in Clause 11.

"11 Assessment of the impacts

COMMENTARY ON CLAUSE 11.

The significance of sound of an industrial / commercial nature depends upon both the margin by which the rating 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 assessments 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 from the rating level, and consider the following:

- a) Typically, the greater this 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”.

- 2.5 BS4142 recommends that the specific sound level during daytime periods 07:00 - 23:00 hrs should be determined over a reference time interval of 1 hour and during night-time periods 23:00 - 07:00 hrs over a reference time interval of 15 minutes.

Assessment in Context

- 2.6 BS4142 recommends that the industrial sound should also be assessed in context. Therefore, the sound levels have been assessed in the context of the character of the area; the existing ambient noise levels and the criteria given in BS8233².
- 2.7 The BS8233 recommendations for indoor ambient noise levels are given below.

Table 1. BS8233 recommendations for indoor ambient noise levels

Activity	Location	07:00 to 23:00 hrs	23:00 to 07:00 hrs
Resting	Living room	35 dBL _{Aeq,16hour}	-
Dining	Dining room/area	40 dBL _{Aeq,16hour}	-
Sleeping (daytime resting)	Bedroom	35 dBL _{Aeq,16hour}	30 dBL _{Aeq,8hour}

- 2.8 Paragraph 7.7.3.2 of BS8233 recommends that for traditional external amenity areas such as gardens and patios, it is desirable that during the daytime the external noise level does not exceed 50 dBL_{Aeq,T} with an upper guideline value of 55 dBL_{Aeq,T} which would be acceptable in noisier environments. The time period is not stated but is assumed to be 16 hours (07:00 hours to 23:00 hrs) as in the previous version of BS8233.

3.0 BASELINE NOISE DATA

- 3.1 A survey of existing noise levels has been carried out at the location marked A Figure 2.

Table 2. Noise survey

Location A	
Microphone position	In free field conditions at a height of 2m
Survey type	Unattended
Sound level meter	Rion NL-31, Class 1, serial number: 00583265
Frequency analysis	Broadband only
Survey Times	13:00 hours Friday 19/11/21 – 12:00 hours Tuesday 23/11/21

- 3.2 The meter was calibrated using a portable Norsonic 1251 calibrator (s/n 30901) at the start and finish of the survey period with no variation in the calibration level.
- 3.3 According to weather reports, the weather conditions during the survey were generally dry with low wind speeds (<5m/s).
- 3.4 The results of the noise survey are summarised below and are presented in full in Appendix A2. All readings were taken over 5-minute sample periods. The 5-minute dB_{LAeq} values have been log-averaged and the 5-minute dB_{LA90} values have been arithmetically averaged to calculate the reference period values (1-hour day and 15-min night) given in the Appendix and the daytime and night-time averages given below. The modal dB_{LA90} values given below have been calculated for daytime and night-time periods based on the daytime 1-hour and the night-time 15-minute dB_{LA90} values.

Table 3. Summary of existing daytime free field noise levels at location A

Day	Period	Ambient noise level dB_{LAeq}		Background noise level dB_{LA90}	
		Average	Range	Average	Mode
19/11/2021	13:00 - 23:00	55	46 - 58	35	34
20/11/2021	07:00 - 23:00	53	47 - 57	38	37
21/11/2021	07:00 - 23:00	52	43 - 55	36	37
22/11/2021	07:00 - 23:00	56	47 - 59	35	35
23/11/2021	07:00 - 12:00	55	52 - 58	39	39

Table 4. Summary of existing night-time free field noise levels at location A

Night of	Period	Ambient noise level dBL _{Aeq}		Background noise level dBL _{A90}	
		Average	Range	Average	Mode
19/11/2021	23:00 - 07:00	62	31 - 76	32	31
20/11/2021	23:00 - 07:00	45	29 - 50	34	30
21/11/2021	23:00 - 07:00	46	27 - 54	30	28
22/11/2021	23:00 - 07:00	45	33 - 54	35	35

- 3.5 The main noise sources during the periods of attendance on site were road traffic, farm vehicle movements and animals on nearby farmland.

4.0 NOISE IMPACT ASSESSMENT AND RECOMMENDATIONS

Criteria and Methodology

- 4.1 The potential noise impact of the plant associated with the proposed BESS scheme has been assessed in accordance with BS4142¹ and in context. This standard is outlined in Section 2 above.

Closest noise sensitive properties

- 4.2 The potential noise levels have been assessed at receptor R which is shown on Figure 2.

