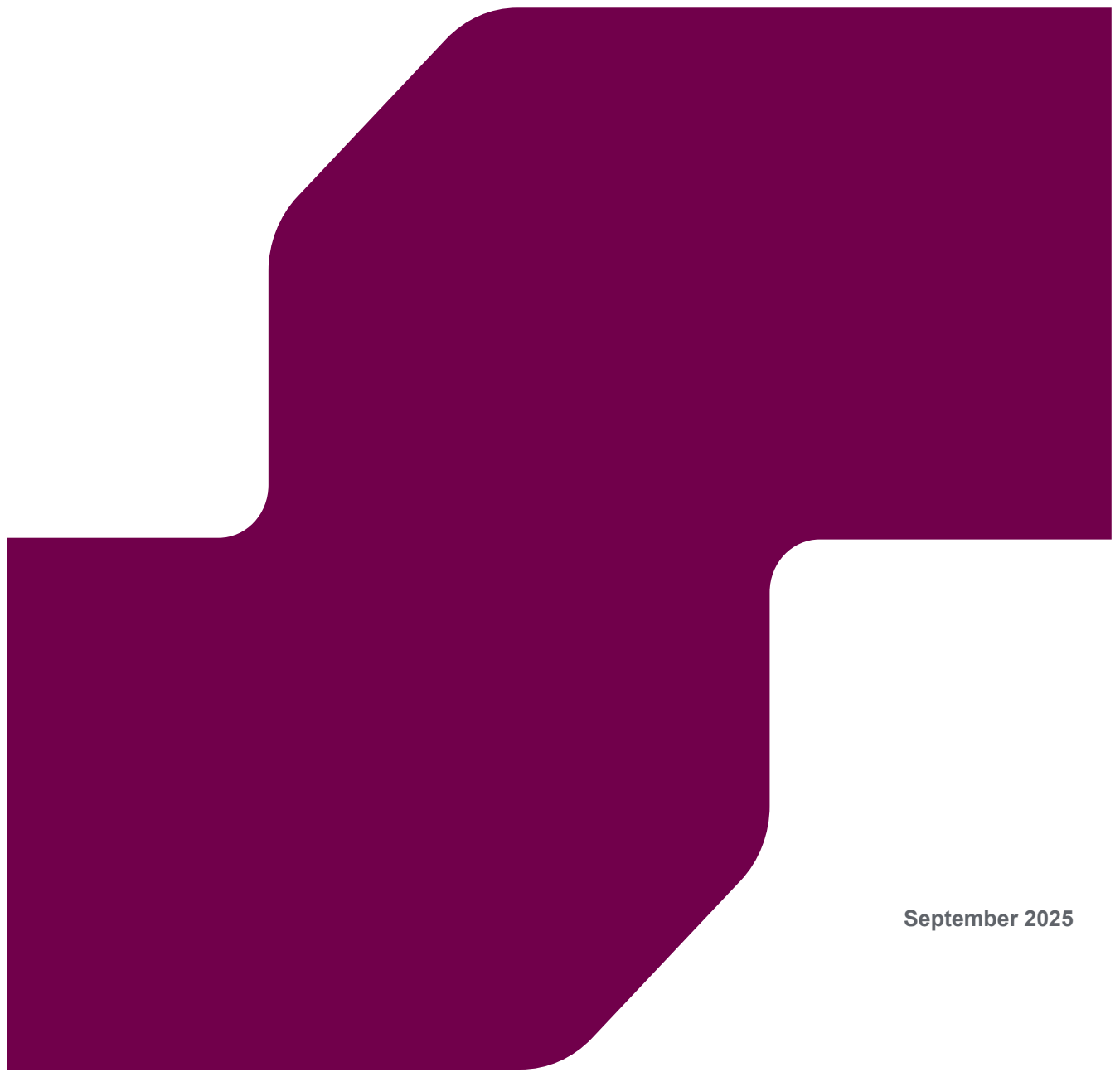


HEOLDDU SOLAR FARM

ENVIRONMENTAL STATEMENT

Chapter 9: Noise



September 2025

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Glossary

Term	Meaning
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.

Term	Meaning
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s_1 and s_2 is given by $20 \log_{10} (s_1 / s_2)$. The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is $20\mu\text{Pa}$.
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
L10,T	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
L90,T	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background sound.
Leq,T	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
Lmax,T	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, 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.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
Sound Power	Sound Power is the total sound energy radiated by a sound source and measured in watts (W).
Sound Power Level	Sound Power Level (SWL or L_W) is the sound power relative to a standard reference power of 1pW, on a decibel scale. It is the amount of sound energy emitted by a source and it is independent of distance and environment.
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.

Term	Meaning
Sound Pressure Level (Sound Level)	The Sound Pressure Level (SPL or L_p) is the sound pressure relative to a standard reference pressure of $20\mu\text{Pa}$ (20×10^{-6} Pascals) on a decibel scale. It is the level of sound energy at a specific location and it is dependent of distance and environment.

Abbreviations/ Acronyms

Abbreviation	Meaning
BPM	Best Practicable Means
BS	British Standard
CCC	Carmarthenshire County Council
CEA	Cumulative Effects Assessment
CEMP	Construction Environmental Management Plan
CRTN	Calculation of Road Traffic Noise
DEMP	Decommissioning Environmental Management Plan
DMRB	Design Manual for Roads and Bridges
ES	Environmental Statement
L10,T	The noise level exceeded for 10% of the time
L90,T	The noise level exceeded for 90% of the time
Leq,T	The equivalent continuous noise level over time
Lmax,T	Maximum noise level
NSR	Noise Sensitive Receptor
PPV	Peak particle velocity

Units

Unit	Description
dB(A)	A-weighting
dB	Decibel

9 NOISE & VIBRATION

9.1 Introduction

9.1.1 This Chapter of the Environmental Statement (ES) presents the findings of an assessment of the likely significant noise effects on noise sensitive receptors (NSRs) as a result of the Proposed Development. The Chapter has been prepared in accordance with the approach set out in the Heolddu Solar Farm Scoping Report and subsequent Environmental Impact Assessment (EIA) Scoping Direction. In addition, this Chapter of the ES has been informed by the following documents submitted with the application for the DNS:

ES Chapters

- Volume 1, Chapter 2: Proposed Development Description
- Volume 1, Chapter 4: Approach to Environmental Assessment

ES Appendices

- Volume 3, Appendix 9.1: Measured Time History
- Volume 3, Appendix 9.2: Statistical Analysis
- Volume 3, Appendix 4.1: Transport Assessment
- Volume 3, Appendix 4.4: Outline Construction Environmental Management Plan (CEMP)

9.1.2 The Proposed Development comprises a solar farm, including associated ancillary infrastructure and development, temporary laydown areas and landscape and environmental enhancements on land at Maes Mawr and Treforris Fawr Farm, Ferryside, Carmarthenshire (the 'Site').

