Tillbridge Solar

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PEI Report Volume I Chapter 13: Noise and Vibration

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tillbridgesolar.com

@: info@tillbridgesolar.com T: 0800 046 9643

13. Noise and Vibration

13.1 Introduction

13.1.1 This chapter presents the findings of an assessment of the likely significant effects on noise and vibration as a result of the Scheme. For more details about the Scheme, refer to **PEI Report Volume I Chapter 3: Scheme Description**.

13.1.2 This chapter assesses noise and vibration effects on human receptors and does not include the assessment of noise and vibration on ecological or heritage receptors. Where relevant, the impacts of noise and vibration on heritage receptors would be assessed in **PEI Report Volume I Chapter 7: Cultural Heritage**, and the impacts of noise and vibration on ecological receptors would be assessed in **PEI Report Volume I Chapter 8: Ecology and Nature Conservation**.

13.1.3 This chapter is supported by the following appendices in **PEI Report Volume II**:

- **Appendix 13-1: Legislation and Planning Policy**;
- **Appendix 13-2: Acoustics Terminology**;
- **Appendix 13-3: Baseline Noise Survey**; and
- **Appendix 13-4: Noise Modelling**.

13.1.4 This chapter is supported by the following figure in **PEI Report Volume III**:

- **Figure 13-1: Noise Sensitive Receptors and Noise Monitoring Locations**.

13.2 Legislation and Planning Policy

13.2.1 Relevant policy documents are listed below. More detailed information regarding legislation and planning policy is presented in in **PEI Report Volume II Appendix 13-1**. Legislation, planning policy, and guidance relating to Noise and Vibration, and pertinent to the Scheme comprises:

Legislation

- The Control of Pollution Act 1974 (CoPA) (Ref 13-1) requires that Best Practicable Means (BPM), as defined in Section 72 of the CoPA, are adopted to control construction noise on any given site. Sections 60 and 61 of the CoPA provide the main legislation regarding enabling works and construction site noise and vibration; and
- The Environmental Protection Act 1990 (EPA) (Ref 13-2) sets out the obligations and responsibilities surrounding statutory noise (and vibration) nuisance, including the obligations of a Local Authority to investigate complaints and take enforcement action where appropriate.

National Planning Policy

13.2.2 The Scheme must have regard to the relevant policies of the National Planning Policy Framework (NPPF) (Ref 13-3) and relevant National Policy Statements (NPS). Key aspects of the NPPF and relevant NPSs, which have been considered during the development of this chapter, are outlined below:

- Overarching National Policy Statement (NPS) for Energy (EN-1) (Ref 13-4) with particular reference to Section 5.11, sets out national planning policy with respect to noise emissions in relation to energy development, including the requirements for any associated noise assessment and the aims of the policy in relation to noise emissions;
- NPS for Renewable Energy Infrastructure (EN-3) (Ref 13-5) highlights the need for good design in respect of noise in order to minimise and mitigate noise impacts;
- Draft Overarching National Policy Statement for Energy (EN-1) (Ref 13-6) reiterates the aims of the policy in respect to noise emissions, also expands upon the requirements for noise assessments including reference to health and wellbeing, and highlighting the need to evaluate mitigation measures and best available techniques to avoid noise impacts, while also allowing for some flexibility for noise impacts to be controlled through environmental permits and parallel tracking where appropriate; and
- Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) (Ref 13-7) includes the additional consideration of transport noise and vibration associated with solar photovoltaic generation schemes;
- National Planning Policy Framework (NPPF) (Ref 13-3), with particular reference to paragraphs 174 and 185 in relation to noise, sets out requirements for schemes to avoid unacceptable levels of noise pollution and to improve the local environment wherever possible, as well as ensuring that new development is appropriate for its location and its effects, including mitigating and reducing to a minimum adverse impacts from noise; and
- Noise Policy Statement for England (NPSE) (2010) (Ref 13-8) seeks to clarify the underlying principles and aims in existing policy documents, legislation, and guidance that relate to noise. The statement applies to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise.

National Guidance

- Planning Practice Guidance: Noise (Ref 13-9) provides guidelines that are designed to assist with the implementation of the noise requirements set out in the NPPF, and provides guideline descriptions to assist in identifying when adverse and significant adverse effects occur.

Local Planning Policy

Lincolnshire County Council

- The Central Lincolnshire Local Plan Adopted April 2023 (Ref 13-10) refers to noise and vibration, with particular reference Policy S14, general criteria for the acceptability of renewable energy proposals, requiring that impacts (including noise) on the amenity of sensitive neighbouring uses are acceptable.

Bassetlaw District Council

- The adopted Bassetlaw Core Strategy and Development Management Policies (2011) (Ref 13-11), with particular reference to Policy DM10, which refers to the need to demonstrate that developments will not result in unacceptable impacts in terms of noise; and
- The emerging Bassetlaw Submission Local Plan (2022) (Ref 13-12), with particular reference to Policy 48, which refers to designing and constructing developments to avoid and minimise impacts on the amenity of existing and future users, individually and cumulatively.

13.3 Assessment Assumptions and Limitations

13.3.1 This chapter forms a preliminary assessment which has been based on available information at the time of preparing the PEI Report. A final assessment will be undertaken as part of the EIA and will be reported in the ES that will be submitted with the DCO submission.

13.3.2 There is a greater level of certainty around the design proposals for the Principal Site due to the provision of Indicative Site Layout Plan (**PEI Report Volume III Figure 3-1**), with some details of the location of the Cable Route Corridor yet to be finalised. As a result, some suitably precautionary assumptions have been made, in particular relating to the baseline sound levels at receptors near to the Cable Route Corridor, which are generally assumed to be similar to receptors near to the Principal Site due to the presence of generally similar sound sources and the low (worst-case) baseline values identified. Baseline traffic information is also not yet available for the area, which limits the extent to which changes in traffic noise can be assessed.

13.3.3 Where the assessment can be refined and improved at the ES stage through further baseline measurements, these will be conducted once details around the Cable Route Corridor and traffic information are available.

13.3.4 Some flexibility is required in order to develop the design proposals for the ES stage and the need to maintain flexibility for the detailed design stage. For example, the precise location of solar stations and PV module layout may require some alteration due to new information regarding ground conditions or access routes.

13.3.5 The assessment makes some worst-case assumptions and relies on some indicative information. In combination, these should allow sufficient flexibility when finalising the design and construction of the Scheme.

Baseline Assumptions and Limitations

13.3.6 Baseline noise monitoring undertaken in July 2022 is considered to be representative of the future baseline scenarios. It is currently anticipated that (subject to the necessary consents being granted) construction work will commence in Q3 2025 and is anticipated to last 24 months. It is anticipated that commercial operations will commence from Q3 2027. The operational life of the scheme is anticipated to be approximately 40-60 years, although the operational life may extend beyond this date, but this does not affect this assessment.

13.3.7 While some temporary changes in baseline noise levels may occur in some localities due to temporary noise sources such as construction works, no developments are understood to be proposed in the area that would lead to a major additional noise source once operational and notably alter the local baseline noise environment prior to 2027 (e.g. highway or railway schemes, industrial facilities).

13.3.8 Any measurement of existing ambient or background sound levels will be subject to a degree of uncertainty. Environmental sound levels vary between days, weeks, and throughout the year due to variations in source levels and conditions, as well as meteorological effects on sound propagation and other factors. Hence, any measurement survey can only provide a sample of the ambient levels. Every effort has been made such that measurements were undertaken in such a way as to provide a representative sample of conditions, such as avoiding periods of adverse weather conditions, and school holiday periods (which are often considered to result in atypical sound levels). However, a small degree of uncertainty will always remain in the values taken from a survey. A precautionary approach is adopted when analysing such data to provide a robust assessment.

Construction and Decommissioning Assumptions and Limitations

13.3.9 The assessment of construction and decommissioning noise (and vibration) has considered construction and decommissioning activities that have the potential to result in significant effects on identified receptors, based on information presented in **PEI Report Volume I Chapter 3: Scheme Description**, previous experience of similar schemes and professional judgement. These assessments are based on a reasonable representative worst-case scenario.

13.3.10 Construction and decommissioning noise predictions have been undertaken using the computer modelling software SoundPLAN ® (version 8.2) (Ref 13-12), based on expected plant items that are typically used in solar developments for the purposes of carrying out a quantitative assessment at this stage. Construction and decommissioning plant assumed in this assessment are summarised in **PEI Report Volume II Appendix 13-4**.

13.3.11 Predictions have been undertaken using BS 5228:2014+A1:2019 ‘Code of practice for noise and vibration control on construction and open sites’ (Ref 13-14) methodologies and AECOM library data of sound sources associated

with the proposed construction and decommissioning activities. These sound sources are taken to be representative of the plant and/or activities that will be used during the construction and decommissioning process of the Scheme. Noise predictions were carried out to represent a conservative scenario where construction and decommissioning plant is operational nearest to the identified receptors and does not take into account quieter periods when limited activities take place or at further distances. Consequently, noise predictions may overestimate construction and decommissioning noise levels and are therefore considered to be a reasonable likely worst case.

