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ENVIRONMENT

SMS ENERGY SERVICES LTD

BARNSLEY BESS
HOPEWELL STREET, BARNSLEY

Noise Impact Assessment

MCA2155

ENVIRONMENT

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EXECUTIVE SUMMARY

BWB Consulting Ltd was appointed by SMS Energy Services Ltd to undertake an environmental noise assessment in support of the Section 73 to the approved planning application reference 2017/1306, for a Battery Energy Storage System site (BESS). The project will consist of a 40MW BESS and associated plant.

This report presents the previously measured background noise levels at the existing nearest noise sensitive receptors to the development site, which have been used to determine the Site's suitability for the proposed use, having regard to relevant guidance on noise.

The results of the BS4142 assessment indicate that, with the implementation of appropriate barrier and unit attenuation mitigation, the resultant impacts from noise associated with the proposed development will be low at the nearest existing noise sensitive receptors.

It is therefore considered that noise need not be a determining factor in the granting of planning approval for the Proposed Development.

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1. INTRODUCTION

Appointment & Background

1.1 This noise assessment has been prepared by BWB Consulting Ltd (hereafter 'BWB') on behalf of SMS Energy Services Ltd in support of the Section 73 to the approved planning application reference 2017/1306, for a Battery Energy Storage System site (BESS). The project will consist of a 40MW BESS and associated plant at land off Hopewell Street, Barnsley.

1.2 The existing noise environment is considered to be influenced by rail noise on the Penistone line between Barnsley and Wombwell, distant road traffic noise from the local road network, and nearby industrial uses.

1.3 This report considers the Site's suitability for the nature of its intended uses and to determine the potential impacts of the proposed Development upon nearby existing sensitive receptors, through previous measurements taken of the existing noise climate, which have been used to carry out the assessment of operational activities associated with the Site, to ensure appropriate internal noise levels (with reference to BS 4142:2014) are achieved at the existing nearest noise sensitive receptors.

1.4 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

Site Setting

1.5 The application site is located off Hopewell Street in Barnsley and is located within the administrative area of Barnsley Metropolitan Borough Council (BMBC). **Figure 1.1** details the site location of the proposed development. The red line depicts the planning boundary.

1.6 The site is bound to the west by an existing electricity substation site, to the north by Oaks Business Park, to the east by dwellings on Hopewell Street and to the south by open land and the Penistone rail line. The nearest existing noise sensitive receptors (NSRs) are dwellings on Hopewell Street approx. 35m to the east, and other adjacent roads off Hoyle Mill Road, and dwellings beyond the rail line off Ashleigh Vale, approx. 120m to the south and southwest.

Figure 1.1 - Site Location



Proposed Development

1.7 The proposed development comprises the installation of a new Battery Energy Storage System site. The project will consist of 18No. of ESS battery cube units and 54No. of 800kVA PCS units.

1.8 The Site layout for the proposed development is shown in **Figure 1.2**.

Figure 1.2 – Proposed Site Layout with acoustic barrier mitigation included



2. STANDARDS AND GUIDANCE

BS 4142: 2014 Methods for Rating and Assessing Industrial and Commercial Sound

2.1 This standard describes methods for rating and assessing the following:

- 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 premises or processes, such as that from forklift trucks, or that from train movements on or around an industrial and/or commercial site.

2.2 The methods 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. The Standard advises the purpose of the methodology includes the assessment of sound from any plant and activities associated with existing industrial and/or commercial uses at proposed residential dwellings.

2.3 If appropriate, the specific sound level of the source ($L_{Aeq,T}$) is corrected, by the application of one or more corrections for acoustic features such as tonal qualities and/or distinct impulses, to give a 'rating' level ($L_{Ar,T}$). The Standard effectively compares and rates the difference between the rating level of the specific sound and the typical background sound level ($L_{A90,T}$) in the absence of the specific sound.

2.4 The Standard advises that the time interval ('T') of the background sound measurement should be sufficient to obtain a representative or typical value of the background sound level at the time(s) the source in question operates or is proposed to operate in the future.

2.5 Comparing the rating level with the background sound level, BS 4142 states:

> "Typically, the greater this difference, the greater the magnitude of impact.
>
> A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
>
> A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
>
> 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."

Previously Submitted Planning Applications for the Site

2.6 It is understood that consultation had previously been undertaken between Environmental Noise Solutions consultants (ENS) and the Environmental Health Dept at BMBC, to liaise and agree the noise assessment methodology for previously submitted applications for the site.