9.2 Legislation, Policy and Guidance

Legislation and Policy

9.2.1 The legislation and planning policy relevant to the assessment of Noise for the Proposed Development are summarised in Table 9.1 below.

Table 9.1: Summary of legislation and policy relevant to this chapter of the ES

Summary of provision	How and where considered in the ES
Future Wales: The National Plan 2040 (2021)	
Policy 18 Titled 'Renewable and Low Carbon Energy Developments of National Significance' – Policy 18 states:	Addressed in Section 9.8 where Noise effects for each of the construction, operational and decommissioning stages of the scheme are assessed.

Summary of provision	How and where considered in the ES
<p><i>Proposals for renewable and low carbon energy projects (including repowering) qualifying as Developments of National Significance will be permitted subject to policy 17 and the following criteria:</i></p> <p><i>7. there are no unacceptable adverse impacts by way of shadow flicker, noise, reflected light, air quality or electromagnetic disturbance...'</i></p>	
Planning Policy Wales Edition 12	
<p>Paragraph 6.7.4</p> <p>The document aims to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales.</p> <p>With regard to the assessment of noise associated with development, paragraph 6.7.4 provides guidance on noise generation near protected areas:</p> <p><i>'The planning system should maximise its contribution to achieving the wellbeing goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term</i></p>	<p>Addressed in Section 9.8 where Noise effects for each of the construction, operational and decommissioning stages of the scheme are assessed.</p>

Summary of provision	How and where considered in the ES
<p><i>effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.'</i></p>	
<p>Carmarthenshire County Council (CCC) Local Development Plan</p>	
<p>Policy RE3 Titled 'Non-wind Renewable Energy Installations', states: <i>'Proposals that would cause demonstrable harm to the landscape, visual impact, noise, ecology, or ground and surface water as a result of the cumulative effect of renewable energy installations will not be permitted.'</i></p>	<p>Addressed in Section 9.8 where Noise effects for each of the construction, operational and decommissioning stages of the scheme are assessed.</p>

Relevant Guidance

9.2.2 The assessment of Noise has been undertaken in accordance with the methodology set out in 'Volume 1, Chapter 4: Approach to environmental assessment of the ES', in addition to the following guidance, where appropriate:

- British Standard 5228-1:2009+A1:2014 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise*' (BS 5228-1) sets out an approach for predicting, assessing and controlling noise levels arising from a wide variety of demolition and construction plant and related activities. As such, it can be used to predict noise levels arising from the operations at proposed construction sites. BS 5228-1 also sets out tables of sound power levels generated by a wide variety of construction plant to facilitate such predictions.
- British Standard 5228-2:2009+A1:2014 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration*' (BS 5228-2) sets out an approach for predicting, assessing and controlling vibration

levels arising from percussive or vibratory piling only. Therefore, it is not possible to accurately predict levels of vibration during the Site preparation and construction phases of development. As such, to control the impact of vibration during site preparation and construction of a development, limits relating to the perceptibility of vibration are typically set.

- Design Manual for Roads and Bridges ('DMRB') Document LA 111 '*Noise and Vibration*' (Rev 2, 2020) sets out guidance for assessing changes in the LA_{10,18hour} road traffic noise levels during the construction and decommissioning phases of the Proposed Development. The DMRB presents a significance matrix for assessing the magnitude of changes in noise level as a result of traffic, which has been used in this assessment to consider the effect of any changes in road traffic noise levels.
- British Standard 4142:2014+A1:2019 '*Methods for Rating and Assessing Industrial and Commercial Sound*' (BS 4142:2014+A1:2019) sets out a method to assess the likely effects of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.
- Technical Advice Note (Wales) 11 – Noise provides advice on how the planning system in Wales can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines some of the main considerations which local planning authorities should consider in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

9.3 Consultation and Engagement

Scoping

- 9.3.1 In February 2025, the Applicant submitted a Scoping Report to PEDW, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction, operation and maintenance and decommissioning phases of the Proposed Development.
- 9.3.2 Following consultation with the appropriate statutory bodies, PEDW provided an EIA Scoping Direction on 29 April 2025. Key issues raised by statutory bodies specific to Noise are listed in **Table 9.2**, including how and where these have been considered in the ES.
- 9.3.3 In addition, consultation and engagement with interested parties specific to Noise has continued. These included discussions with Transport regarding changes in average weekly traffic levels changes. Further detail regarding key matters discussed and how these have been addressed is provided in **Table 9.2** of this ES Chapter below.

Table 9.2: Summary of key scoping responses relevant to Noise

Comment	How and where considered in the ES
PEDW	
<p><i>The applicant’s attention is drawn to comments from CCC on this matter. They state that the development is located within close proximity of a number of sensitive receptors in the form of residential properties, with potential significant effects arising during the construction and operational phases. On that basis and given the scheme design is evolving, CCC states that it is premature to scope out the topic. (ID.20)</i></p>	<p>Section 9.8 assesses the Noise impact of the Proposed Development during both the Construction and Operational phase.</p>

9.4 Assessment Methodology

Scope of the Assessment

- 9.4.1 In the context of this assessment, noise is defined as unwanted or undesirable sound derived from sources such as road traffic, commercial/industrial processes or construction works that interfere with normal activities, including conversation, sleep or recreation. Vibration is defined as the transmission of energy through the medium of ground or air resulting in small movements of the transmitting medium, such as a building, which can cause discomfort to people or even damage to structures if the movements are large enough.
- 9.4.2 The prediction of future noise and vibration levels generated by the construction, operational and decommissioning phases of the Proposed Development and the significance of their potential effects have been assessed in accordance with the appropriate BS, which is outlined in the previous section.
- 9.4.3 The scope of this ES has been developed in consultation with relevant statutory and non-statutory consultees as detailed in **Table 9.2**.
- 9.4.4 Taking into account the scoping process and other consultation, **Table 9.3** summarises the issues considered as part of this assessment.

Table 9.3: Issues considered within this assessment

Activity	Impacts scoped into the assessment
Construction	
Noise	Potential effects on existing dwellings as a result of noise from construction works (Paragraphs 9.8.1 – 9.8.9).
Vibration	Potential effects on existing dwellings as a result of vibration from construction works (Paragraph 9.8.10).
Operation and maintenance	
Noise	Potential effects on existing dwellings as a result of sound from commercial plant during the operational phase. (Paragraphs 9.8.12 to 9.8.35).
Decommissioning	
Noise	Potential effects on existing dwellings as a result of noise from decommissioning works (Paragraph 9.8.36).

9.4.5 Effects which are not considered likely to be significant have been scoped out of the assessment. A summary of the effects scoped out is presented in

9.4.6 **Table 9.4** below.