Source noise levels

- 4.3 Information provided by the client indicates that there will be 110 BESS containers. The noise-generating items on the BESS containers will be the HVAC units used for cooling. There will be two HVAC units on each end of each BESS container making 4 per container. There will therefore be 440 BESS HVAC units. Each pair of BESS containers will be served by a unit containing two inverters and one transformer. There will be 55 of these inverter/transformer units. Therefore, there will be 110 inverters and 55 transformers. Following initial calculations, the supplier was asked to provide mitigation at source to the units. The units, with mitigation in place, will produce the following noise levels:

- BESS HVAC 65 dB(A) at 1m
- Inverter 65 dB(A) at 1m
- Transformer 72 dB(A) at 1m

- 4.4 Typical frequency analysis has been provided which has been used in the assessment. No noise data has been provided for the switchgear containers, but it is understood they are likely to have low noise emissions and they have therefore been assumed to have negligible noise output in comparison with other items.

Acoustic Barriers

- 4.5 4m high acoustic barriers will be installed to the north, east, and south of the plant plus one internal barrier as shown in brown on Figure 3.
- 4.6 The acoustic barriers should be imperforate and have a minimum mass of 12 kg/m². The acoustic barriers should be fully sealed to the ground at the base and should be designed so that gaps do not open between panels or at the base due to weathering over the lifespan of the barrier. This will normally mean that panels are interlocking or have cover strips and that gravel boards at the base are designed to limit deterioration due to contact with the ground. Consideration should be given to the procedures for maintenance or replacement of the barriers as necessary to ensure their continued effectiveness. The acoustic barriers may consist of one of the following:
- An acoustic fence meeting the above specification. Acoustic fences are available in various materials with varying lifespans as can be seen from the examples of proprietary acoustic fences below.
 - A masonry wall with no gaps.
- 4.7 Examples of suppliers of proprietary acoustics fences are as follows:
- | | |
|---------------------------|---|
| Gramm Barriers: | http://www.grammbarriers.com/our-products/acoustic-barriers/ |
| Jacksons Fencing: | https://www.jacksons-fencing.co.uk/acoustic-fencing |
| Premier Acoustic Fencing: | http://www.premieracousticfencing.co.uk/ |
- 4.8 The entrance gates should have the same mass as the barrier and close onto seals at the edges and to the ground.

Modelling Assumptions

- 4.9 The noise levels from the proposed plant at receptor locations have been calculated in accordance with ISO9613-2³ using CadnaA acoustic modelling software, produced by DataKustick GmbH. The model takes into account distance attenuation, ground absorption, atmospheric absorption and screening by the 4m barriers detailed above. Modelling has been carried out with all source heights at 1.5m above local ground level.

- 4.10 This assessment has been based on all plant producing the same noise levels both in the daytime and at night. In practice the plant will have lower noise levels at night because the main noise is from cooling and temperatures are lower at night. Therefore, the use of the same source noise levels makes the assessment conservative.
- 4.11 The calculations have been based on receptor heights of 1.5m during the daytime and 4m at night. The ground levels have been taken from ordnance survey data. The modelling has been based on soft ground ($G=1.0$). The atmospheric conditions used in the model input were a temperature of 10 °C and a relative humidity of 70%. The modelling calculations have been carried out on the basis of the receptors being downwind of all sources simultaneously and no allowance has been made for directivity. This assumption is conservative.

Modelling Results

- 4.12 The calculated noise levels are given below.

Table 5. Calculated noise levels.

Receptor	dBL _{Aeq} Day, 1.5m	dBL _{Aeq} Night, 4m
R1	24	26

BS4142 Assessment

- 4.13 The BS4142 assessment of the above noise levels is shown below. The noise sources are not impulsive and therefore an impulsive penalty is not required. The cooling system does run on demand but once on it tends to run continuously for longer periods rather than cycling on and off repeatedly and therefore an intermittency penalty has not been added. Distinct tonality is not expected to be perceptible at the receptors because the overall noise levels are low and therefore no tonal penalty has been added.
- 4.14 The assessment has been based on the lowest modes of the 1-hour daytime and 15-minute night-time dBL_{A90} background noise levels recorded at the noise monitoring locations.
- 4.15 The BS4142 assessment is given below.

Table 6. BS4142 assessment.

Time	Day	Night
Specific noise level, dBL _{Aeq}	24	26
Tonal Penalty, dB	0	0
Impulsive/Intermittency penalty, dB	0	0
Rating, dB	24	26
Background noise level, dBL _{A90}	34	28
Rating - background, dB	-10	-2

- 4.16 The above assessment results normally indicate a low noise impact. BS4142 recommends that the noise should also be judged in context as discussed below.

Noise considered in context

- 4.17 The site is near to an electricity sub-station and therefore the type of noise associated with the BESS will not be out of character for the area.
- 4.18 The above calculations are based on all plant running simultaneously and at the same noise levels in the night-time as in the daytime. This is conservative because cooling equipment will not generally run at full capacity at night when ambient temperatures are generally lower.
- 4.19 To assist with the consideration of the noise in context the levels have been compared with the lowest average daytime and night-time ambient noise levels measured during the survey. In addition, the plant noise levels have been compared with the criteria given in BS8233. It is recognised that this standard is generally used for anonymous noise sources, and it is used here only to provide additional information on the scale of the noise levels. The results of these comparisons are given below.