13.3.12 As part of the installation of solar panel modules, frame mounts are likely to be required to be installed into the ground through a form of piling. As the frame mount installation method has not yet been finalised, it is assumed as a reasonable worst-case that an auger piling method will be adopted, which is a typical approach in similar developments.

13.3.13 Noise predictions of construction and decommissioning vehicle movements have been undertaken using the method given in BS 5228-1 (Ref 13-14) Annex F F.2.5, which are compared to baseline noise levels adjacent to the primary access road (A631).

13.3.14 Noise effects during the decommissioning phase of the Scheme is anticipated to be similar or less than noise effects during the construction phase. The decommissioning works would likely be shorter duration and less intensive, with fewer noisy activities (for example without the need for piling) than in the construction phase. The noise assessment is therefore presented jointly for the construction and decommissioning phases, with construction predictions and activities considered representative (or an overestimate) of the decommissioning phase. It is assumed, conservatively, that the significance of effects during decommissioning will be the same as for construction.

13.3.15 Baseline traffic data is not yet available for use in determining the construction traffic noise impacts. At this stage, a more limited calculation method has been used to identify the likely risks for construction traffic relating to the access points on the A631. Where construction traffic routes are away from major roads, such as for the construction of the Cable Route Corridor, greater impacts may occur. This will be assessed in detail based on baseline traffic flow information at the ES stage.

Operational Assumptions and Limitations

13.3.16 A series of assumptions were made for the generation of the operational noise model (see **PEI Report Volume II Appendix 13-4**), as follows:

- Digital noise modelling of the Scheme once it is operational has been based on the parameters set out in Indicative Site Layout Plan (**PEI Report Volume III Figure 3-1**);
- Sound level data for operational noise-producing plant (i.e. inverters, transformers, BESS units, and tracking motors assumed to be present as a worst-case prediction) have been based on industry sound pressure level measurement data (see **PEI Report Volume II Appendix 13-4**);

- The degree to which surrounding land uses are able to attenuate noise through ground absorption has been modelled based on recommended absorption coefficients from OS Mapping land use categories, and have been assumed to be largely soft (G=0.8) in all areas not defined;
- Air temperature was assumed to be 10 degrees and humidity 70%, which are considered typical annual average weather conditions for the UK;
- Three orders of reflection were modelled, i.e. the model calculations include contributions due to sound waves that have been reflected up to three times (e.g. due to objects);
- Variation in ground heights (i.e. topography) has been incorporated into the noise modelling; and
- All receptor points have been set at a standard height of 1.5 m above local ground levels (representative of ground floor windows) for daytime noise and 4 m above ground (representative of first floor windows) for night-time noise, as is standard industry practice.

13.3.17 Operational noise has been predicted with all plant being in maximum operation at all times of day as a worst-case assumption.

13.3.18 BESS cooling fans will operate dependent on ambient temperatures and would not be in a full mode of operation during cooler temperatures but have been assumed to operate fully at all times as a reasonable worst-case.

13.3.19 Sound level data for transformers in reduced modes of operation are not available from manufacturers and therefore not available for the purposes of this assessment. Noise predictions are based on inverters and cooling fans operating at full load so are likely to be overestimated. Consequently, this is considered to represent a reasonable worst-case assessment.

13.3.20 No major vibration sources are envisaged to be introduced as part of the Scheme and as such there an assessment of operational vibration was scoped out of the EIA (see **PEI Report Volume II Appendix 1-1**).

13.4 Assessment Methodology

Study Area

13.4.1 The study area was defined to include noise and vibration receptors likely to be at risk of possible direct and indirect impacts from the Scheme, termed the Zone of Influence (ZoI), which forms the study area for the assessment.

13.4.2 The potential ZoI for construction noise effects from the Principal Site and the Cable Route Corridor will include receptors within 300m from the Scheme Boundary, based on the results from preliminary modelling, and based on guidance in BS 5228-1 stating that construction noise predictions are generally reliable up 300m.

13.4.3 The potential ZoI for operational noise effects is considered to be 500m from the Scheme Boundary, based on the results from preliminary modelling. It is considered that receptors further than 500m from the Scheme Boundary will experience considerably lower levels of noise and vibration emissions as

these will attenuate over distance, resulting in negligible noise and vibration effects from the Scheme.

Sensitive Receptors

13.4.4 Potential sensitive receptors (i.e. buildings whose occupants may be disturbed by adverse noise and vibration levels, and structures that are sensitive to vibration) have been taken into consideration when assessing the effects associated with noise and vibration levels from the construction and operational phases of the Scheme.

13.4.5 The type of noise-sensitive receptors that may experience significant effects due to the construction and operation of the Scheme are identified in Table 13-1 as residential and non-residential. Non-sensitive locations include those where no human or other noise-sensitive activity takes place, or where such activity would not be affected by noise from the Scheme, such as barns, outbuildings, or industrial facilities.

13.4.6 It is acknowledged that Public Rights of Way (PRoWs) also have the potential to be impacted by noise from the Scheme. However, given the transient usage of a PRoW, a material change in the experience of using the PRoWs as a whole, which could affect people's health or quality of life, is not anticipated and therefore PRoWs have not been considered as sensitive receptors.

Table 13-1: Receptor Types

Receptor Group	Receptors in Group
Residential	Individual dwellings and private open spaces (e.g. gardens)
Non-residential	Non-residential community facilities such as schools, hospitals, places of worship, and noise sensitive commercial properties

13.4.7 The effect of noise and vibration generated during the construction and operational phases of the Scheme are considered at nearby sensitive receptors. A number of receptors that may be affected have been considered in this assessment. The sensitive receptors considered are the nearest receptors to the Site (i.e. the receptors that will experience the highest levels of noise and vibration). Although noise and vibration may be perceivable at other receptors in the area around the Scheme, effects will not be significant if they are suitably controlled at the identified receptors.

13.4.8 Noise-sensitive receptors have been identified through a desktop study of aerial imagery and mapping across both the Principal Site and Cable Route Corridor, and are presented in Figure 13-1 and summarised in Table 13-2.

13.4.9 Some receptors identified in the EIA Scoping Report (**PEI Report Volume II Appendix 1-2**) have been removed due to refinement of the proposed Cable Route Corridor. The receptors removed are those no longer within the study area.

Table 13-2: Sensitive Receptors

Receptor Reference	Location	Description	Approximate Co-ordinates
R1	Church Farm, School Lane	Residential	488116, 389930
R2	Moorlands Magin Moor, Harpswell Lane A631	Residential	489616, 390827
R3	Hemswell Grange, Harpswell Lane A631	Residential	490744, 390707
R4	Harpswell Hill Mobile Home Park, Harpswell Lane	Residential	492899, 390218
R5	Harpswell Village	Residential	493239, 389971
R6	Heapham Village	Residential	488162, 388565
R7	Springthorpe Grange, School lane	Residential	489417, 390114
R8	Harpswell Low Farm, Harpswell Lane A631	Residential	490489, 390411
R9	Grange Cottage / Grange Bungalow / Harpswell Grange, Harpswell Lane A631	Residential	491328, 390489
R10	Hermitage Low Farm House, Common Lane	Residential	492132, 388980
R11	Billyards Farm, Common Lane	Residential	491152, 388353
R12	Manor Farm / Low Farm Cottage / Heapham Cliff Farm, Common Lane	Residential	489993, 388333
R13	Grange Farm / South View, Common Lane	Residential	489176, 388373

Receptor Reference	Location	Description	Approximate Co-ordinates
R14	Glentworth Grange / Low Farm / Spitals Farm / Orchard House / Westlands Farm, Kexby Road	Residential	492033, 387121
R15	Northlands Cottages, Northlands Road	Residential	493584, 388291
R16	Tilby-Dale, Stow Road B1231	Residential	487955, 383435
R17	Sort Hills, Willingham Road	Residential	485564, 382477
R18	Marton Village	Residential	484046, 381932
R19	Trent Port, Trent Port Road	Residential	483413, 381534
R20	Cottam Village	Residential	481894, 380113
R21	Westbrecks Farm, Westbrecks Lane	Residential	480137, 380016
R22	Moor Farm	Residential	489898, 384216
R23	Lowfield Farm	Residential	489870, 384431
R24	Davidson's Farm / Ivy Cottage / Magin Moor Farm	Residential	489961, 384848
R25	Parish Farm	Residential	490174, 386217
R26	Low Field Farm	Residential	490469, 387321
R27	1-4 Flat Tops, Normanby	Residential	488212, 382810
R28	Normanby by Stow Village	Residential	488110, 383086
R29	Stow Park	Residential	485534, 381513
R30	Grange Farm Stables / Marton Grange	Residential	485024, 381712

Receptor Reference	Location	Description	Approximate Co-ordinates
R31	Poplar Farm	Residential	484528, 381540
R32	63-67 / 66-80, High Street, Marton	Residential	484049, 381212
R33	Brampton Grange	Residential	484250, 380991
R34	Manor Farm, Tillbridge Lane	Residential	486141, 381506
R35	Danes Farm / Highfield Farm	Residential	486980, 381489
R36	Manor Court, Stow	Residential	487907, 381939
R37	22-29, Church Road, Stow	Residential	488037, 382314
R38	Church View Farm	Residential	488353, 382566
R39	Glentworth Village	Residential	479771, 379103
NR1	All Saints Church, Heapham	Non-residential	488254, 388817
NR2	St Chad's Church, Harpswell	Non-residential	493099, 389745
NR3	St Michael's Church, Glentworth	Non-residential	494527, 388138

13.4.10 Receptor locations R16-24 and R27-38 relate to the Cable Route Corridor only. Other receptor locations may relate to the Principal Site and/or Cable Route Corridor, especially where there is overlap between these.