Table 9.4: Issues scoped out of the assessment

Issue	Justification
Potential effects on existing dwellings as a result of changes in road traffic noise during the construction and operational phases	With regard to assumptions; traffic numbers will be low during construction/decommissioning and particularly during operation, with existing highway routes being utilised to minimise levels of on-site construction traffic activity. Furthermore, in terms of limitations, traffic levels are below the calculable range of the Calculation of Road Traffic Noise (CRTN) methodology, meaning that the change in Basic Noise Level (BNL) calculation method would be unreliable and results potentially disproportionate, given the very low baseline flows. Taking the above into account, road traffic noise from the Development has been scoped out of the assessment as likely significant effects are not anticipated.
Potential effects on existing dwellings as a result of operational vibration	Operating solar farms are not known to vibrate significantly. Therefore, vibration has been scoped out of this assessment.

Study Area

- 9.4.7 The Noise and Vibration study area (hereafter referred to as the 'study area') comprises the NSRs located adjacent to the Site and those sections of the surrounding road network anticipated to experience potential significant effects as a result of the construction, operation and decommissioning of the Proposed Development. The location and geographic extent of the study area is presented in Volume 2, Figure 9.1 of the ES.
- 9.4.8 The study area for the construction, operational and decommissioning phase assessments incorporates the area within, and up to, approximately 600m from the Site boundary, where residential properties have been identified to be closest potentially sensitive receptors in all directions. The assessment considers receptors within the area between Ferryside, Llandyfaelog, and Broadway. Any receptors outside of this study area are less impacted by noise at each phase of the Proposed Development.

Construction & Decommissioning Noise

- 9.4.9 Noise levels generated by construction and decommissioning plant and activities have the potential to impact upon nearby NSRs.
- 9.4.10 The construction period is expected to be between 39-52 weeks in duration.
- 9.4.11 Construction activities are proposed to take place between 08:00-18:00 Monday to Friday, 08:00-13:30 on Saturdays, with no works on Sundays or Bank Holidays.
- 9.4.12 A detailed construction programme is not fully developed, therefore the construction noise assessment has been undertaken using an indicative construction plant list (as set out in **Volume 1, Chapter 2: Project Description (Table 2.4)**) with associated sound power level information detailed within BS 5228-1:2009+A1:2014.
- 9.4.13 The sound power level information has been used to predict construction noise levels at the closest NSRs using a spreadsheet-based noise model.
- 9.4.14 BS 5228-1 sets out an approach for predicting, assessing and controlling noise levels arising from a wide variety of demolition and construction plant and related activities. As such, it can be used to predict noise levels arising from the operations at proposed construction sites. BS 5228-1 also sets out tables of sound power levels generated by a wide variety of construction plant to facilitate such predictions.
- 9.4.15 The magnitude of the potential impact on sensitive receptors would depend upon a number of variables, the following of which are of particular relevance to this assessment:
- The amount of noise generated by plant and equipment being used at the Site, generally expressed as a sound power level;
 - The periods of operation of the plant at the Site, known as the 'on-time';

- The distance between the noise source and the receptor, known as the 'stand-off';
- The attenuation due to ground absorption or barrier screening effects; and
- The reflection of noise due to the presence of hard vertical faces such as walls.

9.4.16 In order to determine the likely effect of noise during construction and decommissioning of the Proposed Development, noise predictions have been carried out in accordance with the procedures presented in BS 5228-1, taking full account of BPM. The prediction method described in BS 5228-1 comprises taking the source noise level of each item of plant and correcting it for the following variables:

- distance effects between source and receiver;
- percentage operating time of the plant;
- barrier attenuation effects;
- ground absorption; and
- facade corrections.

9.4.17 BS 5228-1 gives several examples of acceptable limits for construction and decommissioning noise. The most simplistic is based upon the exceedance of fixed noise limits and Annex E.2 states that:

'Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut.'

9.4.18 Annex E.2 goes on to state:

'Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the Site boundary should not exceed: 70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise or 75 decibels (dBA) in urban areas near main roads in heavy industrial areas. These limits are for daytime working outside living rooms and offices.'

9.4.19 In respect of potentially more sensitive residential receptors, this assessment has considered the criteria set out in Annex E.3 of BS 5228-1, which considers impact significance based upon the change in ambient noise associated with construction activities. BS 5228-1 states that this can be considered as *'an alternative and/or additional method to determine the significance of construction noise levels'*.

9.4.20 Paragraph E.3.2 describes Example Method 1 ('The ABC Method'), which considers the existing ambient noise environment (the L_{Aeq} noise level environment) at the neighbouring sensitive receptors and identifies levels that if exceeded would be considered to result in a significant adverse effect and is noted to apply to residential receptors only.

Construction & Decommissioning Vibration

- 9.4.21 Vibration may be impulsive such as that due to hammer-driven piling; transient such as that due to vehicle movements along a railway; or continuous such as that due to vibratory driven piling.
- 9.4.22 The primary cause of community concern in relation to vibration generally relates to building damage from both construction and operational sources of vibration, although, the human body can perceive vibration at levels which are substantially lower than those required to cause building damage.
- 9.4.23 Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that they produce cosmetic damage such as a crack in plaster unless the magnitude of the vibration is excessively high. The most likely impact, where elevated levels of vibration do occur during a proposed development's construction and decommissioning phases, is associated with perceptibility.
- 9.4.24 There are currently no British Standards that provide a methodology to predict levels of vibration from construction activities, other than that contained within BS 5228 Part 2, which relates to percussive or vibratory piling only. Therefore, it is not possible to accurately predict levels of vibration during the Site preparation and construction phases of a proposed development, as well as its decommissioning phase. As such, to control the impact of vibration during site preparation and construction of a development, limits relating to the perceptibility of vibration are typically set.
- 9.4.25 BS 5228-2 indicates that the threshold of human perception to vibration is around 0.14 mms^{-1} , although it is generally accepted that for the majority of people vibration levels in excess of between 0.14 and 0.3 mms^{-1} peak particle velocity ('PPV') are just perceptible, which forms the basis of the recommend maximum permitted vibration levels of 1 mms^{-1} PPV within occupied residential dwellings.
- 9.4.26 BS 5228-2 also sets out the distances (based on historical field measurements) at which certain activities could give rise to a just perceptible level of vibration. These distances are presented in
- 9.4.27 **Table 9.5** below.

Table 9.5: Distances at which vibrations are just perceptible

Construction/Decommissioning Activity	Distance from activity when vibration may just be perceptible (metres)
Excavation	10 - 15
Heavy vehicles (e.g. dump trucks)	4 – 10
Hydraulic Breaker	15 – 20
Rotary Bored Piling	20 - 30

9.4.28 The approach described above, has therefore been adopted within this assessment.

Commercial Operation / Process Sound

9.4.29 BS 4142:2014+A1:2019 sets out a method to assess the likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

9.4.30 The procedure contained in BS 4142:2014+A1:2019 for assessing the effect of sound on residential receptors is to compare the measured or predicted sound level from the source in question, the $L_{Aeq,T}$ 'specific sound level', immediately outside the dwelling with the $L_{A90,T}$ background sound level.

9.4.31 Where the sound contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific sound level to obtain the $L_{Ar,Tr}$ 'rating level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary.