Table 7. Comparison with ambient noise levels and BS8233 criteria.

Time	Day	Night
Source noise level, dBL _{Aeq}	24	26
Comparison with ambient noise levels		
Ambient noise level, dBL _{Aeq}	52	45
Difference between ambient & source noise level, dB(A)	-28	-19
Ambient + source noise level, dBL _{Aeq}	52	45
Increase in ambient noise level, dBL _{Aeq} [†]	0	0
Comparison with BS8233 criteria for gardens		
BS8233 Upper limit for private gardens	55	-
Difference between source noise & desired limit, dB(A)	-31	-
Comparison with BS8233 internal noise limiting criteria		
Internal noise level due to source noise, dB(A) ^{††}	9-14	11-16
BS8233 recommended internal noise criteria dB(A)	≤ 35	≤ 30

[†]An increase in ambient noise level of up to 3dB(A) is not considered to be significant

^{††}Attenuation due to partially open window taken as 10-15dB(A)

- 4.20 The consideration of the noise in context supports the conclusion of the BS4142 assessment that the noise impact of the proposed BESS development would be low.

5.0 CONCLUSIONS

5.1 The proposed equipment will have mitigation measures designed by the supplier to ensure that the following noise levels are not exceeded:

- BESS HVAC 65 dB(A) at 1m
- Inverter 65 dB(A) at 1m
- Transformer 72 dB(A) at 1m

5.2 A 4m acoustic barrier will be installed to the north, east and south of the plant and along one internal line between the units.

5.3 Noise modelling calculations have been based on 440 BESS HVAC units (2 on each end of 112 BESS containers), 110 inverters and 55 transformers.

5.4 Assessment of the mitigated noise levels has been carried out in accordance with BS4142. The BS4142 assessment indicates a low noise impact. The consideration in context supports the conclusion that the noise impact will be low.

5.5 The noise emissions can be satisfactorily controlled and therefore it is recommended that the application for planning consent for the BESS development should not be refused on noise grounds.

6.0 REFERENCES

1. BS4142: British Standard 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound.
2. BS8233: British Standard 8233, Guidance on sound insulation and noise reduction for buildings, BSI 2014.
3. ISO9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of Calculation, The International Organisation for Standardisation.

