One Earth Solar Farm

Volume 6.0: Environmental Statement [EN010159]

Volume 2: Aspect Chapters

Chapter 15: Noise and Vibration

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Contents

Glossary

Term	Definition
Decibel (dB)	The logarithmically scaled measurement unit of sound.
A-weighting	Frequency weighting applied to measured sound in order to account for the relative loudness perceived by the human ear.
$L_{Aeq,}T$	A-weighted equivalent continuous sound level over a given time period. It is the sound level of a steady sound that has the same energy as a fluctuating sound over the same time period.
$L_{A90,}T$	The A-weighted sound level exceeded for 90% of the measurement period. Often referred to as the background sound level.
Ambient sound level, $L_a = L_{Aeq,T}$	The A-weighted equivalent continuous sound level of the totally encompassing sound for a given situation and time interval, T.
Specific sound level, $L_s = L_{Aeq,Tr}$	The A-weighted equivalent continuous sound pressure level produced by the specific sound source at the reference location over a reference time interval, T.
Rating level, $L_{Ar,Tr}$	The specific sound level plus any adjustment for the characteristic features of the sound.
Peak particle velocity (PPV)	A measure of the magnitude of vibration, representing the greatest instantaneous particle velocity in a given time period. Measured in mm/s.

List of Abbreviations and Acronyms

Term	Definition
AAWT	Annual Average Weekday Traffic
BESS	Battery Energy Storage System
BNL	Basic Noise Level
CEMP	Construction Environmental Management Plan
CTMP	Construction Traffic Management Plan
CRTN	Calculation of Road Traffic Noise
dB	Decibel
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
ENIA	Environmental Noise Impact Assessment
ES	Environmental Statement
ESC	Environmental Sound Criteria
HDD	Horizontal Directional Drilling
IEMA	Institute of Environmental Management and Assessment
LOAEL	Lowest Observed Adverse Effect Level
m	Metre
mm	Millimetre
MVPT	Medium Voltage Power Transformer
NOEL	No Observed Effect Level
NPSE	Noise Policy Statement for England
oCEMP	Outline Construction Environmental Management Plan
oDEMP	Outline Decommissioning Environmental Management Plan
PCS	Power Converter Station
PPV	Peak Particle Velocity

Term	Definition
s	Second
SOAEL	Significant Observed Adverse Effect Level
UAEL	Unacceptable Adverse Effect Level

15. Noise and Vibration

15.1.1 This Chapter of the Environmental Statement (ES) has been prepared by Logika and presents an assessment of the likely significant environmental effects of the Proposed Development upon Noise and Vibration.

15.1.2 A description of the methods used in the assessment is set out in this Chapter. This is followed by a description of the relevant baseline conditions, future baseline conditions and sensitive receptors, together with an assessment of the likely significant effects of the Proposed Development during construction, operation and maintenance, and decommissioning. Consideration of the likely significant environmental effects has been undertaken throughout the design of the Proposed Development. Specific environmental measures relevant to Noise and Vibration have been identified and have been considered as part of the assessment.

15.1.3 To conclude a summary of the assessment is presented along with the next steps, where applicable. Details of the cumulative effects assessment is presented separately within **ES Volume 2, Chapter 18: Cumulative Effects [EN010159/APP/6.18].**

15.1.4 As was defined by the Scoping Opinion, this chapter considers the following potential noise and vibration effects that have been scoped-in as follows:

- Noise from onsite construction activities: noise from construction activities may include (but is not limited to) sounds associated with construction of modules (such as fixing of modules and mounting equipment); the tipping and compaction of aggregate to create internal roads; movement of any earth; the delivery and movement of other solar infrastructure such as the inverters etc.
- Vibration from onsite construction activities: vibration effects from the piling of the mounting equipment into the ground for the modules.
- Noise from construction traffic: noise effects from construction traffic may include road traffic sounds, such as engine noise and tyres on road surfaces.
- Vibration from construction traffic.
- Operational noise from plant and equipment: Consideration is given to noise from solar infrastructure equipment.
- Noise and vibration from decommissioning activities, both in terms of onsite decommissioning activities and traffic.

15.1.5 This Chapter is supported by the following figures located within **ES Volume 3: Figures Supporting Volumes 1 and 2 [EN010159/APP/6.20]** and further detailed information contained within the following appendices located within **ES**

Volume 3: Technical Appendices Supporting ES Volumes 1 and 2 [EN010159/APP/6.21].

- **Volume 3, [EN010159/APP/6.20]: Figures**
  - **Figure 15.1:** Strategic Noise Mapping Results - Daytime.
  - **Figure 15.2:** Strategic Noise Mapping Results – Night-Time.
  - **Figure 15.3:** Baseline Noise Monitoring Locations
  - **Figure 15.4**: Study Areas
  - **Figure 15.5:** Construction Traffic Noise Study Area and Sensitive Receptors
  - **Figure 15.6:** Construction Noise Study Area and Sensitive Receptors
  - **Figure 15.7:** Construction Vibration Study Area and Sensitive Receptors
  - **Figure 15.8:** Operational Noise Study Area and Sensitive Receptors
- **Volume 3, [EN010159/APP/6.21]: Appendices**
  - **Appendix 15.1:** Summary of Legislation, Policy and Technical Guidance
  - **Appendix 15.2:** Baseline Noise Survey, which describes the project specific baseline noise monitoring that has been carried out and the results of that monitoring.
  - **Appendix 15.3:** Construction Noise and Vibration Assessment, which sets out the assessment methodology, calculation assumptions, prediction results and assessment conclusions in relation to the assessment of noise and vibration during construction, including construction traffic.
  - **Appendix 15.4**: Operational Noise Assessment, which sets out the assessment methodology, calculation assumptions, prediction results and assessment conclusions in relation to the assessment of noise during operation.