9.4.32 BS 4142:2014+A1:2019 states:

'The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs.'

9.4.33 An estimation of the impact of the specific sound can be obtained by the difference of the rating level and the background sound level and considering the following:

- *'Typically, the greater this difference, the greater the magnitude of the 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.'*
- *'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.'*

9.4.34 During the daytime, the assessment is carried out over a reference time period of 1-hour. The periods associated with day or night, for the purposes of BS 4142:2014+A1:2019, are considered to be 07:00 to 23:00 and 23:00 to 07:00, respectively.

9.5 Assessment Criteria and Assignment of Significance

Receptor Value and Sensitivity

- 9.5.1 The criteria for defining sensitivity in this Chapter of the ES are outlined in Table 9.6 below.

Table 9.6: Sensitivity criteria

Sensitivity/Value	Definition
High	All identified NSRs are residential in use and are considered to be of high sensitivity.

Assessment of Significance / Assessment Criteria

Construction & Decommissioning Noise

- 9.5.2 Annex E of BS 5228-1 outlines the 'ABC Method' as a methodology for assessing construction noise. Table E.1 of BS 5228-1 sets out significance effect threshold values at residential receptors. The process for determining this requires the determination of the ambient noise level at the relevant receptor (rounded to the nearest 5 decibels ('dB')), which is used to set an appropriate threshold value (in dB) for the NSRs. This is then compared to the construction site noise level.
- 9.5.3 With reference to the measured ambient noise levels presented in Table 9.15, all NSRs have been determined to fall within Category A. Construction noise levels should therefore aim not to exceed 65 dB $L_{Aeq,T}$
- 9.5.4 The relevant statistics from Table E.1 are set out in **Table 9.7** below. Compliance with these guidance levels would ensure that no significant adverse effects are experienced at the NSRs. As stated in BS 5228-1, if the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. Other project-specific factors, such as the number of receptors affected and the duration and character of the activities should be considered in the determination of significant effects.

Table 9.7: Construction Noise Impact Significance Criteria

Assessment category and threshold value period, L_{Aeq}	Threshold value, dB, $L_{Aeq,T}$		
	Category A	Category B	Category C
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
<i>NOTE 1 A significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level as outlined in Annex E of BS 5228-1.</i>			

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

Commercial Operation / Process Sound

9.5.5 The impact significance of commercial operation / process sound is set out in

9.5.6 **Table 9.8**, below.

Table 9.8: BS 4142:2014+A1:2019 Impact Significance Criteria

Rating Level Relative to Background Sound Level	BS 4142:2014+A1:2019 Impact Categorisation	Likely Significance of Effect
>=+10 dB	Significant Adverse Impact	Significant, depending on the context
<+10 dB	Adverse to Significant Adverse Impact	More Likely to be Significant. Consideration of other factors including context required
<=+6 dB	Low to Adverse Impact	Less likely to be Significant. Consideration of other factors including context is required
<=0 dB	Low Impact	Not Significant

Construction & Decommissioning Vibration

9.5.7 In accordance with the guidance given in BS 5228-2, 1 mms^{-1} PPV has been selected as the target criteria to control the impact of construction and decommissioning vibration, with the criteria for assessing the magnitude of vibration impacts according to the margin by which this target criterion is achieved or exceeded presented in **Table 9.9**. This target criterion is based on the guidance contained within BS 5228-2, experience from previous sites and accepted vibration policy criteria across a range of enforcing authorities elsewhere in the UK. The limits

are presented in terms of PPV as it is the simplest indicator for both perceptibility and building damage.

Table 9.9: Construction and Decommissioning Significance Criteria

Vibration Level, mms^{-1} PPV	Significance of Effect
>1.0	Significant, depending on the context
0.30 – 1.0	More Likely to be Significant. Consideration of other factors including context require
0.14 – 0.3	Less likely to be Significant. Consideration of other factors including context is required
< 0.14	Not Significant
<p>Notes: The above vibration limits relate to maximum PPV ground borne vibration occurring in any one of three mutually perpendicular axes (one of which may be vertical). Vibration is to be measured on the foundation or on an external façade no more than 1m from the ground, or failing this, solid ground as near to the building façade as possible.</p>	

- 9.5.8 It is again worth noting that the purpose of the target construction and decommissioning vibration criteria is to control the impact of construction and decommissioning vibration insofar as is reasonably practicable and is entirely based on the likelihood of the vibration being perceptible, rather than causing damage to property. Hence, although vibration levels in excess of 1 mms^{-1} PPV would be considered significant in respect of the likelihood of perceptibility, they would not be considered significant in terms of the potential for building damage, which would require levels of at least 15 mms^{-1} PPV to result in minor cosmetic damage in light / unreinforced buildings.

Assumptions and Limitations

- 9.5.9 With regard to assumptions; traffic numbers will be low during construction/decommissioning and particularly during operation, with existing highway routes being utilised to minimise levels of on-site construction traffic activity. Furthermore, in terms of limitations, traffic levels are below the calculable range of the CRTN methodology, meaning that the change in BNL calculation method would be unreliable and results potentially disproportionate, given the very low baseline flows.
- 9.5.10 Taking the above into account, changes in road traffic noise from the Proposed Development has been scoped out of the assessment as significant effects are not anticipated.

9.6 Baseline Environmental Conditions

- 9.6.1 A baseline sound measurement exercise was undertaken at key NSR locations in and around the Site, between 7 and 12 November 2024. Details of the baseline sound survey can be found in the following section.
- 9.6.2 Measurements were taken at three discrete locations (Volume 2, Figure 9.2), representative of the closest potentially affected NSR locations to the Proposed Development. These are residential receptors and are shown in Volume 2, Figure 9.3, relative to the Site boundary.
- 9.6.3 All sound measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of British Standard 7445:2003 '*Description and Measurement of Environmental Noise*' (BS 7445:2003).
- 9.6.4 All acoustic measurement equipment used during the sound survey conformed to Type 1 specification of British Standard 61672:2013 '*Electroacoustics. Sound Level Meters. Part 1 Specifications*' (BS 61672:2013). A full inventory of this equipment is shown in **Table 9.10** below.