FIGURE 1. SITE LOCATION

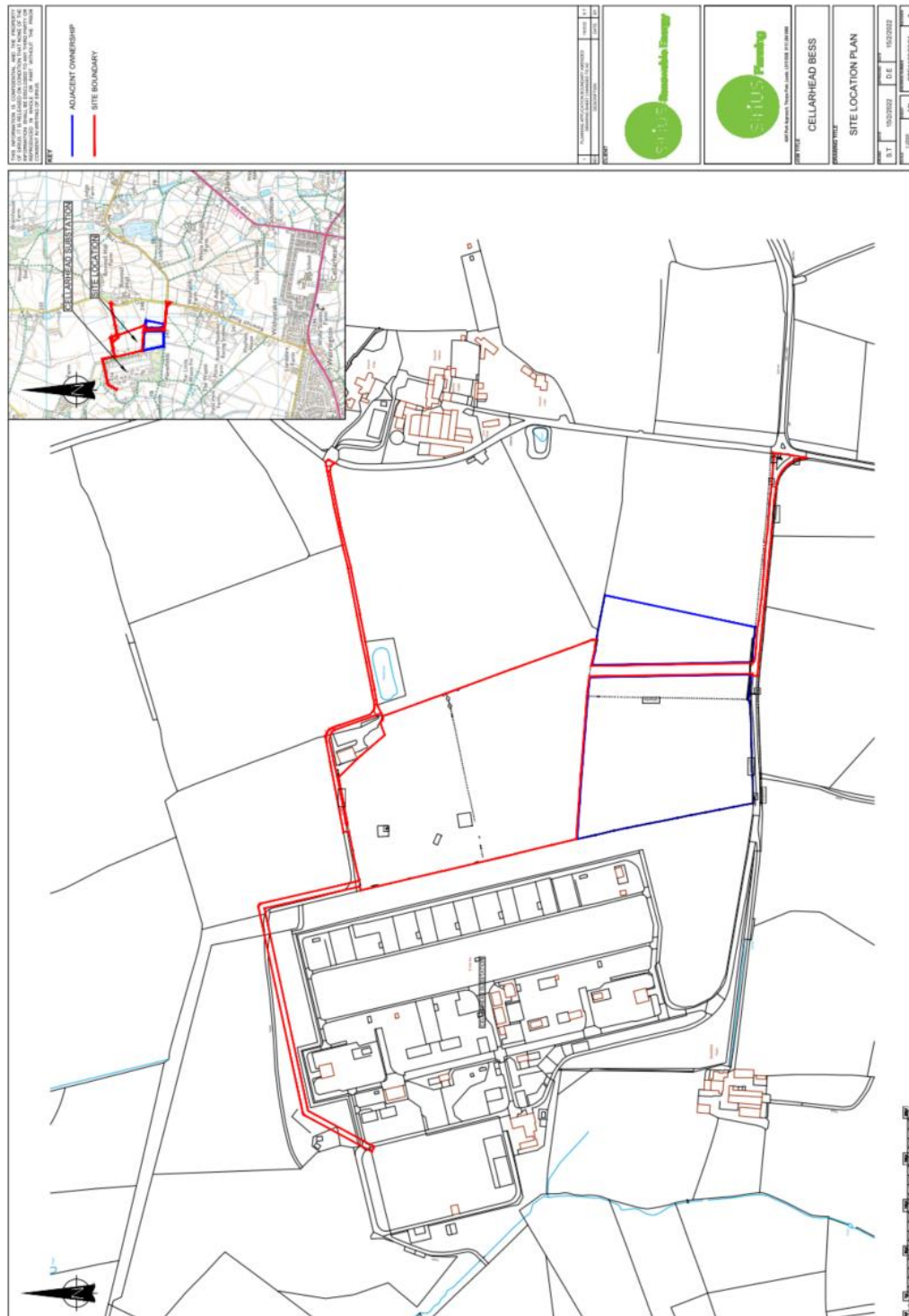
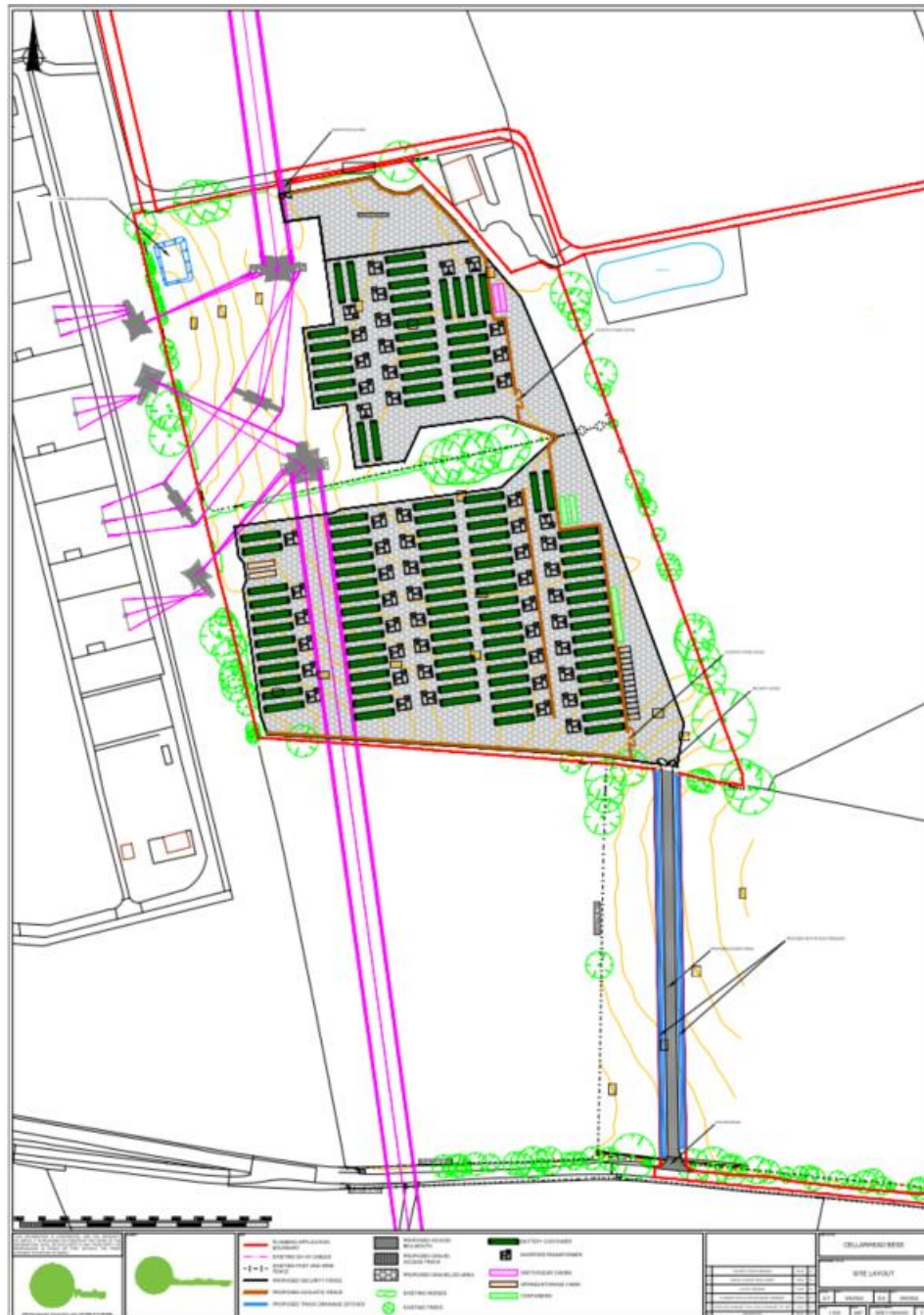