15.2 Relevant Legislation, Policy and Technical Guidance

15.2.1 Legislation, planning policy and guidance relating to noise and vibration, and relevant to the Proposed Development comprises the following, further details are included in **ES Volume 3, Appendix 15.1: Summary of Legislation, Policy and Technical Guidance [EN010159/APP/6.21]:**

- Legislation
  - Environmental Protection Act 1990

- Control of Pollution Act 1974

> Policy

- Overarching National Policy Statement (NPS) for Energy 2023 (EN-1)
- National Policy Statement on Renewable Energy Infrastructure 2023 (EN-3)
- National Planning Policy Statement for Electrical Networks 2023 (EN-5)
- National Planning Policy Framework 2024 (NPPF)
- Noise Policy Statement for England 2010 (NPSE)
- Planning Practice Guidance – Noise 2019 (PPGN)
- Central Lincolnshire Local Plan 2023 (CLLP)
- Bassetlaw Local Plan 2020-2038 (Adopted May 2024)
- Bassetlaw District Council 2010 Local Development Framework, Publication Core Strategy and Development Management Policies
- Draft Bassetlaw Local Plan 2023 2020-2038: Main Modifications Version (BLP)

> Technical Guidance

- Institute of Environmental Management and Assessment Guidelines for Environmental Noise Impact Assessment (IEMA)
- BS 7445-1: 2003 ‘Description and measurement of environmental noise. Guide to quantities and procedures’ (BS 7445-1)
- BS 5228:2014+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’ (BS 5228-1)
- BS 5228:2014+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration’ (BS 5228-2)
- BS 4142:2014+A1:2019 ‘Methods for rating and assessing industrial and commercial sound’ (BS 4142)
- BS 8233:2014 ‘Guidance on Sound Insulation and Noise Reduction for Buildings’ (BS 8233)
- Design Manual for Roads and Bridges LA111 ‘Noise and Vibration’ 2020 (DMRB)
- Department of Transport, Calculation of Road Traffic Noise 1998 (CRTN)

15.3 Assessment Methodology and Significance Criteria

The Study Area

15.3.1 The study area has been defined based on the type of noise and vibration generated by the Proposed Development during the construction, operation (including maintenance) and decommission phases and the distances from sensitive receptors at which noise and vibration has the potential to cause impacts. The potential noise and vibration effects that have been scoped-in to the study are as follows:

- Noise from onsite construction activities and decommissioning, using professional judgement (see **ES Volume 1, Chapter 1: Introduction [EN010159/APP/6.1]**), a study distance of 300m from onsite construction activities is considered, as beyond this distance, construction noise effects are unlikely.
- Vibration from onsite construction and decommissioning activities: A distance of 100m from high-energy construction works such as piling is considered. Beyond this distance, vibration effects are unlikely.
- Noise from construction and decommissioning traffic: These sounds are considered for properties within 50 m of roads in the immediate vicinity of the Proposed Development that are likely to experience a change in road traffic noise which has the potential to lead to significant noise effects due to the addition of construction traffic, and roads within the Proposed Development that are proposed to carry construction vehicles.
- Vibration from construction and decommissioning traffic: vibration effects from construction traffic is considered for properties within 50 m of existing roads that are likely to experience a change in road traffic which could lead to significant vibration effects, and proposed roads within the Order Limits that are proposed to carry construction vehicles.
- Operational noise from plant and equipment: the solar modules do not generate any noise. Consideration is given to noise from inverters, transformers, other substation equipment and battery storage equipment. For the purposes of the assessment a distance of 500m from electrical equipment such as inverters, transformers, other substation equipment and battery storage equipment has been considered, to ensure all potential impacts are identified.

15.3.2 **ES Volume 3, Figure 15.4: Study Areas [EN010159/APP/6.20]** shows the study areas considering the likely effects as bulleted above.

Establishing the Baseline

Existing Baseline

15.3.3 A baseline noise measurement survey was carried out from Thursday 15th to Thursday 22nd February 2024. Seven unattended noise monitoring locations

were utilised over a 7-day period and were selected to be representative of baseline noise levels at the residential properties that are in the vicinity of areas that are within the various study areas for the Proposed Development. The host authorities were consulted on the baseline noise survey locations and duration of monitoring. Details on the survey are provided in Section 15.4 below.

Future Baseline

15.3.4 The ambient noise climate in the local vicinity of the Proposed Development is rural in nature, with only relatively small areas experiencing appreciable amounts of road traffic noise. This is not anticipated to change in the future. Future baseline noise conditions are therefore assumed to be similar to those that currently exist for the purposes of the assessment.

Identifying Receptors and Receptor Sensitivity

15.3.5 All relevant noise sensitive receptors that have been identified in the Study Areas are residential properties. As such, for the purposes of all elements of the noise and vibration study, all receptors are considered highly sensitive to a change in noise and vibration (defined as high sensitive receptors).

Assessment Methodology

15.3.6 Full details of the adopted impact assessment methodology are presented in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21]** and **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21]** and are summarised below.

15.3.7 The Noise Policy Statement for England (NSPE) requires noise and vibration assessments to identify effects from a development that would result in significant adverse impacts on health and quality of life. The NPSE vision is to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development".

15.3.8 This long-term vision is supported by three Noise Policy Aims that can be delivered through effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. These aims are to:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life; and
- Where possible, contribute to the improvement of health and quality of life

15.3.9 The NPSE effect levels that relate to the likelihood of significant adverse effects on health and quality of life are as follows:

- NOEL – 'No Observed Effect Level': The level below which no effect can be detected;
- LOAEL – 'Lowest Observed Adverse Effect Level': The level above which adverse effects on health and quality of life can be detected; and
- SOAEL – 'Significant Observed Adverse Effect Level': The level above which significant adverse effects on health and quality of life occur.