Table 9.10: Inventory of Sound Measurement Equipment

Position	Make, Model & Description	Serial Number
MP1	Rion NL-52 Sound Level Meter	00175499
	Rion NH-25 Preamplifier	22091
	Rion UC-59 Microphone	21910
MP2	Rion NL-52 Sound Level Meter	00810575
	Rion NH-25 Preamplifier	11118
	Rion UC-59 Microphone	19968
MP3	Rion NL-52 Sound Level Meter	00320618
	Rion NH-25 Preamplifier	10626
	Rion UC-59 Microphone	05005
All	Rion NC-74 Acoustic Calibrator	34984020

- 9.6.5 Measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory had calibrated the field calibrator used within the 12 months preceding the measurements.
- 9.6.6 The weather conditions during the survey were monitored via the deployment of a rain tipping gauge and anemometer, thus ensuring the exclusion of any weather affected periods from the dataset. The microphones were fitted with protective windshields for the measurements

9.6.7 The measurement positions are described below and identified in **Volume 2, Figure 9.4**.

Table 9.11: Measurement Position Descriptions

Measurement Position	Description
MP1	<p>Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level.</p> <p>MP1 was situated in an empty livestock field, toward the northwestern Site Boundary. The sound environment at this position was dominated by distant road traffic noise emanating from the A484, at a distance of approximately 2.7km northeast of this position. Underlying contributions from road traffic travelling on smaller, surrounding roads and low-level farming operations to the south also contributed to the ambient noise levels. Natural sounds such as wind-induced vegetation movement and bird song were also noted, although to a lesser extent.</p>
MP2	<p>Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level.</p> <p>MP2 was situated in an empty livestock field, towards the southern Site Boundary, to the west of Rownhall Road. The sound environment at this position was dominated by distant road traffic noise emanating from the A484, at a distance of approximately 2.6km east of this position, and from Ferryside, 2.2km to the west. Underlying contributions from natural sounds such as wind-induced vegetation movement and bird song were also noted.</p>
MP3	<p>Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level.</p> <p>MP3 was situated in an empty field towards the eastern Site Boundary. The sound environment at this position was dominated by road traffic noise emanating from the A484, at a distance of approximately 1.0km east of this position. Underlying contributions from natural sounds such as wind-induced vegetation movement and bird song were also noted, as well as sheep grazing in the adjacent field to the west.</p>

Summary of Results

9.6.8 The summarised results of the environmental sound measurements are presented in **Table 9.12**, with a measured time history and statistical analyses presented within Volume 3, Appendix 9.1 and 9.2. Values have been rounded to the nearest whole number.

Table 9.12: Summary of Sound Measurement Results

Position	Associated Receptors	Period	L_{Aeq,T} (dB)	L_{AF90,T} (dB)	L_{AFmax} (dB)
MP1	1-3	Day: 07:00-23:00	40	27	68
		Night: 23:00-07:00	27	21	55
		Construction: Mon-Fri 08:00 – 18:00 Sat 08:00 – 13:30	42	27	59
MP2	4 12-16	Day: 07:00-23:00	52	25	84
		Night: 23:00-07:00	39	22	71
		Construction: Mon-Fri 08:00 – 18:00 Sat 08:00 – 13:30	56	28	77
MP3	5-11	Day: 07:00-23:00	37	27	69
		Night: 23:00-07:00	30	24	52
		Construction: Mon-Fri 08:00 – 18:00 Sat 08:00 – 13:30	40	31	59

Future baseline conditions

- 9.6.9 The future baseline, in the absence of any development at the Site or its immediate surrounding area is not anticipated to significantly change. The presence of transport infrastructure, which governs the anthropogenic contributions to the prevailing sound environment is anticipated to continue to dominate the acoustic environment of the area, with any changes being linked to changes in road traffic profiles.
- 9.6.10 Although vehicle technology is changing, with electric vehicles gradually becoming more popular, the nature of traffic in the area is not expected to be significantly

affected by this change, due to the speed of flow ensuring that aerodynamic and tyre noise dominates.

9.6.11 It is considered that there would be no significant or measurable change to the baseline conditions at the Site as presented above for the future baseline year of 2026.

9.7 Mitigation and Enhancement Measures Adopted as Part of the Proposed Development

9.7.1 Both embedded and additional mitigation measures relevant to the assessment of Noise and Vibration are summarised in **Table 9.13** below. Where relevant, measures have been identified that may result in enhancement of existing environmental conditions.

Table 9.13: Mitigation measures to be adopted as part of the Proposed Development

Mitigation measure	How the measure will be secured
Embedded mitigation	
<p>Implementation of 'Best Practicable Means', including:</p> <ul style="list-style-type: none"> - Using silenced plant and equipment. - Switching off of engines where vehicles are standing for a significant period of time. - Fitting of acoustic enclosures to suppress noisy equipment. - Operating plant at low speeds and incorporation of automatic low-speed idling. - Selection of electrically driven equipment, as opposed to internal combustion powered. - Selection of hydraulic powered equipment, as opposed to pneumatic. - Selection of wheeled plant, as opposed to tracked. - Properly maintaining all plant (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced etc). - Where practicable, low vibration working methods 	<p>Measures are contained in Volume 3, Appendix 4.4: Outline CEMP that is submitted with the DNS application.</p> <p>It is anticipated that implementation of the CEMP will be secured through a condition of the DNS consent.</p>

Mitigation measure	How the measure will be secured
<p>would be employed and consideration given to the most suitable plant.</p> <ul style="list-style-type: none"> - Vibration would be controlled at source via methods such as mechanical isolation and the spread of vibration would be limited by breaking potential transmission pathways i.e. common structures; and - Where processes could give rise to potentially significant levels of vibration, on-site vibration levels would be regularly monitored. 	
<p>The Proposed Development has been designed, such that all noise generating plant is optimally located and distributed throughout the Site in order to ensure acoustic effects at NSRs are minimised. This approach, coupled to the adoption of appropriate plant specifications, to be adopted effectively designs out the operational noise effects of the Proposed Development.</p>	<p>It is anticipated that Volume 2, Figure 2.1: Site Layout Plan will form an approved plan on the DNS consent.</p>
<p>Further mitigation</p>	
<p>There are no further mitigation measures that are required for either Noise or Vibration.</p>	<p>N/A</p>

Construction & Decommissioning Noise

- 9.7.2 The following good practice measures, comprising Best Practicable Means (BPM) have been incorporated into the Outline CEMP.
- 9.7.3 Effective co-ordination and time management of construction operations would be important in avoiding noise and vibration nuisance to surrounding uses. Early and helpful communications with the surrounding NSRs would assist reducing potential for and in managing any complaints arising during the construction works of the Proposed Development.
- 9.7.4 Contractors would be required to ensure that works are carried out in accordance with BPM as stipulated in the Control of Pollution Act 1974. A full explanation of

measures to control construction noise would be incorporated within the detailed CEMP.

9.7.5 The proposals in regard to general noise mitigation would be in accordance with BPM as specified in BS 5228 and would comprise the following, where possible:

- Using 'silenced' plant and equipment;
- Switching off engines where vehicles are standing for a significant period of time;
- Fitting of acoustic enclosures to suppress noisy equipment as appropriate;
- Operating plant at low speeds and incorporation of automatic low-speed idling;
- Selecting electrically driven equipment in preference to internal combustion powered, hydraulic power in preference to pneumatic and wheeled in lieu of tracked plant;
- Properly maintaining all plant (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced, etc.);
- Certifying plant to meet any relevant EC Directive standards; and
- Undertaking awareness training of all contractors in regards to BS 5228 (Parts 1 and 2) which would form a prerequisite of their appointment.