Baseline Noise Monitoring Methodology

13.4.11 Baseline noise monitoring has been carried out to establish the existing noise climate in the area around the Principal Site. The monitoring procedures followed guidance from BS 7445-1:2003 'Description and environment of environmental noise – Part 1: Guide to quantities and procedures' (Ref 13-17) and BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (Ref 13-18). All noise measurements included $L_{Aeq,T}$ and $L_{A90,T}$ sound level indicators.

13.4.12 Letters were sent to residents of identified receptors to request access for noise monitoring. Where access was not possible at desired private properties, a representable public access location was chosen at a place

where it was deemed secure for leaving long term equipment. Noise monitoring was undertaken for one week during one of two separate time periods from 8th to 15th July or 15th to 22nd July 2022. These periods are considered representative of normal baseline noise levels, being outside of school holiday periods.

13.4.13 Monitoring locations are shown in Figure 13-1 and summarised in Table 13-3. The monitoring locations have been allocated as representative of the local noise environment at a selection of noise-sensitive receptors for the Principal Site based on their surroundings and relative distance to nearby sound sources (in particular road traffic). This is summarised in Table 13-3.

Table 13-3: Noise Monitoring Locations

Location Reference	GPS Coordinates	Monitoring Period	Representative of Receptors
ML1	53.409376, -0.697182	15/07/2022– 22/07/2022	N/A
ML2	53.397114, -0.6818	15/07/2022– 22/07/2022	R1, R7
ML3	53.387573, -0.681393	15/07/2022– 22/07/2022	R6, NR1
ML4	53.387303, -0.648457	15/07/2022– 22/07/2022	R12, R13
ML5	53.397194, -0.594485	08/07/2022– 15/07/2022	R2, R3, R4, R5, R8, R9, NR2
ML6	53.373882, -0.611465	08/07/2022– 15/07/2022	R14, R25
ML7	53.383584, -0.589237	08/07/2022– 15/07/2022	R15, R39, NR3
ML8	53.39078, -0.613441	08/07/2022– 15/07/2022	R10, R11

13.4.14 Receptor locations R16-24 and R27-38 relate to the Cable Route Corridor only and are assessed against construction effects only. At the time of undertaking baseline measurements, the Cable Route Corridor was not finalised and therefore baseline measurement locations in its vicinity could not be identified. For the purposes of construction effects, measurements near to the Principal Site are considered suitably representative to establish construction effect criteria.

Sources of Information

Desktop Survey

13.4.15 Sources of information consulted include:

- Aerial imagery of the Scheme Boundary and surrounding area to define sensitive receptors and monitoring locations;
- Plant noise source data were taken from measurements of other solar farms using similar equipment to those proposed, from manufacturer specifications, and from British Standard 5228 (Ref 13-14) noise library data; and
- **PEI Report Volume I Chapter 3: Scheme Description** for information on the operational Scheme and construction.

Impact Assessment Methodology

Overview of Construction and Decommissioning Works

13.4.16 For the purposes of assessing noise and vibration, the construction programme has been summarised into four scenarios that represent high Noise Generating Activities (NGA). These activities are most likely to generate likely significant effects and are as follows:

- NGA1 – Construction of substations.
- NGA2 – Construction of BESS, inverters, and transformers.
- NGA3 – Construction of ground-mounted solar PV panels.
- NGA4 – Cable installation (general works).
- NGA5 – Cable installation (including Horizontal Directional Drilling (HDD) activities).

13.4.17 The earliest construction could start is 2025 and construction will require an estimated 24 months. The majority of works activities would be completed under core working hours as set out in Table 13-4.

Table 13-4: Core working hours

Days	Core working hours
Monday to Saturday	07:00 – 19:00
Sundays and Bank Holidays	No works

13.4.18 Some works activities may need to occur out of these hours/times due to activities requiring to be undertaken continuously (such as HDD and cable jointing – part of NGA5) if it is not safe or practical to end it at 19:00 on a particular day. Where work outside of times is necessary, prior notification will be provided to the LPA, in the form of a CoPA (Ref 13-1) Section 61 consent application where necessary.

Construction of Substations

13.4.19 The following activities will be undertaken to construct the substations:

- Installation of electric cabling;
- Construction of foundations;
- Import of components to site; and
- Installation of transformers, shunt reactors, switchgear, and other ancillary electrical equipment.

Installation of Solar Stations

13.4.20 Solar farm infrastructure such as inverters and transformer stations will be installed in solar stations, requiring the following steps prior to installation:

- Excavation of the base;
- Creation of concrete formwork for concrete foundation;
- Concrete pour;

- Installation of electric cabling;
- Import of components to site; and
- Installation of inverters, transformers, and battery storage units.

Construction of Solar PV Panels

13.4.21 A supporting substructure of mounting struts (up to a maximum depth of 3.5 m) are required for each PV string, although various factors will help to inform the number and arrangement of panels and strings. It is assumed at this stage that the installation method will be auger piling. Although the installation method of substructure for solar PV panels is yet to be confirmed, piling represents a reasonable worst case in terms of noise emissions.

Cable Route Corridor

13.4.22 The Cable Route Corridor comprises an area within which the high voltage cables will be laid in order to connecting the Principal Site with the national transmission system at Cottam sub-station. It is proposed that the cables will be installed by a combination of open cut and trenchless methods. Open cut methods will be utilised more commonly across the underground cable route as it will be utilised when installing the cables within open agricultural land. Trenchless grid connection methods will be HDD and may at times require extended working hours to complete.

Prediction Methodology

13.4.23 Noise levels experienced by sensitive receptors during such works depend upon several variables, the most significant of which are:

- The noise generated by plant or equipment used on site, generally expressed as sound power levels (L_w) or the vibration generated by the plant;
- The periods of use of the plant on site, known as its on-time;
- The distance between the noise/vibration source and the receptor;
- The noise attenuation due to ground absorption, air absorption and barrier effects; and
- The time of day or night the works are undertaken.

Assessment Criteria

13.4.24 This preliminary environmental assessment has been undertaken following relevant guidance, including the NPSE.

13.4.25 The NPSE sets definitions for ‘significant adverse effects’ and ‘adverse effects’ using the concepts:

- Lowest Observed Adverse Effect Level (LOAEL) – the level above which, as an average response, adverse effects on health and quality of life can be detected; and
- Significant Observed Adverse Effect Level (SOAEL) – the average response level above which, as an average response, significant adverse effects on health and quality of life occur.

13.4.26 The NPSE states that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times".

13.4.27 Noise levels exceeding the SOAEL should be avoided as far as reasonably practicable. For noise levels exceeding the LOAEL, the NPSE states that:

"It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur".

13.4.28 All noise effects are local, only affecting nearby sensitive receptors, and are direct in nature; however, defining a likely effect and whether it is significant or not depends on the nature of a noise source. Likely effects have been defined based on guidance set out in national policy.

13.4.29 Government policies for noise are generally based on community exposure response relationships and noise insulation of a typical dwelling. Consequently, an assessment based on LOAELs and SOAELs cannot be applied to non-residential sensitive receptors. As such, the approach to the assessment of non-residential receptors differs from that adopted for residential receptors. Non-residential receptors are considered on a case-by-case basis by considering the applicable design criteria for good internal noise levels.

Construction and Decommissioning Noise Criteria

13.4.30 Annex E of BS 5228-1 provides example methods for the assessment of the significance of construction noise effects. Assessment criteria for magnitude of impact due to construction noise is presented in Table 13-5.