15.3.10 The Planning Practice Guidance for Noise (PPG(N))[1] provides further detail about how the effects of noise can be described in terms of perception and outcomes, adding a fourth term:

- UAEL – 'Unacceptable Adverse Effect Level': The level above which adverse effects are unacceptable.

15.3.11 A noise exposure hierarchy is presented in PPG(N), linking the response of the NSRs to the increasing effect levels and associated actions, as summarised in **Table 15.1**.

Table 15.1 PPG(N) Noise Exposure Hierarchy

Increasing Effect Level	Response	Observed Effect	Action
Below NOEL	Not present	No effect	No specific measures
Above NOEL	Present and not intrusive	No Observed Effect	No specific measures
Above LOAEL	Present and intrusive	Observed Adverse Effect	Mitigate and reduce to a minimum
Above SOAEL	Present and disruptive	Significant Observed Adverse Effect	Avoid
Above UAEL	Present and very disruptive	Unacceptable Adverse Effect	Prevent

15.3.12 The NPSE states that it is not possible to state a "*single objective*" noise (or vibration) based measure applicable to all sources and receptors that defines the onset of LOAEL and SOAEL. However, the thresholds for the onset of each of the effect levels can be defined based upon relevant policy, available standards and technical guidance.

[1] *Ministry of Housing, Communities and Local Government, Planning Practice Guidance: Noise (PPG(N), 2019). Available at https://www.gov.uk/guidance/noise--2*

15.3.13 Where it is not possible to define the onset of LOAEL and SOAEL from policy, standards or guidance, effect levels have been defined with reference to those previously used for the assessment of other nationally significant infrastructure projects in England.

15.3.14 For the purposes of this assessment, noise exposure at assessed NSRs that are below the LOAEL threshold are not considered to constitute a significant effect. Where the noise exposure at a residential NSR newly exceeds the SOAEL threshold, when any relevant noise mitigation measures are taken into account, a likely significant adverse effect in terms of the EIA Regulations is deemed to occur, in addition to a significant observed adverse effect on health and quality of life in terms of Government noise policy.

15.3.15 Determining whether a significant adverse effect occurs where noise exposure lies between the LOAEL and SOAEL thresholds requires consideration of additional quantitative and qualitative factors, namely:

- Noise level – the level of exposure between the LOAEL and SOAEL values;
- Change in noise level – the magnitude of noise level change; and
- Receptor type (community population) – the size of population exposed.

15.3.16 Additional factors to be considered include:

- Type and magnitude of effect;
- The existing ambient acoustic environment;
- Additional metrics (such as, L_{Amax});
- How effective the measures employed to mitigate effect are likely to be;
- The duration of the effect; and
- The scale of population exposed.

Construction Traffic Noise

15.3.17 The assessment of off-site construction traffic noise is based upon the principles advised in Design Manual for Roads and Bridges LA 111 ‘Noise and Vibration’ (DMRB LA 111) and the Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment (ENIA Guidelines).

15.3.18 Noise impacts along the existing highways have been assessed in terms of the change in basic noise level (BNL), which are the nominal noise levels at 10 m perpendicular to the kerb. This approach enables a relative comparison to be made of the change in noise level associated with sections of road.

15.3.19 Onsite construction traffic has been assessed using the methodology set out in BS5228-1 for the assessment of haul roads.

15.3.20 Criteria for determining the impact of construction traffic noise are set out in **Table 15.1** and **Table 15.2** of **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

Construction Noise

15.3.21 The assessment of construction noise effects associated with the Proposed Development has regard to the methodologies set out in BS 5228-1.

15.3.22 The LOAEL and SOAEL thresholds of potential effect will be determined with regard to the 'ABC Method' Category A and Category C values, respectively, as set out in Annex E of BS 5228-1 (2014) and presented in **Table 15.5** of **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

Construction Vibration

15.3.23 The assessment of construction vibration effects has regard to the methodologies set out in BS 5228-2. Construction vibration impacts have been determined with regard to Peak Particle Velocity (PPV) adverse effect levels obtained from BS 5228-2, as presented in **Table 15.6** of **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

Operation and Maintenance

15.3.24 The consideration of operational noise has regard to the methodology set out in BS 4142. Appropriate control of noise effects has been secured by setting of Environmental Sound Criteria (ESC) which have informed the design of the Proposed Development.

15.3.25 The following operational activities are considered with respect to those that have the potential to show adverse effects:

- Substations
- Transformers
- Battery storage
- Inverter equipment

15.3.26 Thresholds determining the impacts of operational noise are set out in **Table 15.1** (for daytime noise) and **Table 15.2** (for night-time noise) in **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21].**

Decommissioning

15.3.27 The noise and vibration effects of decommissioning are likely to be at worst comparable with those that would occur during construction, since the noisiest construction activities (e.g. piling, trenching and highways works) are not likely to be required or would be significantly reduced in scale during decommissioning. No additional methodology is therefore provided for the assessment of decommissioning.

Significance Criteria

15.3.28 In general terms, negligible and minor impacts indicate that an effect is likely to be not significant. Moderate and major and unacceptable impacts indicate than an effect is likely to be significant.

15.3.29 The final assessment of significance for a specific source of noise is a combination of receptor sensitivity (where applicable), magnitude of impact (either in terms of noise exposure or change in noise exposure, or a combination of the two), and consideration of context based on the remaining factors outlined below.

Magnitude of Impact

15.3.30 **Table 15.2** sets out the magnitude of impact descriptors used in the noise assessments. The descriptors relate to both a change in noise exposure and a magnitude of change in noise exposure.