9.7.6 Typically, adopting BPM would have the potential to reduce overall construction noise levels by approximately 5 dB; however, this is dependent upon the type and extent of activities being carried out.

9.7.7 Should any non-routine activities be identified that would make it impracticable to work to the target criterion, provisions would be set out in advance and with the agreement of CCC, to reduce the effect.

9.7.8 For any proposed construction works to be undertaken outside of the permitted working day, particularly at night, prior consent would be sought from CCC. Dispensation procedures for works would be agreed in advance and included within Construction Method Statements and the detailed CEMP or Section 61 consent where adopted. Section 61 of the 1974 Act, allows a person carrying out works to apply to the local planning authority for prior consent for construction works.

9.7.9 Deliveries and removal of material off-site, would be subject to the following controls:

- Planning all mass concreting operations for Saturdays whenever possible;
- Ensuring that all construction traffic is parked off the public highway;
- Controlling the discharge of trucks from Site to avoid congestion; and

- Implementing traffic management systems at the entrance to the Site at all times to control traffic into the Site.

9.7.10 With regard to the potential effects of vibration from piling activities impacting upon existing utilities in the area, particular attention would be given during the preparation of the detailed CEMP to the safeguarding of the in-ground services near the Site. At this stage, the mitigative input is limited to that set out within BS 5228, which is summarised below:

- Where reasonably practicable, low vibration working methods would be employed and consideration given to the most suitable plant;
- Vibration would be controlled at source via methods such as mechanical isolation and the spread of vibration would be limited by breaking potential transmission pathways i.e. common structures; and
- Where processes could give rise to potentially significant levels of vibration, on-site vibration levels would be regularly monitored.

9.7.11 The noise-generating activity and plant to be used during the decommissioning phase is expected to be similar to the construction phase. Like the construction phase, the decommissioning phase will therefore be managed through implementation of an approved Decommissioning Environmental Management Plan (DEMP) which would be prepared prior to the decommissioning of the Proposed Development. It is anticipated that the DEMP would be required by condition of the consent.

Operational Sound

9.7.12 The Proposed Development has been designed, such that all noise generating plant is optimally located and distributed throughout the Site in order to ensure acoustic effects at NSRs are minimised. This approach, coupled to the adoption of appropriate plant specifications, to be adopted effectively designs out the operational noise effects of the Proposed Development.

9.8 Assessment of Effects

Construction Phase

Construction Noise

9.8.1 Construction noise levels have been predicted at the closest identified NSRs based on the predicted construction activities of the ES, and in accordance with BS 5228-1.

9.8.2 Works will be undertaken between 08:00 and 18:00 from Monday to Friday, and between 08:00 and 13:30 on Saturdays. No construction activities or deliveries will occur on Sunday or Public Holidays. Any works agreed outside these hours are to be agreed with CCC.

9.8.3 In order to assess the realistic ‘worst-case’ scenario for the assessment of the Proposed Development’s likely significant effects resulting from construction noise, worst-case construction noise levels during the erection of infrastructure have been predicted at the closest NSRs.

Sound Source Data

9.8.4 The sound source data associated with the most significant plant items to be used near to the closest NSRs during the construction works, has been taken from BS 5228-1, and are set out below.

Table 9.14: Construction Noise Source Data

Plant	BS 5228 Reference	Quantity	% On Time	Sound Pressure Level @ 10m, dB L _{Aeq}
Tracked Excavator (14t)	Table C.2 25	1	50	69
Dozer (20t)	Table C.2 10	1	50	81
Telescopic Handler (10t)	Table C.2 35	1	50	71
Mobile Telescopic Crane (80t)	Table C.4 39	1	50	77

9.8.5 Calculations were carried out in accordance with guidance given in BS 5228-1:2009+A1:2014.

9.8.6 From these predictions, it has been possible to determine whether the adopted target noise criterion of 65 dB L_{Aeq,T} from the ABC Method is likely to be met during the noisiest stages of the construction activities.

Construction Noise Level Summary

9.8.7 A summary of the predicted construction noise levels at a statistically representative selection of NSRs, which lie directly adjacent to the Site boundary is provided in **Table 9.15** below. These NSRs have been presented as a realistic ‘worst-case’ scenario due to their proximity to the Site boundary.

Table 9.15: Construction Noise Levels at Receptor

NSR	Distance to Site (m)	Construction Noise Level, dB L _{Aeq,T}
1	440	5

NSR	Distance to Site (m)	Construction Noise Level, dB L _{Aeq,T}
2	315	21
3	60	37
4	35	38
5	280	20
6	385	19
7	480	17
8	355	20
9	340	21
10	550	16
11	180	23
12	150	28
13	140	29
14	470	18
15	470	17
16	330	21

9.8.8 The predictions presented in **Table 9.15** above identify that noise levels are not predicted to exceed the adopted 65 dB(A) limit when works are undertaken at the closest point to the closest off-site NSR. Construction noise effects are therefore considered as 'not significant'.

9.8.9 Consequently, further mitigation measures are not considered necessary to those set out previously.

Construction Vibration

9.8.10 The separation distances between the closest construction works and the closest residential receptors, coupled with the low-intensity nature of the construction works, would ensure that construction vibration effects on these receptors would be no greater than low impact (not significant). Any construction works should seek to not encroach upon minimum distances given within both **Volume 3, Appendix 4.4: Outline CEMP** and

9.8.11 Table 9.5 of this chapter.

Operational Phase

Sound Source Data

- 9.8.12 The sound source levels used in the assessment are set out in **Table 9.16** below. It is important to note that these are candidate plant selections, used for the purposes of this assessment and that individual plant specifications may differ. Sound from tracking motors is insignificant and is therefore not assessed.

Table 9.16: Source Sound Data

Plant	Quantity	Sound Power Level per Unit, L _{WA} dB
MV Twin Skid (Inverter)	10	74
MV Twin Skid (Transformer)	5	71
132kV Substation Transformer	1	84

Calculation Process

- 9.8.13 Calculations were carried out using Cadna/A software, which undertakes its calculations in accordance with guidance given in ISO 9613-1:1993 and ISO 9613-2:2024, which considers a worst-case downwind propagation to all NSRs.

Model Assumptions

- 9.8.14 Given that the ground condition of the land between the Site and nearest NSRs is predominantly soft, the ground factor has been set to $G=0.9$ within the calculation software. A maximum of two orders of reflection has been considered. Full octave frequency spectra have been used in the calculations.
- 9.8.15 In order to accurately model the land surrounding the Site, an AutoCAD DXF drawing was produced, which was based on data provided by the Ordnance Survey, along with associated LIDAR Composite DTM topographic contours sourced from the Defra Data Services Platform.

Specific Sound Level Map

- 9.8.16 The sound maps showing the daytime and night-time specific sound level emissions at 4 metres above ground level that are associated with the Proposed Development are shown in Volume 2, Figure 9.5 and Figure 9.6.