13.4.31 For assessment purposes, the LOAEL has been set as 65 dB $L_{Aeq,T}$ during the daytime which is equal to the lowest daytime threshold level set out in the BS 5228-1 Annex E.3.2 example 'ABC method' and Annex E.3.3 example '5dB change method'. The SOAEL has been set as 75 dB $L_{Aeq,T}$ during the daytime which is equal to the highest daytime threshold level set out in the ABC method as well as the trigger level at which noise insulation may be offered per Annex BS 5228-1 Annex E.4 'Example of thresholds used to determine the eligibility for noise insulation and temporary rehousing'. While it is possible for significant effects to occur below 75 dB $L_{Aeq,T,}$ the construction of the Scheme covers a large area and is unlikely to take place close to any given receptor for a substantial period of time. This duration of effect has been taken into consideration when determining a significant effect due to an exceedance of the SOAEL.

Table 13-5: Thresholds of Potential Effects of Construction Noise at Residential Buildings

Time Period	Threshold Value ($L_{Aeq,T}$ dB)	
	LOAEL	SOAEL
Day (07:00 – 19:00) Saturday (07:00 – 13:00)	65	75
Evening (19.00 – 23.00) Weekends (13.00–23.00 Saturdays and 07.00–23.00 Sundays)	55	65
Night (23.00 – 07.00)	45	55

These effects are expected to occur if the programme of works indicates that the relevant threshold values are likely to be exceeded over a period of at least one month. The values apply to a location one metre from a residential building façade containing a window, ignoring the effect of the acoustic reflection from that façade.

13.4.32 Although there is currently a lack of evidence relating health effects to construction noise, the method for assessing construction noise effects is defined based on the current industry best practice.

13.4.33 In terms of sound insulation or temporary rehousing due to construction noise, BS 5228-1 states that a property would be eligible if exposed to significant levels of noise "*for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months*". Consequently, although no requirement for insulation or temporary re-housing is identified (see section 13.8), these durations will be considered where a significant effect is identified.

Construction and Decommissioning Vibration

13.4.34 BS 5228-2 provides further guidance on the perception of vibration within occupied buildings. This provides a simple method of determining annoyance alongside evaluation of cosmetic damage associated with vibration. Table 13-6 details Peak Particle Velocity (PPV) levels (a standard measure of vibration effects) and their potential effect on humans, and provides a description of construction and demolition vibration impacts on human receptors. These levels are used to define the LOAEL and SOAEL for human exposure to vibration.

Table 13-6: Criteria for magnitude of impacts for construction and decomissioning (human response)

Magnitude of impact	PPV vibration level	BS 5228-2 description of impact
LOAEL	0.3 mm/s	*"Vibration might be just perceptible in residential environments." **
SOAEL	1.0 mm/s	*"It is likely that vibration of this level in residential environments will cause complaint, but it can be tolerated if prior warning and explanation has been given to residents."*

* Note to table: This includes similar uses e.g. hotels, bed and breakfasts

Source: BS 5228-2:2009+A1:2014 Table B.1

13.4.35 The recommended PPV vibration limits for transient vibration, above which cosmetic damage could occur for different types of buildings are also provided in BS 5228-2 and presented in Table 13-7. For these limits, 'minor damage' is possible at vibration magnitudes that are greater than twice those given in Table 13-6, and 'major damage' can occur at values greater than four times the tabulated values. Consequently, the significance of effect has been provided based on the sensitivity of a building to vibration induced cosmetic damage.

Table 13-7: Transient vibration guide values for cosmetic damage (building response)

Type of building	Peak component particle velocity in frequency range of predominant pulse, at which cosmetic damage could occur	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures, Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures, Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Note 1: A potential negligible effect (not significant) is indicated at vibration levels up to the threshold values.

Note 2: A potential minor adverse effect (not significant) is indicated at vibration levels up to a magnitude of twice the threshold values.

Note 3: A potential moderate adverse effect (significant) is indicated at vibration levels up to a magnitude of four times the threshold values.

Note 4: A potential major adverse effect (significant) is indicated at vibration levels equal to or greater than a magnitude of four times the threshold values.

Source: BS 5228-2:2009+A1:2014 Table B.2 Transient vibration guide values for cosmetic damage

13.4.36 Given that criteria in Table 13-7 relate to the risk of cosmetic damage, they are dependent on the type of building and its physical sensitivity to vibration. The criteria presented relate to the potential for cosmetic damage, not structural damage; cosmetic damage would precede the onset of any structural damage.

13.4.37 All identified noise and vibration effects occur on the local level, with the potential to result in either negligible, adverse, or significant adverse impacts. No noise and vibration beneficial effects are anticipated to occur.

13.4.38 Identified noise and vibration impacts on human receptors during the construction works are short-term or medium-term temporary impacts, lasting for the duration of the construction works or a shorter period when construction works are close to receptors. Cosmetic damage to buildings is a permanent effect (unless and until repaired) but does not recur after construction works have concluded.

13.4.39 Although a significant effect due to construction activities may be determined through an assessment based on exceedances of the defined SOAELs for construction noise and vibration, additional consideration of the overall significance of the effect for temporary construction activities will be provided through qualitative discussion of the following:

- Duration of temporary likely effects:
- Frequency of events; and
- Sensitivity of receptor.

Construction and Decommissioning Traffic Noise

13.4.40 During the peak construction period, there will be up to 120 Heavy Goods Vehicle (HGV) deliveries and up to 1250 light vehicles on the strategic road network per day. Traffic during decommissioning is expected to be similar to (or less than) the construction phase. Construction and decommissioning traffic noise have been assessed for a representative worst-case day during the construction stage based on information in **PEI Report Volume I Chapter 3: Scheme Description**. Predicted construction traffic noise levels along the main access routes have been compared to measured ambient noise levels so a potential change in noise can be derived.

13.4.41 In the absence of detailed baseline traffic data to utilise the methodology within the Calculation of Road Traffic Noise (CRTN) (Ref 13-16) in terms of the 18-hour average road traffic noise level from 06:00 to 24:00, noise predictions of construction vehicle movements have been undertaken using the method given in BS 5228-1 (Ref 13-1413-38) Annex F F.2.5. These levels are compared to baseline noise levels measured adjacent to the primary access route (A631).

13.4.42 The temporary changes in road traffic noise levels due to construction traffic at a distance of 5 m from the local road network have been assessed against criteria relating to short-term changes in noise from Table 3.54a of DMRB LA111 (Ref 13-20). While these criteria relate to Basic Noise Levels (BNL) as determined by CRTN (i.e. $L_{A10,18h}$ noise levels) and this comparison uses $L_{Aeq,12h}$ noise levels, the criteria are considered a suitable reference for estimating the change in absolute road traffic noise level due to construction traffic, and in determining the likelihood of significant effects. Assessment criteria are presented in Table 13-8.

Table 13-8: Construction Traffic Noise Assessment Criteria

Effect Level	Magnitude criteria
Negligible	≥ 0 dB and < 1 dB
Minor	≥ 1 dB and < 3 dB
Moderate	≥ 3 dB and < 5 dB
Major	≥ 5 dB

Source: DMRB LA111 Table 3.54a

13.4.43 As a result, the LOAEL for changes in road traffic noise due to construction traffic is set as a 1.0 dB increase in road traffic noise, while the SOAEL is set as a 3.0 dB increase.

Operational Noise

13.4.44 Noise predictions of the operational Scheme have been undertaken using SoundPLAN, which implements the calculation procedures of ISO 9613 ‘Acoustics – Attenuation of Sound During Propagation Outdoors’ (Ref 13-20),

to predict the propagation of noise away from the Scheme in all directions and to quantify resultant noise levels at the identified noise sensitive receptor locations.

13.4.45 Operational noise has been assessed following BS 4142 guidance, whereby the rating level of noise emissions from activities are compared against the background level of the pre-development noise climate. Source data for operational noise emissions is presented in **PEI Report Volume II Appendix 13-4**. The relevant parameters in this instance are as follows:

- Background sound level – $L_{A90,T}$ – defined in the Standard as the 'A' weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval ('T') measured using a 'fast' time weighting and quoted to the nearest whole number of decibels;
- Specific sound level – $L_{Aeq,Tr}$ – the equivalent continuous 'A' weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr; and
- Rating level – $L_{Ar,Tr}$ – the specific sound level plus any adjustment made for the characteristic features of the noise.

13.4.46 BS 4142 recognises that certain acoustic features of a sound source can increase the impact over that expected based purely on the sound level. The standard identifies the following features to be considered:

- Tonality - a penalty of 2 dB is applied for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible;
- Impulsivity - a penalty of 3 dB is applied for impulsivity which is just perceptible at the receptor, 4 dB where it is clearly perceptible and 6 dB where it is highly perceptible. An impulse is defined as the sudden onset of a sound;
- Intermittency - a penalty of 3 dB can be applied if the intermittency of the specific sound is readily identifiable against the residual acoustic environment at the receptor i.e. it has identifiable on/off conditions; and
- Other sound characteristics - a penalty of 3 dB can be applied where the specific sound features characteristics that are neither tonal nor impulsive, but are readily distinctive against the residual acoustic environment.

13.4.47 BS 4142 states the following regarding the assessment of impacts, comparing the rating level of the new noise source with the existing background level:

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

- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

13.4.48 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.