Table 15.2 Magnitude of Impact Descriptors

Impact	Absolute Noise Exposure	Change in Noise Exposure
Negligible	Used to describe a noise exposure equal to or below LOAEL	Used to describe a magnitude of change in noise exposure which is imperceptible.
Minor	Used to describe a noise exposure greater than LOAEL and equal to or below SOAEL	Used to describe a magnitude of change in noise exposure which has the potential to indicate a significant effect.
Moderate	Used to describe a noise exposure greater than LOAEL and equal to or below SOAEL	Used to describe a magnitude of change in noise exposure which indicates a significant effect.
Major	Used to describe a noise exposure greater than SOAEL	
Unacceptable	Used to describe a noise exposure greater than UAEL	

Onsite Construction Noise

15.3.31 **Table 15.3** sets out the construction noise effect significance categories.

Table 15.3 Impact Magnitude - Construction Noise

Impact	Noise Level (dB(A))	Effect	Construction Noise Effect Significance
Negligible	Less than 65 dB(A)	Less than or equal to LOAEL	Not Significant
Minor	Greater than or equal to 65 dB(A) and less than 70 dB(A)	Greater than LOAEL and less than or equal to SOAEL	Not Significant subject to the employment of all practicable noise mitigation measures and consideration of additional factors (refer to **paragraph 15.3.16**).
Moderate	Greater than or equal to 70 dB(A) and less than 75 dB(A)	Greater than LOAEL and less than or equal to SOAEL	Significant if the impact will occur for 10 or more days or nights in any 15 consecutive days or nights, or a total number of days exceeding 40 in any 6 consecutive months. Noise mitigation measures may be required to avoid significant adverse effects on health and quality of life. Consideration should also be given to additional factors (refer to **paragraph 15.3.16**)
Major	Greater than or equal to 75 dB(A) and less than 85 dB(A)	Greater than SOAEL	Significant. if the impact will occur for 10 or more days or nights in any 15 consecutive days or nights, or a total number of days exceeding 40 in any 6 consecutive months. Noise mitigation measures may be required to avoid significant adverse effects on health and quality of life. Consideration should also be given to additional factors (refer to **paragraph 15.3.16**)
Unacceptable	Greater than 85 dB(A)	Greater than UAEL	Significant. if the impact will occur for 10 or more days or nights in any 15 consecutive days or nights, or a total number of days exceeding 40 in any 6 consecutive months. Noise mitigation measures will be required to avoid significant adverse effects on health and quality of life. Consideration should also be given to additional factors (refer to **paragraph 15.3.16**)

15.3.32 Development related exposures which fall between LOAEL and SOAEL (low impact) have the potential to constitute a significant effect, subject to additional considerations, namely:

- The magnitude of noise exposure;
- The change in noise exposure as a result of the construction activities; and
- The duration of the noise exposure.

15.3.33 Where development related exposures fall between LOAEL and SOAEL, noise mitigation measures, where not already defined by BPM, should be applied to minimise the adverse effect.

15.3.34 Full details of the construction noise assessment can be found in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

Onsite Construction Vibration

15.3.35 **Table 15.4** summarises the construction vibration effect significance categories.

Table 15.4 Impact Magnitude - Construction Vibration

Impact	Level of Vibration (mm/s PPV)	Effect	Construction Vibration Effect Significance
Negligible	Less than 0.3 mm/s	Less than or equal to LOAEL	Not Significant
Minor	Greater than or equal to 0.3 mm/s and less than 0.6 mm/s	Greater than LOAEL and less than or equal to SOAEL	Not Significant
Moderate	Greater than or equal to 0.6 mm/s and less than 1 mm/s	Greater than LOAEL and less than or equal to SOAEL	Significant if the impact will occur for 10 or more days or nights in any 15 consecutive days or nights, or a total number of days exceeding 40 in any 6 consecutive months. Otherwise Not Significant
Major	Greater than or equal to 1 mm/s and less than 10 mm/s	Greater than SOAEL	Significant if the impact will occur for 10 or more days or nights in any 15 consecutive days or nights, or a total number of days exceeding 40 in any 6 consecutive months. Otherwise Not Significant
Unacceptable	Greater than 10m mm/s	Greater than UEL	Significant if the impact will occur for 10 or more days or nights in any 15 consecutive days or nights, or a total number of days exceeding 40 in any 6 consecutive months. Otherwise Not Significant

15.3.36 Full details of the construction vibration assessment can be found in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

Construction Traffic Noise

15.3.37 **Table 15.5** presents the magnitude of impact scale for construction road traffic noise which has been established by reference to DMRB LA111 and the IEMA Guidelines.

Table 15.5 Changes in Road Traffic Noise (Construction)

Impact Magnitude		Short-term Change in Road Traffic Noise Level Noise Change (dB $L_{A10,18hr}$, or L_{night})
Negligible		<1.0
Minor		1.0 – 2.9
Moderate		3.0 – 4.9
Major		>5.0

15.3.38 The assessment of construction road traffic noise effects commences with an assessment of the short-term change in road traffic BNL as calculated using the CRTN methodology. A short-term change in BNL of less than 1 dB(A) represents a negligible impact and a significant effect in terms of the EIA Regulations is not deemed to occur.

15.3.39 For road links that do not currently carry traffic (e.g. internal access tracks within the site), the same noise assessment criteria have been used as for onsite construction activities (see Table 15.3).

15.3.40 Full details of the construction traffic noise assessment can be found in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

Construction Traffic Vibration

15.3.41 The same criteria have been used for the assessment of construction traffic vibration as have been used for the assessment of onsite construction vibration (see Table 15.4).

15.3.42 Full details of the construction traffic vibration assessment can be found in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].** Operational and Maintenance

15.3.43 For operational plant and equipment noise, likely significant effects in EIA Regulations terms are compared against the magnitude of noise exposure scale in and below.

Table 15.6 Criteria for magnitude of daytime operational noise impacts and night-time impacts where existing night-time background noise levels are greater than 30 dB L_{A90}, derived following BS 4142.