FIGURE 2. RECEPTOR AND NOISE MONITORING LOCATIONS



FIGURE 3. INDICATIVE PROPOSED LAYOUT



APPENDIX A1: ACOUSTIC TERMINOLOGY

Ambient noise	The sound pressure level at a given location (i.e. sound from all sources) usually measured using the L_{Aeq} parameter.
A-weighting	A weighting applied to the frequencies which make up a sound pressure level to mimic the response of the human ear which is less responsive to low frequency sounds as it is to high frequency sounds. The resultant level after application of the weighting is called the 'A-weighted sound pressure level' and is denoted by dB(A) or by using a subscript A (e.g. dB_{Aeq}).
Background noise	The noise measured in the absence of the noise under investigation usually using the statistical parameter L_{90} which represents the quietest parts of the measurement period.
Broadband sound	Sound which contains all the frequencies.
Decibel (dB)	A logarithmic measurement scale used for sound pressure levels. This scale is used because the simple use of sound pressures would be unwieldy as the range of pressures to which the human ear responds is very large. The normal threshold of hearing at 1kHz is 0dB. A level of $120dB_{Aeq}$ is very loud (L signifies level and the A and eq are explained under A-weighting and L_{eq}). Some night club dance floors can have sound levels of around $110 dB_{Aeq}$. In the workplace the wearing of hearing protection is compulsory for staff who experience a noise level of over $85dB_{Aeq}$ averaged over an 8-hour day and is normally used when the levels are over $80dB_{Aeq}$ averaged over the 8-hour day. Noise intrusion levels into bedrooms (e.g. from traffic noise) are often controlled to below $30dB_{Aeq}$ in the design of new properties (standards sometimes vary between authorities). Noise levels of below $20dB_{Aeq}$ are very quiet and would normally only be achieved in a well-designed recording studio. Although noise calculations are normally carried out using figures to 1 decimal place the results are often presented to the nearest dB as changes of a fraction of a dB are not normally perceptible even in controlled conditions.
Facade noise level	Noise level including a contribution from the reflection from a building facade, usually measured at 1m from the facade.
Free field	Noise levels with no contribution from reflections from nearby structures.
Hertz	The units used for frequency denoted by Hz, i.e. the number of cycles of pressure fluctuation per second. K used in front of Hz represents 1000 (1kHz = 1000Hz). High frequency sounds (e.g. 8kHz) are high pitched and low frequency sounds (e.g. 63Hz) are the bass notes.

L _{eq}	A parameter used to denote the 'equivalent continuous sound pressure level'. This is the sound pressure level of a continuous sound that would contain the same energy as the varying sound being measured or investigated. L _{Aeq} is the parameter used to denote the 'A-weighted equivalent continuous sound pressure level' (see A-weighting).
L ₁₀	A statistical parameter often used for the measurement of road traffic noise. It is the level exceeded for 10% of the time period being considered. If A-weighted a subscript A is included and the time period can also be included in subscript, e.g. L _{A10, 1hour} .
L ₉₀	A statistical parameter often used for the measurement of background noise levels. It is the level exceeded for 90% of the time period being considered. If A-weighted a subscript A is included and the time period can also be included in subscript, e.g. L _{A90, 5min} .
L _{max}	The maximum noise level which occurred during the monitoring period. L _{Amax,f} denotes the maximum A-weighted sound pressure level using the fast time constant of 125ms.
Loudness	Although a 3dB increase is equivalent to a doubling of the sound power level of a sound source this increase is the minimum perceptible under normal conditions. It takes a 10dB change in noise level for it to sound roughly twice (or half) as loud subjectively.
Rating Level	A term used in BS4142. The 'Specific Noise Level' plus a 5dB weighting if the noise has certain characteristic features which may make it more disturbing.
Residual noise	The ambient noise remaining when the specific noise source being investigating is not contributing to the noise level at that location (normally measured using the L _{Aeq} parameter).
Specific Noise Level	A term used in BS4142. The L _{Aeq} noise level produced at the assessment position by the noise source being investigated over the reference time period (1-hour in the day and 5-mins at night).
SEL	Single Event Level. The total sound energy of a noise event (e.g. a train pass-by) compressed into 1 second. i.e. . the 1 second L _{Aeq} which has the same total A-weighted energy as the entire event.