13.4.49 BS 4142 advises that, where rating levels and background levels are low, which is the case in rural areas surrounding the Scheme Boundary, the assessment of operational noise should take into context the absolute noise level. The ANC Guide to BS 4142 (Ref 13-22) provides context to this by stating:

"BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90}, and low rating levels as being less than about 35 dB $L_{Ar,Tr}$".

13.4.50 The ANC Guide further suggests that:

"…*similar values would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate"*.

13.4.51 A minimum rating level of 35 dB $L_{Ar,Tr}$ for the LOAEL would align with guidance in PPGN (Ref 13-9), which defines noise below the LOAEL as follows:

"Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life".

13.4.52 BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. (Ref 13-23) and the World Health Organization (WHO) 'Guidelines for Community Noise' (1999) (Ref 13-24) provide guidance levels for internal noise within dwellings of 30 dB $L_{Aeq,T}$ for good sleeping conditions at night. However, at night, residents are likely to be inside their properties. BS 8233:2014 states that building envelope attenuation would be reduced to approximately 15 dB by a partially open window. Consequently, an external SOAEL of 45 dB $L_{Ar,Tr}$ has been adopted for the night-time.

13.4.53 The assessment criteria for noise from fixed plant installations are summarised in Table 13-9.

Table 13-9: Operational Noise Assessment Criteria

Effect Level	Rating Level (external) at Receptor, $L_{Ar,Tr}$	
	Daytime (07:00-19:00) and Evening (19:00-23:00)	Night-time (23:00-07:00)
LOAEL	Less than or equal to the typical background level ($L_{A90,T}$) – minimum of 35 dB $L_{Ar,Tr}$	Less than or equal to the typical background level ($L_{A90,T}$) – minimum of 30 dB $L_{Ar,Tr}$
SOAEL	Greater than 10 dB above the background noise level – minimum of 45 dB $L_{Ar,Tr}$	Greater than 10 dB above the background noise level – minimum of 45 dB $L_{Ar,Tr}$

13.4.54 Identified operational noise impacts are long term effects occurring over the operational life of the Scheme.

Operational Vibration

13.4.55 The Scheme includes the use of battery storage infrastructure, electrical connection infrastructure including transformers and inverters, potentially includes tracker panel motors and mechanisms, and solar PV panels. None of these components is known to be a major source of vibration and would not require specific measures to control vibration emissions.

13.4.56 Operational vibration was scoped out of the EIA as there are no operational sources of vibration, (see **PEI Report Volume II Appendix 1-1**).

Non-Residential Receptors

13.4.57 Design guides for good internal conditions in non-residential receptors are set indoors. The only non-residential receptors in this assessment are places of worship (NR1, NR2, and NR3, identified in Table 13-2). Design criterion from BS 8233: 2014 for place of worship, counselling, meditation or relaxation is considered applicable. This design criterion is a range of 30-35 dB $L_{Aeq,T}$. Assuming that the churches may have doors or windows open at some points during the year, the maximum external noise level (assuming 15 dB attenuation for a partially open door or window) before the design criterion would be exceeded would be 50 dB $L_{Aeq,T}$.

13.5 Stakeholder Engagement

13.5.1 A request for an EIA Scoping Opinion was sought from the Secretary of State through the Planning Inspectorate in 2022 as part of the EIA Scoping Process. Responses in relation to noise and vibration, to date, are presented below in Table 13-10.

Table 13-10: Engagement Undertaken

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
Planning Inspectorate	The Applicant proposes to scope out an assessment of noise associated with operational traffic on the basis that once operational the Proposed Development would generate minimal traffic. Considering the characteristics of the Proposed Development, and the anticipated level of traffic generation, the Inspectorate is content that this matter can be scoped out. However the ES description of development should confirm the anticipated trip generation (including number and type of vehicles) during operation to justify this.	Anticipated numbers of permanent staff and anticipated maintenance visits described, including potential types of vehicles.	Section 3.6 Operational Activities
Planning Inspectorate	The Applicant proposes to scope out an assessment of operational vibration effects on the basis that no major vibration sources are anticipated to be introduced as part of the Proposed Development. Considering the nature of the Proposed Development during operation the Inspectorate is content to scope this matter out. However, the ES should describe the potential sources of vibration arising from the operation of e.g. substation, battery storage infrastructure, and tracker panel mechanisms, as well as any measures to control emissions.	Description of potential vibration sources and proposed measures to control vibration has been included.	Section 13.4 Assessment Methodology, paragraph 13.4.55
Planning Inspectorate	Figure 14-1 shows the location of the “nearest noise-sensitive receptors” in relation to the Proposed Development. The ES should provide a plan showing the location of all sensitive receptors assessed to aid understanding of the potential for significant effects relating to noise.	Figure to include all sensitive receptors assessed.	Figure 13-1
Planning Inspectorate	The Scoping Report states that only noise and vibration effects on human receptors will be assessed within the Noise and Vibration chapter of the ES and effects on ecological and cultural heritage receptors will be assessed within the respective aspect chapters of the ES. There is no reference to noise effects within the Cultural Heritage section of the Scoping Report and so it is not clear whether this will be considered within the ES. The ES should ensure that noise and vibration effects on cultural heritage assets are included within the ES, including consideration of effects on setting.	The potential for noise and vibration effects to be assessed in Cultural Heritage and Ecology and Nature Conservation ES chapters.	To be considered within the ES.

Consultee	Summary of main matter raised	How has the matter been addressed?	Location of response in the chapter
	Similarly, whilst the Ecology chapter of the Scoping Report refers to the potential for noise and vibration effects on ecological features during construction, the potential for operational noise effects is not listed (noting that operational vibration can be scoped out, as agreed in Box ID 3.8.2 above). The ES should ensure that the potential for noise and vibration effects on all sensitive receptors (human, ecological, and cultural heritage) are assessed.		
Planning Inspectorate	The Scoping Report states that solar PV panels, mounting structures, and cabling do not produce noise during operation. However, Scoping Report paragraph 3.6 identifies that the type of panel to be used is not yet determined and tracking panels may be used. Should this type of panel be used, the ES should assess the potential for significant noise effects on receptors during operation.	Tracking motors have been assumed to be used as a worst-case assumption.	Section 13.3 Assessment Assumptions and Limitations, paragraph 13.3.1613.3.12
Planning Inspectorate	The Scoping Report states that although significant effects relating to construction noise level will be determined based on exceedances of a Threshold Value, professional judgement will also be used to refine the significance of effects. For example, it is stated that only noise levels above the Threshold Value for more than 10-days/ weekends/ nights in a 15 consecutive day period or 40 days/ weekends/ nights within a 6-month consecutive period would be considered significant. This appears to be based on British Standard Guidance (BS 5228: Code of practice for noise and vibration control on construction and open sites – Part 1: Noise). However, this guidance refers to the above criteria in the context of this being the level at which noise insulation or temporary rehousing should be offered by Developers. The Inspectorate is of the opinion that there is potential for significant effects to occur at lower noise levels which would not require insulation or rehousing. The ES should justify the approach to defining significant effects, drawing on established practice and guidance where possible.	Justification for approach to be provided where significant effects are identified.	To be considered within the ES, where applicable.

13.6 Baseline Conditions

13.6.1 This section describes the baseline environmental characteristics for the Scheme and surrounding areas with specific reference to noise and vibration. Further details of the methodology and results of the baseline noise surveys are presented in **PEI Report Volume II Appendix 13-3**.

Existing Baseline

Principal Site

13.6.2 During the baseline noise surveys, road traffic noise from the surrounding road network was present at the majority of the locations. At locations furthest away from roads, such as ML2 and ML4, wind noise was seen to be most dominant noise source. ML5, ML6, and ML8 saw bird song as the most dominant noise source. At ML2 and ML6 local farming activity noise was observed. At ML3, ML4, ML6, ML7 and ML8, aircraft using Sturgate Airfield were also seen to have a contribution to the noise environment. Further local noise sources that influence noise conditions are fauna, farming activities and local resident activities.

13.6.3 A summary of the noise monitoring results is presented in Table 13-11. Typical ambient ($L_{Aeq,1h}$) and background ($L_{A90,1h}$) sound levels are presented for the daytime, evening and night for weekdays and weekends.