Magnitude of Impact	Noise Rating Level (dB L_{Aeq})	Effect	Operational Noise Effect Significance
Negligible	Less than a level of 5 dB below prevailing background.	Less than or equal to LOAEL	Not Significant
Minor	Greater than or equal to a level of 5 dB below prevailing background and less than a level of 5 dB above background	Greater than LOAEL and less than or equal to SOAEL	Not Significant
Moderate	Greater than or equal to a level of 5 dB above prevailing background and less than a level of 10 dB above background	Greater than LOAEL and less than or equal to SOAEL	Potentially significant, depending on context. Noise mitigation measures may be required in order to avoid significant adverse effects on health and quality of life.
Major	Greater than a level of 10 dB above prevailing background	Greater than SOAEL	Significant, depending on context. Noise mitigation measures are likely to be required in order to avoid significant adverse effects on health and quality of life.

Table 15.7 Criteria for magnitude of night-time operational noise impacts, derived following BS 4142.

Magnitude of Impact	Noise Rating Level (dB L_{Aeq})	Effect	Operational Noise Effect Significance
Negligible	Less than 30 dB L_{Aeq}	Less than or equal to LOAEL	Not Significant
Minor	Greater than or equal to a level of 30 dB L_{Aeq} and less than 35 dB L_{Aeq}	Greater than LOAEL and less than or equal to SOAEL	Not Significant
Moderate	Greater than or equal to 35 dB L_{Aeq} above background and less than 40 dB L_{Aeq}	Greater than LOAEL and less than or equal to SOAEL	Potentially significant, depending on context. Noise mitigation measures may be required in order to avoid significant adverse effects on health and quality of life.

Magnitude of Impact	Noise Rating Level (dB L_{Aeq})	Effect	Operational Noise Effect Significance
Major	Greater than 40 dB L_{Aeq}	Greater than SOAEL	Significant, depending on context. Noise mitigation measures are likely to be required in order to avoid significant adverse effects on health and quality of life.

15.3.44 Full details of the operational noise assessment is included in **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21].**

Decommissioning

15.3.45 It is likely that the decommissioning phase is comparable to or less than the effects presented in the assessment of construction noise, vibration and construction-related traffic in terms of their respective activities. Therefore, any significant effects arising from the construction assessment will be considered for the decommissioning phase, and the same criteria as set out in Table 15.3 and Table 15.4 above apply.

Defining the Effect

15.3.46 For the purposes of this assessment, where Moderate, Major or Unacceptable adverse impacts are identified that cannot be mitigated, the effect is considered Significant in EIA terms. Where Negligible or Minor adverse impacts are identified, the effect is considered Not Significant in EIA terms.

15.3.47 Short and medium term effects are those which occur within the timeframe of the construction phase. Short-term applies to specific activities which might result in a high level of noise over a relatively short duration (a few months to a year) whilst medium-term applies to the whole construction period. Long-term effects apply to the whole duration of the operational phase of the Proposed Development. All receptors are considered High sensitivity for the purpose of the noise assessment.

15.3.48 For construction traffic noise and vibration and onsite construction noise and vibration, all effects are adverse, local, direct and short to medium term in duration.

15.3.49 All operational noise source effects are adverse, local, direct and permanent.

Consultation

15.3.50 As set out in **ES Volume 1, Chapter 2: EIA Methodology [EN010159/APP/6.2],** a number of consultation activities have been undertaken. **ES Volume 3, Appendix 2.2: ES Response to PINs Scoping Opinion [EN010159/APP/6.21]**

summarises the EIA Scoping Opinion for the Proposed Development and where elements have been agreed to be scoped out of the EIA.

15.3.51 Any consultation elements which have been raised and addressed post-scoping, are detailed within the Consultation Report (see **Consultation Report [EN010159/APP/5.1]**).

15.3.52 No further specific technical consultations have been undertaken, which have informed the technical assessment as presented in this Chapter.

Assumptions, Exclusions and Limitations

15.3.53 Construction activity is anticipated to commence in 2027 and will continue for a period of 2 years (24 months). The Proposed Development would be operational by 2030. At this stage phasing of works in unknown until a construction contractor has been appointed. The assessment assumes the maximum effect scenario of construction works happening across the whole Order Limits simultaneously for the full construction period, although this is unlikely. It is more likely that works would move across the Order Limits over this period, therefore, the noise and vibration assessment is considered conservative.

15.3.54 At the present time, full details of the precise plant and equipment that will be used for the construction of the Proposed Development are not known, as this will not be decided until a construction contractor has been engaged. As such, the construction noise and vibration assessments make use of the plant details as listed in **ES Volume 1, Chapter 5: Description of the Proposed Development [EN010159/APP/6.5]** and assumed construction plant lists, that have been based on past experience of similar projects. Noise and vibration predictions for construction equipment have been based on standard source levels provided in BS 5228. These assumptions are detailed in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21].**

15.3.55 Similarly, the precise details of operational plant and equipment, in particular the Batter Energy Storage System (BESS), substation and Power Conversion Station (PCS) equipment have not been determined. This will be the subject of a future design exercise, in order to make best use of battery and solar technology that is evolving over time. The operational assessment has therefore been based on indicative plant and equipment and indicative layouts in order to carry out an assessment that is likely to be representative of the operation of the Proposed Development. These assumptions are detailed in **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21].**

15.4 Baseline Conditions

Current Baseline Conditions

15.4.1 Baseline noise conditions have been determined through a baseline noise measurement survey which was carried out from Thursday 15th to Thursday 22nd February 2024.