2.7 It is therefore understood that BMBC have seen sight of and agreed the survey protocol and assessment methodology to inform this study.

2.8 The planning application references, for which noise impact assessments were previously undertaken by ENS for the site, are as follows:

- **2017/1306**: Variation of condition 2 and 7 of 2017/0117 to allow the amendment of site layout, landscaping and the appearance of the battery containers.
- **2017/0117**: Erection of battery storage facility.
- **2106/0296**: Erection of enclosed battery storage area to assist with the balance of supply and demand of the national grid.

2.9 Baseline noise monitoring data, undertaken by ENS Consultants in 2016, has been used to support the noise assessments for the above planning applications and has also been used in this assessment.

Noise Sensitive Receptors

2.10 Existing residential properties have been identified in proximity to the Site. The closest existing noise sensitive receptors (NSRs) to the east and south are detailed in **Table 2.2** with approximate distances to the planning boundary, which can be seen in **Figure 1.1** and **1.2** as the red boundary line.

Table 2.2: Noise Sensitive Receptors

Receptor Location	Type of Receptor	Description / Name	Approximate Distance to Planning Boundary
NSR 1	Residential	Hopewell Street dwellings	~ 35 m to the east
NSR 2	Residential	Ashleigh Vale dwellings	~ 120 m to the south/south west

3. BASELINE NOISE DATA

Summary

3.1 It was considered that existing noise levels had not returned to pre-covid levels at the time of assessment, therefore the previously undertaken baseline noise survey, undertaken by ENS Consultants in 2016, and accepted by the Council in the previous assessment of noise and granting of planning, has been used.

3.2 Attended monitoring was carried out between Wednesday 18th May and the early hours of Thursday 19th May 2016 to cover key daytime and night-time periods when levels are expected to be lowest, at two measurement positions, representative of the nearest NSRs, as illustrated in **Figure 3.1.**

Figure 3.1 – Noise Monitoring Locations (ENS Survey, 2016)



3.3 The measurement locations adopted during the baseline survey at Site are presented in **Figure 3.1.** Details of the monitoring location identified in **Figure 3.1** are also provided.

Measurement Location 1 (ML1)

3.4 ML1 was selected to determine the prevailing background noise climate at a location representative of the noise sensitive receptors along Ashleigh Vale to the south and southwest (NSR 2).

Measurement Location 2 (ML2)

3.5 ML2 was selected to determine the prevailing background noise climate at the closest noise sensitive receptors (NSR 1) to the proposed development site, along Hopewell Street.

Noise Observations

3.6 Noise observations made at the time of the survey were that 'prevailing noise sources affecting the survey positions (as noted by the survey engineer during day and night periods) included distant road traffic from the surrounding road network. During the daytime occasional passing trains and overhead aircraft were also audible. At night, there was a reduced number of audible trains but contributions from local industrial units became more apparent'.

Noise Measurement Results

3.7 A summary of the measured ambient (L_{Aeq}) and background (L_{A90}) noise levels for the daytime and night-time periods are presented in **Table 3.1**.

Table 3.1: Summary of Baseline Noise Monitoring Results measured by ENS

Monitoring Position	Date	Time (hh:mm)	$L_{Aeq,T}$ dB	$L_{A90,T}$ dB[1]
ML2 (NSR 1)	18/05/2016	10:47 – 11:02	55	37
		11:02 – 11:17	51	39
		11:17 – 11:32	52	37
		11:32 – 11:47	51	37
		23:21 – 23:36	49	38
	19/05/2016	00:04 – 00:19	40	38
ML1 (NSR 2)	18/05/2016	11:55 – 12:10	46	40
		12:10 – 12:25	47	40
		12:25 – 12:40	47	40
		12:40 – 12:55	49	38
		23:00 – 23:15	43	39
		23:43 – 23:58	40	37

Notes:
1 The 'typical' background value has been established as the most occurring (i.e., 'modal' value) or the mean value, whichever is the lower of the two averaging data sets

3.8 Analysis of the noise measurement data determined that typical daytime background noise levels were 37 dB L_{A90} at Position 1 (NSR2) and 40 dB L_{A90} at Position 2 (NSR1). Typical background noise levels at night were 38 dB L_{A90} at both positions.