Specific Sound Level Summary

- 9.8.17 A summary of the predicted specific sound levels at the identified NSRs, based on the sound maps shown in Volume 2, Figure 9.5 and Figure 9.6 is shown in **Table 9.17** below.

Table 9.17: Specific Sound Level Summary

Receptor	Predicted Specific Sound Level, dB L _{Aeq,T}	
	Daytime	Night-time
NSR1	11	11
NSR2	15	15
NSR3	21	21
NSR4	20	20
NSR5	18	18
NSR6	14	14
NSR7	14	14
NSR8	16	16
NSR9	20	20
NSR10	17	17
NSR11	21	21
NSR12	20	20
NSR13	17	17
NSR14	11	11
NSR15	10	10
NSR16	11	11

Rating Penalty Principle

9.8.18 Section 9 of BS 4142:2014+A1:2019 describes how the rating level should be derived from the specific sound level, by determining a rating penalty. BS 4142:2014+A1:2019 states:

“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. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

- a) subjective method;*
- b) objective method for tonality;*
- c) reference method.”*

9.8.19 Given that the Proposed Development is not currently operational, the subjective method has been adopted to derive the rating level from the specific sound level. This is discussed in Section 9.2 of BS 4142:2014+A1:2019, which states:

“Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

Correct the specific sound level if a tone, impulse or other characteristics occurs, or is expected to be present, for new or modified sound sources.”

9.8.20 BS 4142:2014+A1:2019 defines four characteristics that should be considered when deriving a rating penalty, namely: tonality; impulsivity; intermittency; and other sound characteristics, which are defined as:

- **Tonality:** A rating penalty of +2 dB is applicable for a tone which is “*just perceptible*”, +4 dB where a tone is “*clearly perceptible*”, and +6 dB where a tone is “*highly perceptible*”.
- **Impulsivity:** A rating penalty of +3 dB is applicable for impulsivity which is “*just perceptible*”, +6 dB where it is “*clearly perceptible*”, and +9 dB where it is “*highly perceptible*”.
- **Intermittency:** BS 4142:2014+A1:2019 states that 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, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.*”
- **Other Sound Characteristics:** BS 4142:2014+A1:2019 states that where “*the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied*”.

Rating Penalty Assessment

9.8.21 Section 9 of BS 4142:2014+A1:2019 describes how the rating level should be derived from the specific sound level, by determining a rating penalty. BS 4142:2014+A1:2019 states:

Table 9.18: Rating Penalty Assessment

Source	Tonality	Impulsivity	Intermittency	Other	Discussion
PV Inverters and	0 dB	0 dB	0 dB	0 dB	The inverters and transformers housed within the containerised inverter stations will operate as

Source	Tonality	Impulsivity	Intermittency	Other	Discussion
Transformers					<p>demand requires. However, once operating, these do not cycle on and off.</p> <p>Tonality is unlikely to be perceptible, as although there is a potential mid-low-frequency bias at source, the residual acoustic environment will substantially mask any significant tones.</p>
132/33kV Substation	0 dB	0 dB	0 dB	0 dB	<p>The battery cooling systems typically operate continuously during the majority of the charging/discharging periods. They might switch on/off, but not simultaneously, during cool down periods when they are less noisy, and therefore the intermittency is not expected to be readily noticeable at the NSR locations.</p> <p>Potential low-frequency bias might exist at source, but due to the distance to NSRs, the residual acoustic environment will mask any significant tones or low frequency characteristics.</p>

9.8.22 In summary, no rating penalty has been included in this assessment.

Uncertainty in Calculations: Measurement Uncertainty

9.8.23 BS 4142:2014+A1:2019 states that measurement uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

- b) the complexity and level of variability of the residual acoustic environment;*
- d) the location(s) selected for taking the measurements;*
- g) the measurement time intervals;*
- h) the range of times when the measurements have been taken;*

- i) the range of suitable weather conditions during which measurements have been taken;
- k) the level of rounding of each measurement recorded; and
- l) the instrumentation used.'

9.8.24 Each of the relevant measurement uncertainty factors outlined above have been considered and discussed in **Table 9.19** below.

Table 9.19: Measurement Uncertainty Factors

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
b) the complexity and level of variability of the residual acoustic environment	0 dB	Residual acoustic environment is relatively constant, and therefore no correction for a complex residual acoustic environment is required.
d) the location(s) selected for taking the measurements	0 dB	Measuring at locations representative of the closest affected NSRs to the Site has enabled the determination of robust background sound levels.
g) the measurement time intervals	0 dB	Measurement time intervals were set in accordance with BS 4142:2014+A1:2019, and therefore no further correction is required.
h) the range of times when the measurements have been taken	0 dB	Measurements were undertaken over seven consecutive daytime and night-time periods.
i) the range of suitable weather conditions during which measurements have been taken	0 dB	Where periods of wind or precipitation were measured, these were removed from the dataset.

9.8.25 In summary, a correction of 0 dB has been included in the assessment, to account for measurement uncertainty.

Uncertainty in Calculations: Calculation Uncertainty

9.8.26 BS 4142:2014+A1:2019 states that calculation uncertainty depends on a number of factors, including the following, which are applicable to the Proposed Development:

- “b) *uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels;*
- c) *uncertainty in the calculation method;*
- d) *simplifying the real situation to "fit" the model (user influence on modelling); and*
- e) *error in the calculation process.”*

9.8.27 Each of the calculation uncertainty factors outlined above have been considered and discussed in **Table 9.20** below.

Table 9.20: Calculation Uncertainty Factors

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b) uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels	0 dB	Sound source levels for all plant are worst-case candidate data to be achieved by the Proposed Development.
c) uncertainty in the calculation method	0 dB	Calculations were undertaken in accordance with ISO 9613-2, which is considered a “validated method” by BS 4142:2014+A1:2019.
d) simplifying the real situation to "fit" the model (user influence on modelling)	0 dB	The real situation has been simplified for the purposes of this assessment, with all on-Site screening effects removed, resulting in a worst-case propagation model.
e) error in the calculation process	±1 dB	ISO 9613-2 indicates that there is a ±3 dB accuracy to the prediction method, dependent upon input variables and propagation complexities.

9.8.28 In summary, an uncertainty budget of ±1 dB has been considered in this assessment, to account for calculation uncertainty.

9.8.29 The overall uncertainty is considered to be small enough that it would not affect the conclusions of this assessment.

BS 4142:2014+A1:2019 Assessment of Operational Effects

9.8.30 The rating level, as calculated from the predicted specific sound level, has been assessed in accordance with BS 4142:2014+A1:2019, at all residential NSRs.