15.4.2 The survey was designed to capture noise levels across the Order Limits during the daytime (0700 hrs to 2300 hrs), evening (1900 hrs to 2300 hrs) and night-time (2300 hrs to 0700 hrs) periods using monitoring locations which are representative of the assessed receptors. **ES Volume 3, Figure 15.3: Baseline Noise Monitoring Locations [EN010159/APP/6.20]** presents the noise monitoring locations. Full details of the equipment used for the noise survey, photographs of the installed monitoring equipment and the details of the measurements obtained can be found in **ES Volume 3, Appendix 15.1: Summary of Legislation, Policy and Technical Guidance [EN010159/APP/6.21].**

15.4.3 The dominant contributors to the existing baseline acoustic environment at the measurement locations (as determined during equipment deployment and collection) were noted to include:

- Road traffic noise from A57;
- Road traffic noise from A1;
- Road traffic noise from A113;

15.4.4 A summary of the baseline noise conditions derived for the Proposed Development, from the seven monitoring locations shown in **ES Volume 3, Figure 15.1: Strategic Noise Mapping Results - Daytime. [EN010159/APP/6.20]** are presented in **Table 15.8**. The noise levels are rounded to the nearest whole decibel. Further information on the baseline noise conditions is presented in **ES Volume 3, Appendix 15.2: Baseline Noise Survey [EN010159/APP/6.21].**

Table 15.8: Baseline Noise Survey Summary

Measurement Location	Period	Measurement Descriptor (dB(A))				
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90} (Mean)	L_{A90} (Mode)
Location A	Day	51	88	47	39	37
	Evening	42	74	39	33	33
	Night	37	72	36	32	30

Measurement Location	Period	Measurement Descriptor (dB(A))				
		L_{Aeq}	L_{Amax}	L_{A10}	L_{A90} (Mean)	L_{A90} (Mode)
Location B	Day	46	82	45	39	41
	Evening	37	75	38	33	34
	Night	35	65	35	29	26
Location C	Day	54	96	56	46	49
	Evening	48	71	51	36	40
	Night	42	69	44	30	27
Location D	Day	64	101	68	48	49
	Evening	57	80	58	39	38
	Night	53	80	47	35	35
Location E	Day	46	77	48	41	42
	Evening	37	60	39	32	32
	Night	33	64	33	27	25
Location F	Day	44	94	43	36	34
	Evening	34	56	35	31	29
	Night	33	54	34	30	28
Location G	Day	65	93	69	53	54
	Evening	60	79	64	39	36
	Night	55	77	52	30	30

Sensitive Receptors

15.4.5 Noise and vibration sensitive receptors have been identified by reference to available local mapping data. These include residential properties in the following areas:

- Properties at the eastern edge of Darlton;
- Properties along the A57 between Darlton and Dunham on Trent, including Goosemoor Cottage, Whimpton House and Field House Farm;

- The village of Ragnall;
- Farms between Darlton and Ragnall, including America Farm, Farr Hill Farm and Vicarage Farm;
- The village of Fledborough and nearby properties, including North Farm, Fledborough House Farm and Station House;
- The village of Skegby and farms to the north of Skegby, including Babbington Springs Farm, Woodcoates, and Gibraltar Farm;
- The village of High Marnham;
- The villages of North and South Clifton;
- Properties along Moor Lane, including Wheatholme, Birkland Barn, Amblerod Farm, The Grange, Woodstock, The Gatehouse, Cosy Cottage and Carr Farm; AND
- Properties along the A57 between Newton on Trent and Drinsey Nook, including Silver Trees Farm, Birchlands Farm (including the residential properties to the north of Birchlands Farm) and Woodside Farm.

Future Baseline Conditions

15.4.6 Current baseline noise levels around the site are typical low, especially at night. The exception to this is locations closest to the A57 (i.e. properties to the north of the proposed site) which experience moderately high levels of road traffic noise, mainly during daytime.

15.4.7 Whilst it is possible that baseline noise levels could change between the current year and the future baseline year, it is unlikely that any changes would alter the outcome of the noise assessment. This is due to the fact that road traffic flows would need to change by a relatively large percentage in order to materially affect baseline noise levels (e.g., assuming traffic composition stays relatively constant, a approximately 10% increase in traffic flows would be needed to result in an approximately 1 dB increase in baseline noise levels, with a doubling or halving of road traffic flows only resulting in an increase or decrease in road traffic noise of 3 dB).

15.4.8 With regard to the operational noise assessment, it is the low baseline noise levels, especially during night-time, that determine the worst-case operational noise impacts. A reduction in background noise levels during the night would not affect the outcome of the assessment, as the operational noise criteria are already the lowest that would apply under the BS 4142 assessment methodology. An increase in background noise levels during the night that is of sufficient magnitude to affect the outcome of the assessment is also considered unlikely.

15.4.9 On balance, it is considered that the existing baseline monitoring (2024) is representative of the future baseline year (2027).

15.5 Environmental Measures

Construction

15.5.1 Measures will be undertaken during the construction phase to minimise disruption and manage the adverse effects of the construction activities.

15.5.2 The Applicant has committed to implementing a Construction Environmental Management Plan (CEMP) and Construction Traffic Management Plan (CTMP) during construction activities for the Proposed Development, an outline CEMP (oCEMP) and outline CTMP (oCTMP) are presented in **Outline Construction Environmental Management Plan [EN010159/APP/7.4]** and **Outline Construction Traffic Management Plan [EN010159/APP/7.9]**, respectively. The CEMP defines the key construction activity principles that will be adhered to and developed during construction activities, including recommendations that represent good practice specific to the noise and vibration assessment, based on the assumed construction plant list and working methodologies. It also includes details on roles and responsibilities, working hours, control measures and activities to be undertaken to minimise environmental effects as well as monitoring and record-keeping requirements. In addition, it will outline the methodology to be adopted should a complaint be received regarding excessive noise and/or vibration levels.

15.5.3 In addition to the above, the trenchless crossing compounds for the cable across the River Trent will be located as far as is reasonably practicable, and not within 100 m of noise sensitive receptors (see **Outline Construction Environmental Management Plan [EN010159/APP/7.4]).** This is to reduce the potential for noise from directional drilling cable works, which may occur in evening or night-time periods, to adversely affect local residents.