4. NOISE MODELLING OF THE PROPOSED SITE

4.1 This section considers operational noise from the proposed BESS Site on the nearest NSRs. Manufacturer test noise data has been used as a basis for the noise assessment of operational noise levels.

Noise Model

4.2 In order to predict the noise levels from the proposed development site at the NSRs, a detailed acoustic model of the site has been generated in order to calculate the noise propagation across the site. This noise model was generated applying the following methodology:

- The model was generated using the PC based CadnaA® noise modelling package;
- For industrial/commercial noise sources, the noise model was set to apply the noise prediction methodology set out in ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation;
- Mapping of the Site and the surrounding area was calibrated into the noise model based on known Ordinance Survey grid reference points;
- Indicative ground topography was approximated using the LIDAR Composite 1m DTM information freely available from the DEFRA data.gov website;
- To reflect the local ground cover, ground absorption was set to G = 0.5 (50% acoustically reflective ground);
- The model was set to include second order reflected noise from solid structures; and
- The receptor points have been modelled at a height of 1.5m for the daytime and 4m and 7m for the night-time periods, to correspond with first floor and second floor bedroom receptor heights.

4.3 The proposed site layout, shown in **Figure 1.2** has been incorporated into the model, and the free-field levels at the existing façades of the nearest NSRs have been calculated. Noise contours have been calculated showing the external free-field noise levels at the nearest NSRs. The predicted noise levels have been used to inform the assessment.

Noise from the Proposed Site

4.4 To assess the potential noise impact from the Battery Energy Storage System Site, an assessment has been undertaken based on the manufacturer noise level data for the ESS units and manufacturer test noise data for the PCS units.

4.5 A summary of the source noise data used within the assessment of noise from the ESS Site are presented in **Tables 4.1** and **4.2**.

4.6 The manufacturer provided broadband and spectral test data presenting the different levels measured at various points at a distance of 1m from the units. The levels in **Table 4.1** present the warranted noise level for the ESS units with the maximum sound pressure

levels experienced above both ends of each ESS unit, and present the log average of maximum test levels around the PCS units with the maximum sound pressure levels experienced at the front of each PCS unit. This is considered to be a conservative approach and therefore presents a robust assessment.

4.7 For the purposes of the assessment, it has been assumed that all of the units will operate at the same time, however in reality this is not likely to occur as the 72 different chiller and heat exchanger units will typically cycle on and off at different times, therefore the typical levels emitted are likely to be lower than this and as such this presents a robust assessment. The levels presented have been corrected for background noise present at the time of testing.

Table 4.1: Adopted noise emission sources data noise associated with the Site units

Noise Source	dBA at 1m
ESS Units	75
PCS units	74

4.8 In addition, test data has been provided by the manufacturer for both units, presented as octave band spectral sound pressure levels. **Table 4.2** presents the typical spectrum for the units applied to the assessment levels presented in **Table 4.1** and used in the 3D acoustic model.

Table 4.2: Spectral Sound Pressure Levels of Plant Items in Manufacturer Test Data

Fixed Plant	Sound Pressure Level L_w Octave Band Centre Frequency Hz (dBA)								Global dB(A)
	63	125	250	500	1k	2k	4k	8k	
ESS Units	39	59	63	68	71	70	63	58	75
PCS Units	45	55	65	70	70	67	62	54	74

4.9 The assessment is based on the following assumptions:

- ESS Unit noise sources have been entered into the noise model as area sources 0.05m above the top surface of a battery cube object of height of 2.65m and dimensions provided by the manufacturer; and
- PCS Unit noise sources have been entered into the noise model as point sources at a height of 1.38m.

4.10 Based on the above information, the predicted specific noise levels have been calculated at the closest existing dwellings NSR 1 and NSR 2 without any mitigation in place.

4.11 It is understood that the Site is likely to operate intermittently over 24-hours.

4.12 **Figures 4.1 and 4.2** shows the noise contours generated by the model for the daytime and night-time periods, without any mitigation in place.