APPENDIX A2: NOISE SURVEY RESULTS

Location A:**Table A2.1: Location A: Free field daytime noise levels
Friday 19 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
19/11/2021	13:00:03	53.1	77.8	34.3
19/11/2021	14:00:03	54.2	81.2	34.7
19/11/2021	15:00:03	55.8	80.8	35.7
19/11/2021	16:00:03	57.8	84.5	36.4
19/11/2021	17:00:03	57.5	86.1	34.4
19/11/2021	18:00:03	58.0	80.3	34.1
19/11/2021	19:00:03	54.5	76.2	36.3
19/11/2021	20:00:03	46.7	72.4	35.1
19/11/2021	21:00:03	46.5	73.4	34.4
19/11/2021	22:00:03	46.2	74.7	35.3
Average		54.9	-	35.1
Highest		58.0	86.1	36.4
Lowest		46.2	72.4	34.1
Mode		-	-	34

**Table A2.2: Location A: Free field daytime noise levels
Saturday 20 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
20/11/2021	07:00:03	49.8	76.2	37.1
20/11/2021	08:00:03	56.8	78.3	43.0
20/11/2021	09:00:03	53.6	73.7	40.8
20/11/2021	10:00:03	52.3	74.8	38.8
20/11/2021	11:00:03	53.5	76.0	41.4
20/11/2021	12:00:03	53.6	80.3	40.3
20/11/2021	13:00:03	52.9	73.8	38.2
20/11/2021	14:00:03	51.8	76.1	37.8
20/11/2021	15:00:03	54.2	76.2	39.1
20/11/2021	16:00:03	55.7	81.2	38.2
20/11/2021	17:00:03	52.5	75.4	37.1
20/11/2021	18:00:03	51.2	74.8	37.1
20/11/2021	19:00:03	50.4	75.2	37.0
20/11/2021	20:00:03	49.4	74.6	34.8
20/11/2021	21:00:03	47.4	74.7	33.6
20/11/2021	22:00:03	48.1	74.3	34.7
Average		52.8	-	38.1
Highest		56.8	81.2	43.0
Lowest		47.4	73.7	33.6
Mode		-	-	37

**Table A2.3: Location A: Free field daytime noise levels
Sunday 21 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
21/11/2021	07:00:03	47.5	75.8	36.7
21/11/2021	08:00:03	52.6	72.6	38.3
21/11/2021	09:00:03	54.8	75.2	36.9
21/11/2021	10:00:03	53.4	83.1	39.3
21/11/2021	11:00:03	52.0	74.3	36.7
21/11/2021	12:00:03	52.9	75.8	37.2
21/11/2021	13:00:03	53.5	76.6	38.1
21/11/2021	14:00:03	53.4	75.0	37.1
21/11/2021	15:00:03	53.6	75.9	37.3
21/11/2021	16:00:03	54.3	74.2	39.5
21/11/2021	17:00:03	54.7	85.8	36.5
21/11/2021	18:00:03	50.9	78.4	33.2
21/11/2021	19:00:03	48.6	77.7	32.6
21/11/2021	20:00:03	50.5	76.1	31.5
21/11/2021	21:00:03	43.4	71.7	31.5
21/11/2021	22:00:03	48.1	76.0	32.9
Average		52.3	-	36.0
Highest		54.8	85.8	39.5
Lowest		43.4	71.7	31.5
Mode		-	-	37

**Table A2.4: Location A: Free field daytime noise levels
Monday 22 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
22/11/2021	07:00:03	58.2	87.2	37.3
22/11/2021	08:00:03	56.7	83.1	38.8
22/11/2021	09:00:03	57.6	82.1	36.9
22/11/2021	10:00:03	53.3	76.0	34.6
22/11/2021	11:00:03	53.4	77.1	32.6
22/11/2021	12:00:03	57.7	80.7	34.7
22/11/2021	13:00:03	57.9	83.4	34.9
22/11/2021	14:00:03	55.0	77.9	37.0
22/11/2021	15:00:03	55.7	79.0	34.5
22/11/2021	16:00:03	56.0	82.2	34.6
22/11/2021	17:00:03	58.9	86.4	39.0
22/11/2021	18:00:03	53.5	75.6	33.7
22/11/2021	19:00:03	53.4	79.5	35.4
22/11/2021	20:00:03	49.0	74.7	34.6
22/11/2021	21:00:03	49.4	76.4	33.3
22/11/2021	22:00:03	47.1	74.7	33.2
Average		55.6	-	35.3
Highest		58.9	87.2	39.0
Lowest		47.1	74.7	32.6
Mode		-	-	35