Operation and Maintenance

15.5.4 The main sources of noise and vibration during operation will be the BESS and substation equipment. The design parameters for the Proposed Development have been established on the basis of locating potential sources of noise as far as reasonably practicable from noise sensitive receptors. The substation and BESS equipment in particular has been located at a distance of at least 300 m from residential properties in order to reduce the likelihood of disturbance due to noise from fixed plant. This distance has been included within the noise modelling of the substation and BESS equipment.

15.5.5 In addition, the BESS units will make use of the manufacturer's noise reduction measures to reduce noise from the BESS units at source. The BESS units will also be orientated to make sure, as far as is practicable, that the main noise and vibration generating elements of the BESS units (such as ventilation openings) are facing away from nearby residential properties. Taking account of the Rochdale Envelope (see **ES Volume 1, Chapter 2: EIA Methodology [EN010159/APP/6.2]**), the modelling does not take into account of these

additional measures, and the results presented in the assessment are therefore considered conservative.

15.5.6 In addition to the above, the PCS / inverter units that are situated within and close to the proposed solar arrays will also generate some noise. The precise locations of the PCS units will be determined during the detailed design of the Proposed Development. In most cases this is likely to result in the PCS units being at least 200 m from residential properties. Where not feasible, the noise levels from the PCS will not exceed the limits in the ES chapter and additional noise mitigation will be provided to ensure that is the case.

15.5.7 During the operational phase of the Proposed Development, onsite activities will be minimal and will principally relate to the vegetation management, equipment maintenance and servicing, replacement and renewal of any components that fail, and monitoring and inspection, to ensure the continued effective operation of the Proposed Development. Any replacement of the equipment is likely to be lower than the effects predicted for the construction phase (which assumes all works is occurring simultaneously). Therefore, no specific measures are required to limit noise during maintenance activities.

Decommissioning

15.5.8 At this stage, the precise details of decommissioning activities that would be required are not available, however it is likely that they would be similar in nature to construction activities. As such, environmental measures incorporated into decommissioning activities are likely to be no worse than those described above for construction. An outline Decommissioning Environmental Management Plan (oDEMP) (see **Outline Decommissioning Environmental Management Plan [EN010159/APP/7.6])** has been prepared to mitigate the likely significant adverse effects during the Decommissioning Phase.

15.6 Assessment of Likely Significant Effects

Construction

15.6.1 An assessment of the likely noise impacts of the Proposed Development during construction has been set out in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21]**. This assessment has been based on the construction noise study areas shown in **ES Volume 3, Figure 15.5: Construction Traffic Noise Study Area and Sensitive Receptors [EN010159/APP/6.20], ES Volume 3, Figure 15.6: Construction Noise Study Area and Sensitive Receptors [EN010159/APP/6.20]** and to **ES Volume 3, Figure 15.7: Construction Vibration Study Area and Sensitive Receptors [EN010159/APP/6.20]** for construction traffic noise and vibration impacts and onsite construction activities respectively.

Construction Traffic Noise and Vibration

15.6.2 The construction traffic noise assessment has identified two road links (Roadwood Lane and Crabtree Lane) as experiencing minor to moderate (1.0 and 3.9 dB) increases in road traffic noise levels respectively during construction. All other road links are identified as having negligible (<1 dB) increases in noise levels. There are no properties within the construction traffic study area in the vicinity of Crabtree Lane or the section of Roadwood Lane that would carry construction traffic, therefore construction traffic impacts at residential properties are predicted to be, at worst, negligible. Noise effects due to construction traffic are therefore **not significant** in EIA terms.

15.6.3 The construction traffic vibration assessment, also set out in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21]**) has identified that there are no sensitive receptors that would experience greater than a negligible vibration impact due to construction traffic. As such, vibration effects due to construction traffic are considered **not significant** in EIA terms.

Onsite Construction Noise

15.6.4 The assessment of noise from onsite construction activities is also set out in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21]**. This assessment identifies the main sources of construction noise as: the piling of the foundations for the solar module support structures, concreting works to construct the foundations of the substation and BESS compounds and construction of access roads within the site. The assessment is summarised in the table below for the worst-case activities.

Table 15.9 Summary of construction noise impacts (See ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21] for full details)

Construction Phase	Predicted Noise Levels at Most Affected Receptors (dB $L_{Aeq,T}$)	Summary of Impacts (unmitigated, not considering duration)	Summary of Impacts (mitigated, considering duration)	Receptors
Trenching	65 – 70 dB	Minor to Moderate	Minor	1 and 2 Skegby House Cottage, Wheatholme Farm, 1 Long Row, Northfield Farm

Construction Phase	Predicted Noise Levels at Most Affected Receptors (dB $L_{Aeq,T}$)	Summary of Impacts (unmitigated, not considering duration)	Summary of Impacts (mitigated, considering duration)	Receptors
Piling	66 – 79 dB	Minor to Major	Minor	Fledborough House Farm, Wheatholme Farm, 1 to 4 Long Row, Mill Farm Cottage, House Farm, The Station, Northfield Farm, Hall Farmyard, 1 to 3 Park Farm Cottages, Birchlands Farm
Access track construction / highways works	66 – 93 dB	Minor to Unacceptable	Minor	Far Hill Farm, Station House, 1 and 2 Station Cottage, The Chase, The Gables
BESS and substation construction	N/A	Negligible	Negligible	N/A

15.6.5 These activities, and in particular the piling of the module support structures and the construction of site access roads, will only take place for a relatively short period of time before work moves on to another location. As such, short term construction impacts are anticipated for limited periods whilst construction works are taking place at the closest locations to residential properties. As such, the noise impacts of construction activities within the site are considered to be **not significant** in EIA terms.