Figure 4.1 - Contour Grid at 1.5m height (no mitigation) for the Daytime period

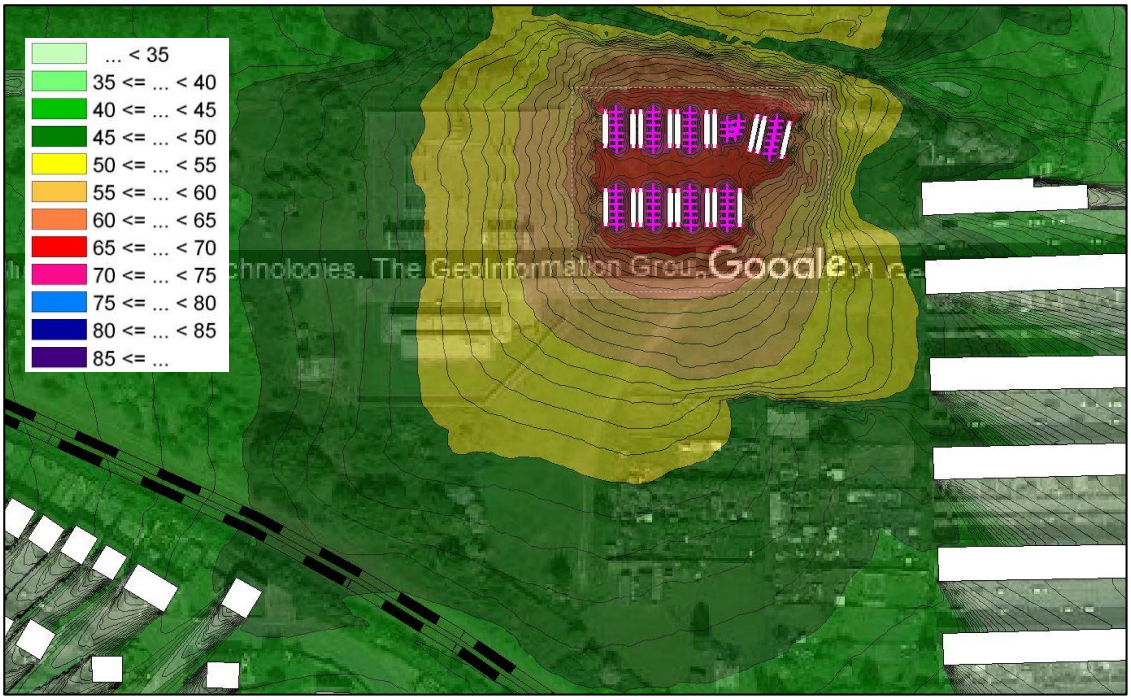
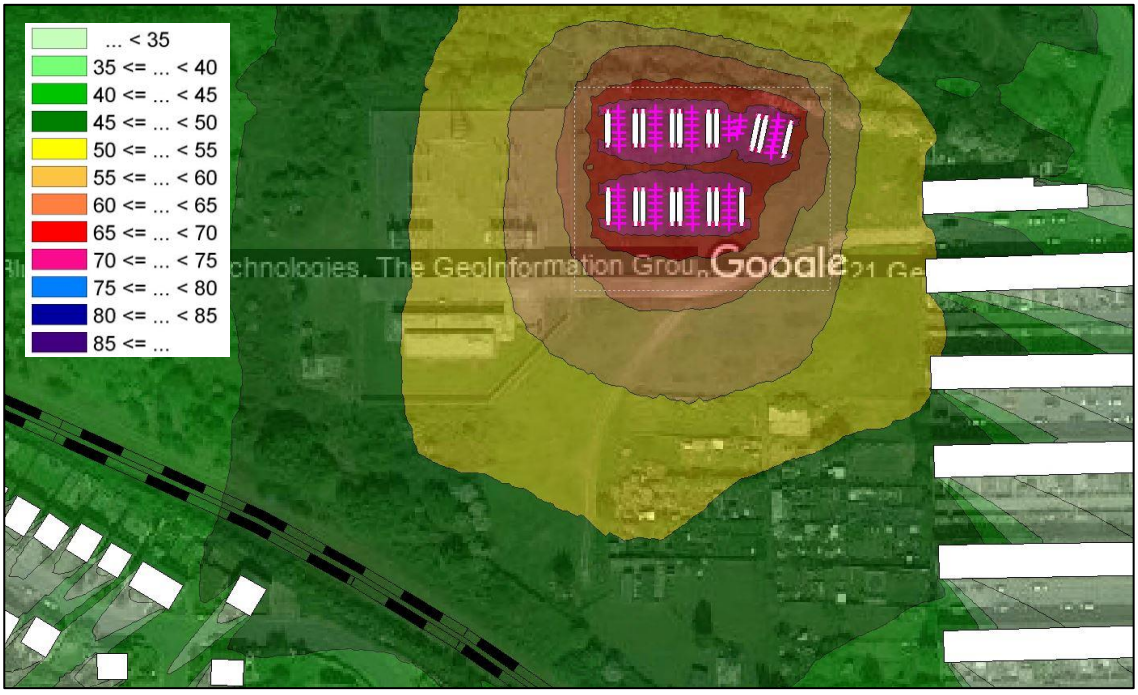


Figure 4.2 - Contour Grid at 4m height (no mitigation) for the Night-time period



4.13 The results of the assessment of noise from the BESS Site at the nearest existing sensitive receptors, is included in **Table 4.3**.