**Table A2.5: Location A: Free field daytime noise levels
Tuesday 23 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
23/11/2021	07:00:03	57.8	86.8	38.7
23/11/2021	08:00:03	56.8	75.9	38.9
23/11/2021	09:00:03	54.2	82.0	38.4
23/11/2021	10:00:03	51.5	75.4	38.5
23/11/2021	11:00:03	53.8	79.1	39.0
Average		55.4	-	38.7
Highest		57.8	86.8	39.0
Lowest		51.5	75.4	38.4
Mode		-	-	39

**Table A2.6: Location A: Free field night-time noise levels
Friday 19 November – Saturday 20 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
19/11/2021	23:00:03	69.8	46.1	33.7
19/11/2021	23:15:03	76.2	109.2	31.3
19/11/2021	23:30:03	42.3	68.1	31.3
19/11/2021	23:45:03	32.9	47.6	30.9
20/11/2021	00:00:03	33.0	46.3	30.8
20/11/2021	00:15:03	43.0	68.2	32.6
20/11/2021	00:30:03	36.8	44.2	35.2
20/11/2021	00:45:03	46.7	71.8	34.9
20/11/2021	01:00:03	36.6	40.7	35.3
20/11/2021	01:15:03	46.7	74.0	33.0
20/11/2021	01:30:03	31.3	37.4	30.0
20/11/2021	01:45:03	34.0	49.3	31.0
20/11/2021	02:00:03	33.8	46.4	30.9
20/11/2021	02:15:03	34.9	46.1	30.9
20/11/2021	02:30:03	43.7	63.4	31.3
20/11/2021	02:45:03	43.6	69.7	32.1
20/11/2021	03:00:03	42.0	66.4	31.2
20/11/2021	03:15:03	37.2	46.9	33.0
20/11/2021	03:30:03	35.2	45.4	32.7
20/11/2021	03:45:03	37.1	44.5	34.3
20/11/2021	04:00:03	47.1	71.7	32.7
20/11/2021	04:15:03	43.0	68.9	32.6
20/11/2021	04:30:03	47.5	74.0	32.8
20/11/2021	04:45:03	34.4	59.2	32.7
20/11/2021	05:00:03	34.7	48.1	31.8
20/11/2021	05:15:03	36.7	47.9	33.4
20/11/2021	05:30:03	49.6	73.5	34.6
20/11/2021	05:45:03	34.2	46.4	31.6
20/11/2021	06:00:03	47.8	73.9	30.3
20/11/2021	06:15:03	46.8	71.4	30.9
20/11/2021	06:30:03	44.2	71.8	33.8
20/11/2021	06:45:03	36.1	48.3	34.6
Average		62.1	-	32.4
Highest		76.2	109.2	35.3
Lowest		31.3	37.4	30.0
Mode		-	-	31

**Table A2.7: Location A: Free field night-time noise levels
Saturday 20 November – Sunday 21 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
20/11/2021	23:00:03	48.6	73.1	34.4
20/11/2021	23:15:03	46.6	72.9	37.8
20/11/2021	23:30:03	49.3	74.2	36.3
20/11/2021	23:45:03	50.3	74.4	34.9
21/11/2021	00:00:03	38.6	50.4	34.5
21/11/2021	00:15:03	38.6	46.6	36.3
21/11/2021	00:30:03	41.3	51.7	37.6
21/11/2021	00:45:03	46.9	69.8	39.6
21/11/2021	01:00:03	41.7	46.9	38.9
21/11/2021	01:15:03	48.0	70.9	37.8
21/11/2021	01:30:03	44.7	68.9	38.3
21/11/2021	01:45:03	39.8	55.1	36.8
21/11/2021	02:00:03	39.0	43.8	37.2
21/11/2021	02:15:03	37.9	42.9	36.2
21/11/2021	02:30:03	36.5	46.0	34.2
21/11/2021	02:45:03	33.1	42.5	29.9
21/11/2021	03:00:03	31.9	45.7	29.2
21/11/2021	03:15:03	42.5	68.9	30.0
21/11/2021	03:30:03	48.7	76.8	33.9
21/11/2021	03:45:03	31.5	41.6	29.4
21/11/2021	04:00:03	31.3	44.8	29.8
21/11/2021	04:15:03	30.4	49.1	28.9
21/11/2021	04:30:03	28.7	40.2	27.3
21/11/2021	04:45:03	31.1	43.8	30.1
21/11/2021	05:00:03	41.9	66.8	30.1
21/11/2021	05:15:03	30.5	36.6	29.3
21/11/2021	05:30:03	30.6	48.7	28.3
21/11/2021	05:45:03	35.5	57.1	29.7
21/11/2021	06:00:03	41.6	66.7	32.3
21/11/2021	06:15:03	46.0	71.6	35.1
21/11/2021	06:30:03	50.2	75.8	34.7
21/11/2021	06:45:03	49.8	71.1	36.7
Average		44.5	-	33.6
Highest		50.3	76.8	39.6
Lowest		28.7	36.6	27.3
Mode		-	-	30