Onsite Construction Vibration

15.6.6 The assessment of construction vibration impacts is again set out in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21]**. The construction activities that have the highest likelihood of generating vibration impacts at the nearest sensitive receptors to the Proposed Development are: piling of the foundations for the solar module support structures and construction of site access roads (specifically, vibratory compaction activities). The assessment has identified that vibration impacts at the nearest residential receptors to the proposed onsite construction activities (Station House, 1 and 2 Station Cottages and The Chase) are likely to lead to relatively high levels of vibration (up to 2.2 mm/s PPV) for short durations (likely a period of hours), when the work is taking place at the nearest points to the relevant receptors. Given the short duration of exposure, effects associated with onsite construction vibration are considered Minor and **not significant** in EIA terms.

15.6.7 A separate assessment has been carried out for potential noise impacts associated with the trenchless crossing works that will be required in order to install the cable route between the eastern and western BESS compounds under the River Trent. This assessment is again presented in **ES Volume 3, Appendix 15.3: Construction Noise and Vibration Assessment [EN010159/APP/6.21]**. Noise from the trenchless crossing works will be similar in nature to other typical construction activities, however for practical reasons, longer work hours may be required for trenchless crossing works. This is because, once a bore is started, it is not possible to stop the drill without risking the drill equipment becoming stuck in the bore. Consequently, it is possible that trenchless crossing work may need to take place in the evening or during some part of the night-time hours, therefore flexibility around allowable hours for trenchless crossing will be needed.

15.6.8 Calculations indicate that at worst, minor noise impacts (noise levels of up to 47 dB $L_{Aeq,T}$) are likely to occur if trenchless crossing works need to take place during the night. It should also be noted that trenchless crossing works will only take place for a very limited duration and that evening / night-time work may not be required for all bores. As such, given the very limited duration, noise impacts associated with the trenchless crossing works are considered **not significant** in EIA terms. Trenchless crossing works will take place at distances that are too far from residential properties to lead to perceptible vibration impacts, therefore vibration from trenchless crossing works is considered **not significant** in EIA terms.

Operation and Maintenance

15.6.9 Operational noise from the proposed BESS and substation has been assessed in **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21]**. The properties most likely to experience the greatest noise impacts (as they are the closet to the BESS and substation compounds) are Gibraltar Farm, at a distance of 300 m from the western BESS compound and Northfield Farm at a distance of 330 m from the eastern BESS compound. Predicted operational noise levels at these properties without additional mitigation indicate moderate operational noise impacts during the daytime and moderate to major operational noise impacts during the night-time due to BESS and substation equipment.

15.6.10 As such, additional mitigation will be required in order to reduce noise levels at the nearest residential properties. As discussed in **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21]**, the operational noise assessment is based on current generation BESS technology, and assuming very conservative assumptions for the operational conditions of the BESS units (including ventilation openings are facing residential properties and no noise reduction measures are included). As such, it is very likely that night-time noise levels, and therefore noise impacts, will be lower than those predicted. Consequently, BESS and substation equipment will be specified that will result in a maximum noise level at the nearest noise sensitive receptors during night-time hours of 35 dB(A). This will result in minor noise impacts at these receptors, which would be considered **not significant** in EIA terms.

15.6.11 The operational noise assessment contained in **ES Volume 3, Appendix 15.4: Operational Noise Assessment [EN010159/APP/6.21]** also includes an assessment of noise from the PCS units / inverters that are situated close to the solar modules. Only Minor operational noise impacts are predicted from the PCS units, therefore operational noise from the PCS units is considered **not significant** in EIA terms.

Decommissioning

15.6.12 At this stage, details of works that will be required during decommissioning are not available. It is, however, likely that decommissioning works will be of a similar nature to those required during construction, therefore noise and vibration impacts during decommissioning are likely to be no worse than those during construction. For this reason, it is expected that the effects of both noise and vibration during decommissioning will be **not significant** in EIA terms.

15.7 Summary

15.7.1 **Table 15.10** sets out a summary of the likely significant environmental effects considered.

Table 15.10 Summary of Significant Environmental Effects

Receptor	Embedded Measures	Description of the Effect	Direct / Indirect	Duration	Geographic Scale	Nature of Effect	Significant / Not Significant	Next Steps
Construction								
Residential receptors	CEMP / CTMP	Construction traffic noise	Direct	Short Term	Local	Negligible	Not Significant	CEMP / CTMP to be agreed
Residential receptors	CEMP / CTMP	Construction traffic vibration	Direct	Short Term	Local	Negligible	Not Significant	CEMP / CTMP to be agreed
Residential receptors	CEMP	Onsite construction noise	Direct	Short Term	Local	Minor	Not Significant	CEMP to be agreed
Residential receptors	CEMP	Onsite construction vibration	Direct	Short Term	Local	Minor	Not Significant	CEMP to be agreed
Residential receptors	CEMP	Trenchless crossing	Direct	Short Term	Local	Minor	Not Significant	CEMP to be agreed
Operation								
Residential Receptors	Setback distance from properties	Operational noise	Direct	Long Term	Local	Minor	Not Significant	Detailed design and selection of operational plant and equipment

Receptor	Embedded Measures	Description of the Effect	Direct / Indirect	Duration	Geographic Scale	Nature of Effect	Significant / Not Significant	Next Steps
Decommissioning								
Residential receptors	-	Decommissioning traffic noise	Direct	Short Term	Local	Negligible	Not Significant	-
Residential receptors	-	Decommissioning traffic vibration	Direct	Short Term	Local	Negligible	Not Significant	
Residential receptors	-	Onsite decommissioning noise	Direct	Short Term	Local	Minor	Not Significant	-
Residential receptors	-	Onsite decommissioning vibration	Direct	Short Term	Local	Minor	Not Significant	-

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