Table 4.3: Predicted noise levels from the Site (with no mitigation in place)

Receptor	Time Period	Predicted noise level ($L_{Aeq,T}$ dB) at NSR
NSR 1 (1st Floor receptors)	Daytime (07:00 – 23:00)	50 dB $L_{Aeq,16h/8h}$
	Night-time (23:00 – 07:00)	
NSR 1 (2nd Floor receptors)	Daytime (07:00 – 23:00)	51 dB $L_{Aeq,16h/8h}$
	Night-time (23:00 – 07:00)	
NSR 2	Daytime (07:00 – 23:00)	46 dB $L_{Aeq,16h/8h}$
	Night-time (23:00 – 07:00)	

5. BS4142 ASSESSMENT

5.1 Based on the results of the acoustic modelling, the specific sound levels have been calculated at the nearest existing noise sensitive receptors. The specific sound levels have then been assessed in accordance with BS 4142 as outlined in **Tables 5.1** and **5.2**.

5.2 As operational use is expected to be intermittent over a 24-hour period, an acoustic feature penalty of +3dB has been applied for intermittency. Based on the octave band spectral data captured under test conditions, provided by the manufacturer, it has been determined that no tonal element is present and therefore an acoustic feature penalty for tonality has not been applied.

5.3 The representative background sound levels in **Section 3.9** will be used in this assessment.

Table 5.1: BS 4142 Assessment of operational use of the BESS Site at NSR 1&2, Daytime

Description	Daytime Sound Levels (dB) at NSR 1 - 1st Floor	Daytime Sound Levels (dB) at NSR 1 - 2nd Floor	Daytime Sound Levels (dB) at NSR 2	Relevant BS 4142 Clause
Specific sound level	50 $L_{Aeq,1hour}$	51 $L_{Aeq,1hour}$	46 $L_{Aeq,1hour}$	7.3.5
Acoustic feature correction	+3	+3	+3	9.2
Rating level	53 $L_{Ar,1hour}$	54 $L_{Ar,1hour}$	49 $L_{Ar,1hour}$	9.2
Background sound level	40 $L_{A90,1hour}$[1]	40 $L_{A90,1hour}$[1]	37 $L_{A90,1hour}$[1]	8
Excess over background	+13	+14	+9	-
BS 4142 impact	**Significant Adverse impact**	**Significant Adverse impact**	**Significant Adverse impact**	-
Commentary	[1]based on the typical $L_{A90,1hr}$ level during the daytime period			

Table 5.2: BS 4142 Assessment of operational use of the BESS Site at NSR 1&2, Night-time

Description	Night-time Sound Levels (dB) at NSR 1 - 1st Floor	Night-time Sound Levels (dB) at NSR 1 - 2nd Floor	Night-time Sound Levels (dB) at NSR 2	Relevant BS 4142 Clause
Specific sound level	50 $L_{Aeq,15mins}$	51 $L_{Aeq,15mins}$	46 $L_{Aeq,15mins}$	7.3.5
Acoustic feature correction	+3	+3	+3	9.2
Rating level	53 $L_{Ar,15mins}$	54 $L_{Ar,15mins}$	49 $L_{Ar,15mins}$	9.2
Background sound level	38 $L_{A90,15minsr}$[1]	38 $L_{A90,15mins}$[1]	38 $L_{A90,15mins}$[1]	8
Excess over background	+15	+16	+11	-
BS 4142 impact	**Significant Adverse impact**	**Significant Adverse impact**	**Significant Adverse impact**	-
Commentary	[1]based on the typical $L_{A90,15mins}$ level during the night-time period			

5.4 The above assessments indicate that noise generated by the proposed BESS Site is likely to give rise to a significant adverse impact at both NSRs during the daytime and night-time periods, with no mitigation in place.