**Table A2.8: Location A: Freefield night-time noise levels
Sunday 21 November – Monday 22 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
21/11/2021	23:00:03	36.5	44.9	28.6
21/11/2021	23:15:03	30.0	48.0	28.3
21/11/2021	23:30:03	41.8	68.0	27.8
21/11/2021	23:45:03	30.0	42.0	28.4
22/11/2021	00:00:03	33.4	49.1	28.9
22/11/2021	00:15:03	30.8	43.1	27.7
22/11/2021	00:30:03	31.1	43.7	27.9
22/11/2021	00:45:03	30.1	45.2	27.4
22/11/2021	01:00:03	29.8	40.3	27.6
22/11/2021	01:15:03	28.8	45.3	26.5
22/11/2021	01:30:03	28.3	42.2	26.4
22/11/2021	01:45:03	30.0	42.0	27.6
22/11/2021	02:00:03	28.8	36.0	26.6
22/11/2021	02:15:03	30.7	38.9	28.5
22/11/2021	02:30:03	31.5	41.6	28.8
22/11/2021	02:45:03	28.7	52.0	25.9
22/11/2021	03:00:03	42.0	68.9	26.2
22/11/2021	03:15:03	28.6	39.8	26.5
22/11/2021	03:30:03	29.6	37.2	27.9
22/11/2021	03:45:03	27.2	33.3	25.5
22/11/2021	04:00:03	27.8	36.4	26.0
22/11/2021	04:15:03	32.2	40.1	29.4
22/11/2021	04:30:03	50.3	74.1	30.1
22/11/2021	04:45:03	34.8	43.0	31.7
22/11/2021	05:00:03	35.4	40.4	33.4
22/11/2021	05:15:03	46.2	74.9	33.4
22/11/2021	05:30:03	49.6	75.3	35.8
22/11/2021	05:45:03	51.9	76.8	34.8
22/11/2021	06:00:03	49.9	76.4	34.0
22/11/2021	06:15:03	54.4	75.3	35.1
22/11/2021	06:30:03	52.4	77.0	34.9
22/11/2021	06:45:03	51.4	76.0	35.1
Average		45.5	-	29.5
Highest		54.4	77.0	35.8
Lowest		27.2	33.3	25.5
Mode		-	-	28

**Table A2.9: Location A: Free field night-time noise levels
Monday 22 November – Tuesday 23 November 2021**

Date	Time	dBL _{Aeq}	dBL _{Amax}	dBL _{A90}
22/11/2021	23:00:03	42.5	75.4	33.7
22/11/2021	23:15:03	35.2	42.9	34.0
22/11/2021	23:30:03	36.1	49.5	35.0
22/11/2021	23:45:03	37.4	54.1	32.5
23/11/2021	00:00:03	36.5	48.7	34.8
23/11/2021	00:15:03	35.6	42.2	34.4
23/11/2021	00:30:03	35.8	57.1	34.0
23/11/2021	00:45:03	35.2	44.7	33.8
23/11/2021	01:00:03	36.6	51.8	33.1
23/11/2021	01:15:03	33.2	43.5	32.2
23/11/2021	01:30:03	34.6	46.1	33.4
23/11/2021	01:45:03	34.4	41.1	33.4
23/11/2021	02:00:03	40.3	58.9	33.7
23/11/2021	02:15:03	34.0	46.3	33.0
23/11/2021	02:30:03	35.1	47.8	33.9
23/11/2021	02:45:03	39.2	57.3	34.8
23/11/2021	03:00:03	36.6	40.4	36.0
23/11/2021	03:15:03	36.2	41.5	35.4
23/11/2021	03:30:03	35.9	38.6	35.2
23/11/2021	03:45:03	40.0	58.8	35.4
23/11/2021	04:00:03	35.7	43.2	34.6
23/11/2021	04:15:03	42.4	67.1	35.1
23/11/2021	04:30:03	44.5	71.8	35.4
23/11/2021	04:45:03	38.5	56.9	33.1
23/11/2021	05:00:03	39.9	54.3	33.9
23/11/2021	05:15:03	46.2	73.3	35.7
23/11/2021	05:30:03	46.7	72.2	36.9
23/11/2021	05:45:03	45.8	73.3	37.4
23/11/2021	06:00:03	48.5	70.7	37.0
23/11/2021	06:15:03	53.4	76.7	36.7
23/11/2021	06:30:03	53.5	77.1	37.2
23/11/2021	06:45:03	52.6	74.8	36.7
Average		44.9	-	34.7
Highest		53.5	77.1	37.4
Lowest		33.2	38.6	32.2
Mode		-	-	35