Table 13-11: Existing Baseline Sound Levels Summary

Location Reference	Week Period	Sound Level Indicator	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
ML1	Weekday	$L_{Aeq,1h}$	71	66	65
		$L_{A90,1h}$	48	34	27
	Weekend	$L_{Aeq,1h}$	72	67	64
		$L_{A90,1h}$	44	36	28
ML2	Weekday	$L_{Aeq,1h}$	50	43	45
		$L_{A90,1h}$	36	30	27
	Weekend	$L_{Aeq,1h}$	50	46	45
		$L_{A90,1h}$	44	34	27
ML3	Weekday	$L_{Aeq,1h}$	54	46	43
		$L_{A90,1h}$	34	28	23
	Weekend	$L_{Aeq,1h}$	59	49	42
		$L_{A90,1h}$	33	28	23
ML4	Weekday	$L_{Aeq,1h}$	45	38	37
		$L_{A90,1h}$	34	28	26
	Weekend	$L_{Aeq,1h}$	40	39	34

Location Reference	Week Period	Sound Level Indicator	Day (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
		$L_{A90,1h}$	34	28	26
ML5	Weekday	$L_{Aeq,1h}$	47	45	40
		$L_{A90,1h}$	39	34	25
	Weekend	$L_{Aeq,1h}$	44	42	40
		$L_{A90,1h}$	37	34	27
ML6	Weekday	$L_{Aeq,1h}$	47	44	43
		$L_{A90,1h}$	33	28	23
	Weekend	$L_{Aeq,1h}$	46	42	41
		$L_{A90,1h}$	34	25	24
ML7	Weekday	$L_{Aeq,1h}$	44	40	40
		$L_{A90,1h}$	29	27	25
	Weekend	$L_{Aeq,1h}$	46	33	35
		$L_{A90,1h}$	28	26	25
ML8	Weekday	$L_{Aeq,1h}$	42	37	41
		$L_{A90,1h}$	34	26	24
	Weekend	$L_{Aeq,1h}$	44	36	42
		$L_{A90,1h}$	34	26	26

Cable Route Corridor

13.6.4 The Cable Route Corridor is assessed against construction noise and vibration only, since below ground cables will not generate operational noise. The baseline sound sources are also largely similar to those in the vicinity of the Principal Site. The LOAEL and SOAEL values set for the Principal Site are therefore considered to also be applicable to the Cable Route Corridor, and no baseline surveys are necessary for this area.

Future Baseline

13.6.5 The future baseline scenarios are set out in **PEI Report Volume I Chapter 5: EIA Methodology**. In the absence of the Scheme, it is considered that the future baseline noise environment will be higher than represented by the July 2022 measurement ambient sound levels. This is due to natural growth of road traffic flows resulting in increased noise in the local area.

13.6.6 The assessments assume that the measured baseline data is representative of future baseline conditions. A lower assumed baseline would result in the same or higher noise impacts, and therefore the adopted approach represents a worst-case scenario.

13.7 Embedded Design Mitigation

13.7.1 This section contains the mitigation measures relevant to this chapter that are already incorporated into the Scheme design, as described in **PEI Report Volume I Chapter 3: Scheme Description**. Where necessary, construction mitigation forms part of the Framework Construction Environmental Management Plan (CEMP) (**PEI Report Volume II Appendix 3-1**).

Construction and Decommissioning

13.7.2 Measures to control noise as defined in Annex B of BS 5228-1 and measures to control vibration as defined in Section 8 of BS 5228-2 will be adopted where reasonably practicable. These embedded measures represent Best Practicable Means (BPM) and will be secured within the CEMP for the construction phase and a Decommissioning Environmental Management Plan (DEMP) for the decommissioning phase. These documents would be secured through DCO requirements.

13.7.3 BPM that will be implemented during construction works and secured through the CEMP and DEMP are presented below:

- Ensuring that all appropriate processes, procedures and measures are in place to minimise noise before works begin and throughout the construction programme.
- All contractors to be made familiar with current legislation and the guidance in BS 5228 (Parts 1 and 2) which should form a prerequisite of their appointment.
- Where reasonably practicable, noise and vibration are controlled at source (e.g. the selection of inherently quiet plant and low vibration equipment), review of the construction programme and methodology to consider quieter methods, consideration of the location of equipment on-site and control of working hours.
- Use of modern plant, complying with applicable UK noise emission requirements.
- Hydraulic techniques for breaking concrete or rocks to be used in preference to percussive techniques, where reasonably practicable.
- Drop heights of materials will be minimised.
- Plant and vehicles will be sequentially started up rather than all together.
- Off-site pre-fabrication where reasonably practicable.
- Use of screening locally around significant noise producing plant and activities.
- Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturer's specifications.
- All construction plant and equipment to be properly maintained, silenced where appropriate, operated to prevent excessive noise and switched off when not in use.

- Loading and unloading of vehicles, dismantling of site equipment or moving equipment or materials around the Scheme Boundary to be conducted in such a manner as to minimise noise generation, as far as reasonably practicable.
- All vehicles used on-site shall incorporate reversing warning devices as opposed to the typical tonal reversing alarms to minimise noise disturbance where reasonably practicable.
- Provision of information to the relevant local authority and local residents to advise of potential noisy works that are due to take place.
- Unnecessary revving of engines will be avoided, and equipment will be switched off when not in use.
- Plant will always be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading will also be carried out away from such areas.

13.7.4 Core working hours for construction activities are set out in Table 13-4.

13.7.5 A construction noise monitoring scheme shall be developed as per requirements of the CEMP following appointment of a Principal Contractor and prior to commencement of construction works. Requirements for monitoring during the decommissioning stages will be outlined in a DEMP that will support the DCO application.

13.7.6 The effect of noise and vibration on nearby sensitive receptors can be minimised through a good communication strategy. Prior to construction works being undertaken, liaison will be undertaken with occupiers of sensitive receptors that may be adversely affected by construction noise and vibration.

13.7.7 The communication strategy and noise complaint system will be secured through the DCO as part of the CEMP and DEMP.

13.7.8 Where necessary, the Applicant will submit an application for prior consent to carry out noisy work under Section 61 of the CoPA 1974 to demonstrate that noise and vibration has been minimised as far as reasonably practicable. The Section 61 application will set out the specific method of working, calculations of noise levels at nearby receptors, the actual working hours required, noise monitoring locations, details of communication measures and the mitigation measures implemented to minimise noise and vibration impacts.

13.7.9 Consideration has been given to traffic routing, timing and access points to the Scheme to minimise noise impacts at existing receptors as detailed in **PEI Report Volume I Chapter 15: Transport and Access**.

13.7.10 Management of construction traffic on the highway network will be managed through the Framework Construction Traffic Management Plan (CTMP) (**PEI Report Volume II Appendix 15-2**), which will be secured through the DCO. Appropriate routing of construction and decommissioning traffic on public roads and along access tracks will be pursuant to the CTMP.

13.7.11 The Indicative Site Layout Plan (**PEI Report Volume III Figure 3-1**) has been used for the purposes of selecting locations for construction activities to inform noise predictions. The layout may be iteratively optimised for the ES in order to improve separation distances and will provide further details on mitigation for both construction and operational noise and vibration, although there will be a requirement to retain some flexibility on where infrastructure will be located on-site.

Operation

13.7.12 Embedded mitigation measures that will be considered and detailed further in the ES are summarised as follows:

- Plant selection (noise emissions will be one of the criteria evaluated when procuring equipment for use on the site).
- Design layout of elements within the Scheme Boundary to minimise noise at receptors, including:
  - Locating the solar stations in areas away from large concentrations of receptors such that noise emissions from electrical equipment are less impactful; and
  - Location and orientation of inverters and transformers.
- Transformers may be standalone units or pre-assembled with inverters and switchgear to form a single contained unit (i.e. enclosed).

13.7.13 Plant that will be used in the Scheme has not yet been finalised. Consequently, a conservative approach of considering the reasonable worst-case options has been taken when defining noise source emissions data and it may be possible that quieter plant can be incorporated into the final design. Quieter plant would be the most effective way of controlling noise emissions.

13.7.14 The assessment is based on a typical layout for similar developments. The layout may be iteratively optimised for the ES to improve separation distances between noise-generating plant and receptor locations, although there will be a requirement to retain some flexibility on where infrastructure will be located on-site.

13.7.15 Low frequency noise can be very difficult to predict with a high level of certainty and similarly hard to identify and resolve if present. This is because it can be generated by the unexpected interactions between system components and can be amplified by the geometry of the site and receptor buildings. The issue of low frequency noise will be considered throughout the detailed design for the substation and eliminated through design, or appropriately mitigated (isolation and attenuation measures) where appropriate and will be secured through the Outline Design Principles, which will be prepared as part of the DCO application.

13.8 Assessment of Likely Impacts and Effects

13.8.1 The Scheme as outlined in **PEI Report Volume I Chapter 3: Scheme Description** has been considered in assessing the likely impacts and effects

of the Scheme, whilst considering the embedded mitigation described in the previous section.

Construction (2025 to 2027) and Decommissioning

13.8.2 This section discusses the potential noise and vibration effects on sensitive receptors arising during the construction and decommissioning phases of the Scheme. The indicative programme and duration of likely installation methods are described in **PEI Report Volume I Chapter 3: Scheme Description**.

Construction and Decommissioning Noise Effects (Principal Site and Cable Route Corridor)

13.8.3 Construction noise predictions were undertaken at receptor locations identified in Table 13-2 for each of the NGA scenarios 1-5.