5.5 Therefore, consideration will be given to mitigation measures in **Section 6**.

6. MITIGATION

6.1 The assessment has indicated that noise from operational use of the proposed development site with no mitigation in place could give rise to a significant adverse impact at both NSRs during the daytime and night-time periods.

6.2 The model has allowed for the following mitigation measures, following several modelling iterations and discussions with the client. It is understood that these measures are intended to be implemented:

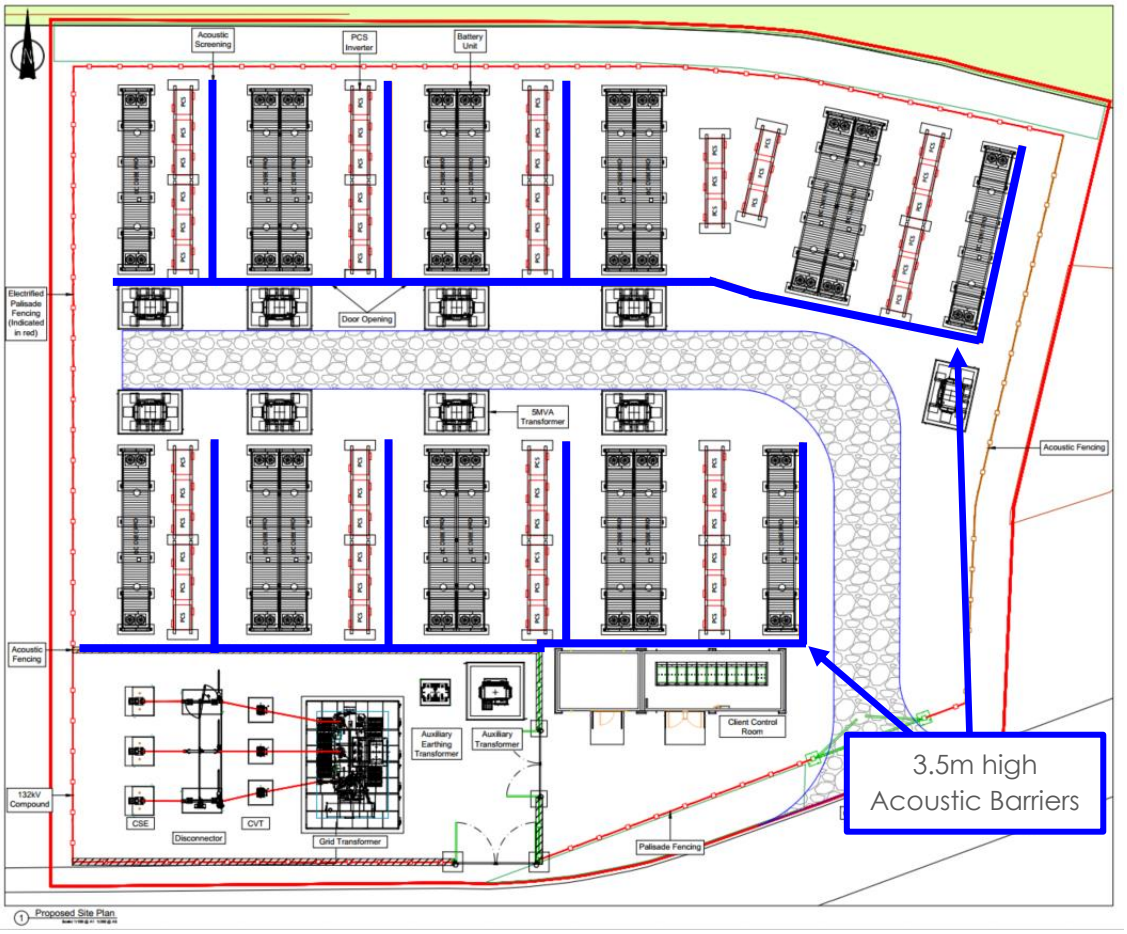
- Acoustic noise barriers around the southern and eastern extents of the banks of ESS and PCS units, as depicted in the Proposed Site Plan. The acoustic barriers will be a minimum of 3.5m height with a 45° angled top, extending 1m at a further vertical height of 0.5m;
- Class A absorptive panels to be applied to the internal skin of the acoustic barriers facing the units;
- Attenuators with a minimum insertion loss of 6dB to be applied to the ESS unit outlets; and

6.3 Cowlings applied to the battery unit outlet attenuators, directed towards the west and north.

6.4 The results of the model calculations indicate that by installing the mitigation measures as described above, which can offer a reduction of approximately 12-13dB at NSR 1 and 9dB at NSR 2, which is predicted to reduce source levels down to meet the measured background levels, that this should allow an appropriate level of protection to the nearby receptors.