9.8.31 The resultant assessment summary, during the daytime period, is shown in **Table 9.21** below.

Table 9.21: Daytime BS 4142:2014+A1:2019 Assessment

Receptor	Rating Level, dB L _{Ar,Tr}	Daytime Background Sound Level, dB L _{A90,T}	Excess of Rating over Background Sound Level, dB
NSR1	11	25	-14
NSR2	15	25	-10
NSR3	21	25	-4
NSR4	20	26	-6
NSR5	18	26	-8
NSR6	14	28	-14
NSR7	14	28	-14
NSR8	16	28	-12
NSR9	20	28	-8
NSR10	17	28	-11
NSR11	21	26	-5
NSR12	20	26	-6
NSR13	17	26	-9
NSR14	11	26	-15
NSR15	10	26	-16
NSR16	11	26	-15

9.8.32 As shown in **Table 9.21** above, during the daytime period, the Proposed Development is predicted to have a '**low impact**' at the NSRs with reference to BS 4142:2014+A1:2019 methodology. Operational effects during the daytime are therefore considered to be 'not significant'.

9.8.33 The resultant assessment summary, during the night-time period, is shown in **Table 9.22**.

Table 9.22: Night-time BS 4142:2014+A1:2019 Assessment

Receptor	Rating Level, dB L _{Ar,Tr}	Night-time Background Sound Level, dB L _{A90,T}	Excess of Rating over Background Sound Level, dB
NSR1	11	21	-10
NSR2	15	21	-6
NSR3	21	21	0
NSR4	20	20	0
NSR5	18	20	-2
NSR6	14	24	-10
NSR7	14	24	-10
NSR8	16	24	-8
NSR9	20	24	-4
NSR10	17	24	-7
NSR11	21	20	+1
NSR12	20	20	0
NSR13	17	20	-3
NSR14	11	20	-9
NSR15	10	20	-10
NSR16	11	20	-9

9.8.34 As shown in **Table 9.22**, during the night-time period, the Proposed Development is predicted to have a '**low impact**' at all NSRs with reference to BS 4142:2014+A1:2019 methodology, with the exception of NSR11. At NSR11 an exceedance of the background sound level of 1dB(A) is predicted, which is considerably below the level at which '*is likely to be an indication of an adverse impact, depending on the context*' occurs (+5dB(A)), with reference to BS 4142:2014+A1:2019 methodology. Operational effects during the night-time are therefore considered to be 'not significant'.

Decommissioning Phase

9.8.35 Noise effects during the decommissioning phase of the Proposed Development, which would occur at the end of the Proposed Development's modelled operational lifespan of 40 years, are anticipated to be similar to those predicted for the Proposed Development's construction phase, where effects have been predicted to be 'not significant'. Many of the Proposed Development's construction phase

activities will be replicated for the decommissioning phase, but in reverse. There is the potential for benefits from technological advancements that are likely to have occurred in the intervening period between the Proposed Development's construction and decommissioning that would be anticipated to reduce noise generation, as well as the duration of the required activities. However, as a 'worst-case' scenario, if such technological advancements do not occur, the Proposed Development's noise effects during decommissioning would be no greater than for the construction phase and therefore 'not significant'.

Future monitoring

- 9.8.36 No future monitoring is required as a consequence of the assessment of Noise and Vibration.

9.9 Cumulative Effects

- 9.9.1 The assessment of cumulative effects for Noise has followed the methodology set out in **Volume 1, Chapter 4: Environment Assessment Methodology**.
- 9.9.2 The study area (**Volume 2, Figure 9.1**) has been defined on the basis of where significant effects attributable to the Proposed Development are expected, and therefore the Noise and Vibration cumulative effects assessment only considers developments that are located within the study area. Of the cumulative development identified in **Volume 3, Appendix 4.5: List of Cumulative Developments**, there are no developments located within the study area.

Construction Phase

- 9.9.3 Owing to the nearest cumulative development being at a distance of 2 km from the Site boundary with no shared receptors, any cumulative effects from noise or vibration during construction are anticipated to be minimal. However, careful co-ordination with any adjacent developers will be necessary during the construction phases, should they overlap, so as to ensure that work phasing is appropriately scheduled and minimise concentrations of work in any given area and spikes in construction traffic. Measures to ensure co-ordination with adjacent developers during construction are contained in **Volume 3, Appendix 4.4: Outline CEMP**.

Operational Phase

- 9.9.4 Owing to the nearest cumulative development being at a distance of 2 km from the Site boundary and/or having incomparable noise impact profiles with the Proposed Development, noise during operation is anticipated to be minimal. Operating solar farms are not known to vibrate significantly and therefore, vibration during operation is also anticipated to be minimal.

Decommissioning Phase

- 9.9.5 Owing to the nearest cumulative project scheme being at a distance of 2 km from the site boundary with no shared receptors, any cumulative effects from noise or vibration during decommissioning are anticipated to be minimal. However, careful

co-ordination with any adjacent developers will be necessary during the decommissioning phases, should they overlap, so as to ensure that work phasing is appropriately scheduled and minimise concentrations of work in any given area and spikes in construction traffic. This will be incorporated and implemented as part of the Decommissioning Plan that will be prepared prior to the decommissioning of the Proposed Development.

9.10 Summary of environmental effects, mitigation measures and monitoring

9.10.1 **Table 9.19** presents a summary of the potential environmental effects, additional mitigation, residual effects and further monitoring identified in this chapter.

Table 9.19 Summary of potential environmental effects, mitigation and monitoring.

Description of impact	Phase ^a			Mitigation measures	Significance of effect	Further mitigation	Residual effect
	C	O	D				
Noise	✓	✓	✓	<p>C: Implementation of Volume 3, Appendix 4.4: Outline CEMP.</p> <p>O: The Proposed Development has been designed, such that all noise generating plant is optimally located and distributed throughout the Site in order to ensure acoustic effects at NSRs are minimised. This approach, coupled to the adoption of appropriate plant specifications, to be adopted effectively designs out the operational noise effects of the Proposed Development.</p>	<p>C: Not significant</p> <p>O: Not significant</p> <p>D: Not significant</p>	<p>No future monitoring is proposed.</p>	<p>C: Not significant</p> <p>O: Not significant</p> <p>D: Not significant</p>
Vibration	✓	✗	✓	<p>Vibration would be controlled at source via methods such as mechanical isolation and the spread of vibration would be limited by breaking potential transmission pathways i.e. common structures; and where processes could give rise to potentially significant levels of vibration, on-site vibration levels would be regularly monitored.</p>	<p>C: Not significant</p> <p>O: N/A</p> <p>D: Not significant</p>		<p>C: Not significant</p> <p>O: N/A</p> <p>D: Not significant</p>

^a C=construction, O=operational and maintenance, D=decommissioning

9.11 References

British Standards Institute (2014) BS 5228-1:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Part 1: Noise

British Standards Institute (2014) BS 5228-1:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration

British Standards Institute (2014) BS 4142+A1:2019 – Methods for rating and assessing industrial and commercial sound

British Standards Institute (2014) BS 8233: 2014 – Guidance on sound insulation and noise reduction for buildings

British Standards Institute (2003) BS 7445: 2003 – Description and measurement of environmental noise

British Standards Institute (2013) BS 61672: 2013 – Electroacoustics. Sound level meters. Part 1 Specifications