13.8.4 Construction noise predictions were undertaken at sensitive receptor locations identified in Table 13-12 for each NGA, and for all NGAs occurring simultaneously as a worst-case. Levels below 30 dB are considered to be negligible and are not reported.

Table 13-12: Construction and Decommissioning Noise Predictions

Receptor Reference	Indicative Free-Field Construction Noise Levels During Daytime Construction Activity (dB $L_{Aeq,12h}$)					
	NGA1	NGA2	NGA3	NGA4	NGA5	Worst-case
R1	34	50	48	33	<30	50
R2	46	57	56	42	<30	57
R3	34	59	61	42	<30	61
R4	32	53	54	38	<30	54
R5	34	52	51	39	<30	52
R6	<30	48	49	35	<30	49
R7	54	57	57	60	<30	60
R8	37	61	59	54	<30	61
R9	32	57	59	41	<30	59
R10	38	59	58	57	<30	59
R11	34	58	57	51	<30	58
R12	31	60	62	45	<30	62
R13	31	59	64	40	<30	64
R14	35	52	48	40	<30	52
R15	44	51	49	41	<30	51
R16	<30	32	31	51	<30	51
R17	<30	<30	<30	45	40	45
R18	<30	<30	<30	54	48	54

Receptor Reference	Indicative Free-Field Construction Noise Levels During Daytime Construction Activity (dB $L_{Aeq,12h}$)					
	NGA1	NGA2	NGA3	NGA4	NGA5	Worst-case
R19	<30	<30	<30	47	33	47
R20	<30	<30	<30	61	55	61
R21	<30	<30	<30	47	30	47
R22	<30	36	36	64	<30	64
R23	<30	36	35	53	<30	53
R24	<30	39	38	57	<30	57
R25	<30	44	42	57	<30	57
R26	32	52	50	47	<30	52
R27	<30	32	31	47	<30	47
R28	<30	33	32	62	<30	62
R29	<30	<30	<30	62	47	62
R30	<30	<30	<30	62	56	62
R31	<30	<30	<30	58	48	58
R32	<30	<30	<30	63	33	63
R33	<30	<30	<30	52	33	52
R34	<30	<30	<30	51	34	51
R35	<30	31	30	44	<30	44
R36	<30	30	<30	43	<30	43
R37	<30	30	<30	43	<30	43
R38	<30	31	31	43	<30	43
R39	34	44	42	34	<30	44
NR1	31	48	48	34	<30	48
NR2	35	52	51	39	<30	52
NR3	33	44	41	34	<30	44

13.8.5 All predicted noise levels remain below the daytime LOAEL (65 dB) for all daytime construction scenarios, and are therefore **not significant**.

13.8.6 Where substantial periods of horizontal drilling are required, there is the potential for NGA5 (HDD activities) to occur during the weekday evenings and weekends or at night. The same predicted sound levels as presented in Table 13-12 would be anticipated during these periods. The LOAEL for the evenings and weekends and the SOAEL for the night (both 55 dB) are exceeded for NGA5 at one location, R30, during HDD activities in reference to drilling across Stowe Park Road. Predicted levels are also equal to 55 dB at one location, R20, in relation to drilling across Cottam Power Station railway line.

13.8.7 Given the distances required to be drilled (Stowe Park Road is a single-carriageway road elevated on a slight embankment, while Cottam Power Station railway comprises four rail tracks of less than 25 m width at its widest point), these works are considered unlikely to require night-time drilling works, especially at Stowe Park Road. If night works are required, such works will be short term, likely no more than a few days. Given the thresholds in Table 13-8 refer to noise levels over a period of one month, the levels predicted are not considered to be sufficient to result in a significant adverse impact.

13.8.8 For all works that are undertaken outside of core work periods, a Section 61 consent will need to be obtained by the Principal Contractor. This will be agreed with the Local Planning Authority and contain details on the methodology, mitigation, communication strategy and monitoring.

13.8.9 As such, noise effects due to HDD activities are considered to be **not significant**.

Construction and Decommissioning Vibration Effects

13.8.10 It is generally accepted by vibration experts that, without a highly detailed understanding of the media, waveform, and frequency distribution, ground-borne vibration prediction methods are "*beset with complexities and uncertainties*" (Ref 13-25). However, it is unlikely that typical construction and decommissioning working routines would generate levels of vibration at local receptors at a level where cosmetic damage would be expected to be sustained or cause adverse effects for local residents. The level of impact at different receptors will be dependent upon a number of factors including distance between the works, ground conditions and the specific activities being undertaken. Consequently, vibration effects are defined with reference to information in guidance documents identified in the following paragraph.

13.8.11 Surface plant, such as cranes, compressors and generators, are not recognised as sources of high levels of ground-borne vibration. Reference to Figure C2 of 'Control of Vibration and Noise During Piling' (Ref 13-26) confirms that Peak Particle Velocity (PPV) values significantly less than 5 mm/s are generated by such machinery, even at distances of only 10 m. For example, the indication is that a bulldozer would generate a PPV of approximately 0.6 mm/s and a "*heavy lorry on [a] poor road surface"* would generate a PPV of less than 0.1 mm/s at 10 m. These values are well below levels at which cosmetic building damage are predicted to occur; the lower levels being 15 mm/s for predominantly transient vibrations and 7.5 mm/s for continuous vibrations at the base of residential or lighter framed commercial buildings. The aforementioned values are also below the 1.0 mm/s SOAEL (see Table 13-6) where it is likely that vibration in residential environments will result in complaints but can be tolerated if prior warning and explanation is given to residents.

13.8.12 It has been assumed, based on construction requirements for similar projects, that piling may be required for construction of solar PV panels. Based on the red line boundary for the Principal Site, the minimum distance between any piling works for the construction of PV modules and the nearest receptor is approximately 35 m and, therefore, ground borne vibration is unlikely to be an issue during piling works.

13.8.13 Similar levels of vibration to piling may be generated by HDD activities. As the nearest receptor to areas of the Cable Route Corridor where HDD activities may take place is also approximately 35 m away, ground borne vibration is unlikely to be an issue during HDD activities.

13.8.14 The highest levels of vibration that would be generated by cable laying activities would be the use of vibratory rollers during reinstatement. Whilst vibratory rollers may generate significant levels of vibration (i.e. exceeding 1.0 mm/s) at receptors within 20 m, the duration of exposure will be suitably short (less than a day). As stated in Table 13-6:

"It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents".

13.8.15 For PPV vibration levels anticipated to exceed 1.0 mm/s, prior warning will be provided on the timings and duration of vibration generating activities. This will be secured through the CEMP and DEMP, which will be secured through the DCO. Given the short duration of these activities affecting individual receptors, prior warning is considered sufficient to offset significant effects.

13.8.16 Accordingly, at this stage, it is anticipated that all construction and decommissioning vibration effects at nearby sensitive receptors would be **not significant**.

Construction and Decommissioning Traffic Noise Effects (Principal Site)

13.8.17 The potential changes in road traffic noise from these roads as a result of the Scheme have been considered by calculating the construction traffic noise based on BS 5228-1 (Ref 13-14) Annex F F.2.5 and comparing against equivalent measured levels adjacent to the A631 (Measurement location ML1, see Figure 13-1 and **PEI Report Volume II Appendix 13-4**). The likely absolute change in road traffic noise level due to construction traffic can then be predicted. Table 13-13 presents the results of the assessment. These predictions are also applicable to decommissioning noise effects.

13.8.18 Construction and decommissioning traffic noise effects for the Cable Route Corridor will be assessed at the ES stage when relevant access routes and baseline traffic flows are known.

Table 13-13: Construction and Decommissioning Traffic Noise Assessment

ML1 Daytime $L_{Aeq,12h}$, dB	Calculated Construction Traffic Noise, $L_{Aeq,T}$, dB	Combined Traffic Noise Level, dB	Change in Traffic Noise Level, dB	Effect Level	Significance
71.4	65.8	72.5	+1.1	Minor	**Not Significant**

13.8.19 No detailed traffic data is currently available. At ES stage, more detailed calculations will be undertaken for all designated haul routes, based on traffic volumes, speeds, and proportions of heavy-duty vehicles for the respective baseline and construction scenarios.

13.8.20 Such an assessment will involve the prediction of road traffic noise levels from all identified construction traffic routes. Potential effects will be identified based on the calculated change in traffic noise from these roads and will be considered at sensitive receptors where the noise climate is likely to be dominated by traffic noise from such roads.

Operation

13.8.21 For the assessment of operational noise during the daytime (07:00 to 19:00 hours) the typical background level has been defined from a Weekend daytime period with lower noise levels compared to a weekday, as to provide a worst-case assessment scenario. It has been assumed that all plant is in operation continuously during the daytime.