6.5 The barriers should have a minimum surface density of 15kg/m^2 and form a continuous unbroken barrier with no gaps at the bottom. This could be achieved with a suitably designed close boarded fence, meeting this minimum specification. The proposed extents of the barriers can be seen in **Figure 6.1**.

Figure 6.1 - Acoustic Barrier Mitigation Extents



6.6 **Tables 6.1 and 6.2** present the results of the assessment of operational use of the proposed development with the detailed mitigation measures during the daytime and night-time periods.

6.7 It is deemed that with the detailed mitigation measures in place, operational noise levels at the noise sensitive receptors are not likely to be perceptible, therefore the application of an acoustic feature penalty correction is not warranted.

Table 6.1: BS 4142 Assessment of operational use at NSR 1&2, Daytime with Mitigation

Description	Daytime Sound Levels (dB) at NSR 1 - 1st Floor	Daytime Sound Levels (dB) at NSR 1 - 2nd Floor	Daytime Sound Levels (dB) at NSR 2	Relevant BS 4142 Clause
Specific sound level	38 $L_{Aeq,1hour}$	38 $L_{Aeq,1hour}$	37 $L_{Aeq,1hour}$	7.3.5
Acoustic feature correction	0	0	0	9.2
Rating level	38 $L_{Ar,1hour}$	38 $L_{Ar,1hour}$	37 $L_{Ar,1hour}$	9.2
Background sound level	40 $L_{A90,1hour}$[1]	40 $L_{A90,1hour}$[1]	37 $L_{A90,1hour}$[1]	8
Excess over background	-2	-2	0	-
BS 4142 impact	**Low impact**	**Low impact**	**Low impact**	-
Commentary	[1]based on the typical $L_{A90,1hr}$ level during the daytime period			

Table 6.2: BS 4142 Assessment of operational use at NSR 1&2, Night-time with Mitigation

Description	Night-time Sound Levels (dB) at NSR 1 - 1st Floor	Night-time Sound Levels (dB) at NSR 1 - 2nd Floor	Night-time Sound Levels (dB) at NSR 2	Relevant BS 4142 Clause
Specific sound level	38 $L_{Aeq,15mins}$	38 $L_{Aeq,15mins}$	37 $L_{Aeq,15mins}$	7.3.5
Acoustic feature correction	0	0	0	9.2
Rating level	38 $L_{Ar,15mins}$	38 $L_{Ar,15mins}$	37 $L_{Ar,15mins}$	9.2
Background sound level	38 $L_{A90,15minsr}$[1]	38 $L_{A90,15mins}$[1]	38 $L_{A90,15mins}$[1]	8
Excess over background	0	0	-1	-
BS 4142 impact	**Low impact**	**Low impact**	**Low impact**	-
Commentary	[1]based on the typical $L_{A90,15mins}$ level during the night-time period			

6.8 The above assessment indicates that with the detailed mitigation measures in place, an appropriate level of protection could be afforded to the receptors to the east (NSR1) and to the south (NSR2) from noise associated with operational use of the proposed development.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 BWB Consulting Ltd was appointed by SMS Energy Services Ltd to undertake an environmental noise assessment in support of the Section 73 to the approved planning application reference 2017/1306, for a Battery Energy Storage System site (BESS). The project will consist of a 40MW BESS and associated plant.

7.2 This report presents the measured background noise levels at the existing nearest noise sensitive receptors to the development site, which have been used to determine the Site's suitability for the proposed use, having regard to relevant guidance on noise.

7.3 The results of the BS4142 assessment indicate that, with the implementation of appropriate barrier and unit attenuation mitigation, the resultant impacts from noise associated with the proposed development will be low at the nearest existing noise sensitive receptors.

7.4 It is therefore considered that noise need not be a determining factor in the granting of planning approval for the Proposed Development.

APPENDICES

APPENDIX A: Glossary of Terms

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) 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 but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates 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.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be 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 some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. 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 best 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 L_{Aeq}, L_{A90} 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) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Acoustic Terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

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