13.8.22 There is not anticipated to be any noticeable impulsive or intermittent characteristics from plant noise emissions as experienced at the surrounding receptors. Transformers within the BESS compound can have tonal features, although noise emissions from the BESS will be dominated by the cooling fans such that any tonal features of the transformers will not be noticeable. However, overall plant noise emissions experienced at receptors will likely be perceived as a distinctive continuous and steady hum; therefore a 3 dB correction to account for noise that is 'distinctive against the residual acoustic environment' has been applied in determining the rating level.

13.8.23 Details of the calculations are provided in **PEI Report Volume II Appendix 13-4**.

13.8.24 Receptors R16 to R25 and R27 to R38 are beyond the study area for the Principal Site. Operational noise levels at these receptors is anticipated to be lower than for closer receptors, and therefore negligible.

13.8.25 As the night-time period provides the most onerous assessment criteria and operational noise is assumed to be constant as a worst-case assumption, the assessment presented in Table 13-14 only considers night-time periods with all items of plant operating, as a worst-case assessment.

Table 13-14: Operational Noise Effects

Receptor Reference	Background Sound Level $L_{A90,T}$	LOAEL / SOAEL	Predicted Rating Level, $L_{Aeq,Tr}$, dB	Effect Level	Significance
R1	27	30 / 45	30	At LOAEL	Not significant
R2	25	30 / 45	37	Between LOAEL and SOAEL	Not significant
R3	25	30 / 45	39	Between LOAEL and SOAEL	Not significant
R4	25	30 / 45	33	Between LOAEL and SOAEL	Not significant

Receptor Reference	Background Sound Level $L_{A90,T}$	LOAEL / SOAEL	Predicted Rating Level, $L_{Aeq,Tr}$, dB	Effect Level	Significance
R5	25	30 / 45	32	Between LOAEL and SOAEL	Not significant
R6	23	30 / 45	26	Below LOAEL	Not significant
R7	27	30 / 45	38	Between LOAEL and SOAEL	Not significant
R8	25	30 / 45	41	Between LOAEL and SOAEL	Not significant
R9	25	30 / 45	37	Between LOAEL and SOAEL	Not significant
R10	24	30 / 45	39	Between LOAEL and SOAEL	Not significant
R11	24	30 / 45	38	Between LOAEL and SOAEL	Not significant
R12	26	30 / 45	40	Between LOAEL and SOAEL	Not significant
R13	26	30 / 45	37	Between LOAEL and SOAEL	Not significant
R14	23	30 / 45	32	Between LOAEL and SOAEL	Not significant
R15	25	30 / 45	32	Between LOAEL and SOAEL	Not significant
R26	23	30 / 45	32	Between LOAEL and SOAEL	Not significant
R39	25	30 / 45	24	Below LOAEL	Not significant
NR1	23	30 / 45	27	Below LOAEL	Not significant
NR2	25	30 / 45	32	Between LOAEL and SOAEL	Not significant
NR3	25	30 / 45	24	Below LOAEL	Not significant

13.8.26 At receptors R6, R39, NR1 and NR3, noise remains below the LOAEL, indicating no adverse impact. At all other receptors, the LOAEL is exceeded, however, the SOAEL is not exceeded at any location, indicating non-significant adverse impacts. No significant impacts are predicted. The NPSE states that:

"…all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur".

13.8.27 Reasonable steps to reduce noise are covered in the embedded mitigation section and may be enhanced to minimise impacts where reasonable, by the selection of quieter plant, changes to the site layout and positioning of noise-emitting equipment away from sensitive receptors, as well as the use of integrated noise control design measures such as enclosures, louvres and acoustic barriers. Where additional mitigation is incorporated, this will be assessed at the ES stage.

13.8.28 While some flexibility in the locating of plant is required, the predictions represent a reasonable worst-case estimate of the resulting noise levels. Should there be any changes in the locations of plant, sound levels should not exceed those predicted. This may be achieved through selection/procurement of quieter equipment, for example, than the worst-case sound power levels that have been assessed. Acoustic barriers may be introduced where they can be incorporated within the Design Parameters set out in Outline Design Principles that will accompany the DCO application.

13.8.29 Further consideration will also be made in the ES to whether any assumptions that are likely to be overestimating the potential impacts can be revised. For example, plant operation during early summer morning periods is likely to lead to some noise from inverters, but at a much lower level than the sound power levels which have been assessed in this PEI Report.

13.9 Additional Mitigation and Enhancements

Additional Mitigation

13.9.1 No additional mitigation measures are proposed for the construction, decommissioning, or operational phases following the above embedded measures, given that there are not expected to be any significant effects as a result of the Scheme.

13.9.2 The Design Parameters set out in Outline Design Principles that will accompany the DCO application will restrict the ability to install the solar stations at locations closer to properties than identified at the ES stage, unless quieter equipment can be procured, such that predicted noise effects are not increased.

Enhancements

13.9.3 No enhancement measures are proposed during construction, operation or decommissioning following the incorporation of the embedded measures described above.

13.10 Residual Effects

13.10.1 This section summarises the residual effects of the Scheme on Noise and Vibration following the implementation of embedded and additional mitigation.

13.10.2 Significant residual effects are defined in accordance with national noise policy as an exceedance of the SOAEL. No significant noise or vibration effects are predicted during the construction and decommissioning phases or the operational phase of the Scheme.

13.11 Cumulative Effects

13.11.1 An assessment of cumulative effects is provided in **PEI Report Volume I Chapter 17: Cumulative Effects**.

13.12 References

Ref 13-1 Her Majesty's Stationery Office (1974); Control of Pollution Act. https://www.legislation.gov.uk/ukpga/1974/40/pdfs/ukpga_19740040_en.pdf

Ref 13-2 Her Majesty's Stationery Office (1995); Environmental Protection Act. https://www.legislation.gov.uk/ukpga/1990/43/pdfs/ukpga_19900043_en.pdf

Ref 13-3 Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779764/NPPF_Feb_2019_web.pdf

Ref 13-4 Department of Energy and Climate Change. (2011) Overarching National Policy Statement for Energy (EN-1). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Ref 13-5 Department of Energy and Climate Change (2011) National Policy Statement for Renewable Energy Infrastructure (EN-3). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

Ref 13-6 Department for Energy Security and Net Zero (2023). Draft Overarching National Policy Statement for Energy (EN-1)

Ref 13-7 Department for Energy Security and Net Zero (2023). Draft National Policy Statement for Renewable Energy (EN-3)

Ref 13-8 Department for Environment Food and Rural Affairs (2010); Noise Policy Statement for England. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf .

Ref 13-9 Ministry of Housing, Communities & Local Government (2019); Planning Practice Guidance - Noise. https://www.gov.uk/guidance/noise--2 .

Ref 13-10 Lincolnshire County Council, “Central Lincolnshire Local Plan” Lincolnshire County Council, Lincoln, 2023 https://www.n-kesteven.gov.uk/sites/default/files/2023-04/Local%20Plan%20for%20adoption%20Approved%20by%20Committee.pdf

Ref 13-11 Bassetlaw District Council Core Strategy and Development Management Policies DPD, adopted 22 December 2011. https://www.bassetlaw.gov.uk/media/1543/cs1adoptedcorestrategy.pdf

Ref 13-12 Bassetlaw District Council, (2022), Publication Draft Bassetlaw Local Plan.

Ref 13-13 SoundPLAN ® registered trademark of SoundPLAN GmbH

Ref 13-14 British Standards Institute (2014) BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites.– Part 1: Noise. London: BSI.

Ref 13-15 British Standards Institute (2014) BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites.– Part 2: Vibration. London: BSI.

Ref 13-16 Department of Transport/Welsh Office (1988), Calculation of Road Traffic Noise. Her Majesty's Stationery Office, London.

Ref 13-17 British Standards Institute (2003) BS 7445 – Description and environment of environmental noise – Part 1: Guide to quantities and procedures. London: BSI.

Ref 13-18 British Standards Institute (2014) BS 4142 – Methods for rating and assessing industrial and commercial sound. London: BSI.

Ref 13-19 Department of Transport/Welsh Office (1988), Calculation of Road Traffic Noise. Her Majesty's Stationery Office, London.

Ref 13-20 Highways England (2020); Design Manual for Road and Bridges LA111: Noise and Vibration, Revision 2.

Ref 13-21 International Organisation for Standardisation (ISO) (1996) ISO 9613 Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation. Switzerland: ISO

Ref 13-22 Acoustics & Noise Consultants (ANC) (2020) BS 4142:2014+A1:2019 Technical Note, Version 1.0

Ref 13-23 British Standards Institute (2014); BS 8233 – Guidance on sound insulation and noise reduction for buildings, BSi, London.

Ref 13-24 World Health Organization (1999); Guidelines for Community Noise.

Ref 13-25 Hiller, D. M., and G. I. Crabb, (2000); Groundborne Vibration Caused by Mechanised Construction Works. TRL Report 429.

Ref 13-26 Selby, A.R. (1997). "Control of vibration and noise during piling." Brochure publication, British Steel, UK