Glöyn Byw | Butterfly Solar Farm

Environmental Statement - Volume 2

Chapter 8.0 – Noise and Vibration

Prepared for

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8.0 NOISE AND VIBRATION

8.1 Introduction

8.1.1 This Chapter of the Environmental Statement presents the findings of an assessment of the likely significant noise and vibration effects on noise sensitive receptors (NSRs) as a result of the Proposed Development.

8.1.2 The Proposed Development comprises a new solar energy generating station and associated on-site Battery Energy Storage Systems (BESS) on land to the north of the B5426, Wrexham ('the Site'). The Proposed Development also includes the associated infrastructure and connection route options to the Legacy National Grid substation. For a detailed description of the Proposed Development, refer to **ES Chapter 4: Scheme Description.**

8.1.3 The Proposed Development would enable the export of up to 99.9 megawatts (MW) of electricity, as well as the storage of electricity in the BESS.

8.1.4 The solar array is divided into three principal areas referred to as the Western, Central and Eastern Array Areas (the WAA, CAA and EAA respectively). The development areas are shown on Figure 1.1 and are described in detail within **ES Chapter 4: Scheme Description.**

8.1.5 This chapter is accompanied by the following appendices:

i) Appendix 8-1: Glossary
ii) Appendix 8-2: Measured Sound Data

8.1.6 This chapter is also accompanied by the following figures:

i) Figure 8.1 – Noise Sensitive Receptor Locations – Western Array Area
ii) Figure 8.2 – Noise Sensitive Receptor Locations – Central Array Area
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8.1.7 The following sections of this chapter include:

i) a description of relevant legislation, planning policy and guidance which has informed the assessment;
ii) a summary of consultation with stakeholders;
iii) a description of the methodology for the assessment, including details of the study area and the approach to the assessment of effects;
iv) a review of baseline conditions;
v) details of the measures to avoid or reduce environmental effects, including mitigation and design measures that form part of the Proposed Development;
vi) an assessment of the likely significant noise effects occurring at receptors during the construction, operation and decommissioning phases of the Proposed Development, taking into account the measures proposed to avoid or reduce effects;
vii) identification of any additional mitigation measures or monitoring required in relation to likely significant effects;
viii) a summary of the residual effects of the Proposed Development from implementation of any additional mitigation; and
ix) assessment of any cumulative effects with other proposed developments.

Competence

8.1.8 The chapter has been prepared by Natalie Wild BA (Hons) MIOA PISEP of inacoustic, who has over 15 years of specialist experience in the field of environmental acoustics and has been a full, corporate member of the Institute of Acoustics since 2015.

8.2 Legislation, Planning Policy and Guidance

8.2.1 Legislation relevant to noise and vibration considered in undertaking the assessment are summarised below.

Legislation

Well-being of Future Generations (Wales) Act 2015

8.2.2 The Well-being of Future Generations (Wales) Act 2015 has a number of wellbeing goals to achieve through implementing sustainable development. Changes in noise levels can have an impact on the health of habitat and humans, as such the goals to create 'a resilient Wales' and 'a healthier Wales' are applicable.

Control of Pollution Act 1974

8.2.3 The Control of Pollution Act, 1974, Part III - Noise is a combination and refinement of three earlier Acts: The Public Health Act, 1936 (replaced by the Public Health Act 1990, Part III), the Noise Abatement Act 1960 and the Public Health Act 1990, Part III). Section 60 of the Act enables a local planning authority to serve a notice on a person (this includes a company) who is carrying out, or who are planning to carry out, works of construction, demolition, roadworks, railway maintenance etc. in order to control the noise from those operations. Section 61 (S61) of the Act also enables such a person to apply to the local authority for consent in respect of such works.

National Planning Policy

8.2.4 National planning policies relevant to the noise and vibration assessment are summarised below.

Future Wales: The National Plan 2040

8.2.5 The National Plan states the following under the heading Developing infrastructure responsibly:

> *When proposing new transport infrastructure or new development, average population exposure to air and noise pollution should be reduced and soundscapes improved where it is practical and feasible to do so. At the very least, exposure to pollution should be minimised. This will include taking into account the long-term effects of current and predicted levels of air and noise*

pollution on individuals, society and the environment arising as a result of proposals for transport infrastructure or development.

8.2.6 Policy 18 of the document, entitled Renewable and Low Carbon Energy Developments of National Significance, states the following:

Proposals for renewable and low carbon energy projects (including repowering) qualifying as Developments of National Significance will be permitted subject to policy 17 and the following criteria:

7. there are no unacceptable adverse impacts by way of shadow flicker, noise, reflected light, air quality or electromagnetic disturbance;

Planning Policy Wales

8.2.7 The Government's planning policies for Wales are contained in Planning Policy Wales (Edition 12, 7th February 2024). The document aims to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales.

8.2.8 With regard to the assessment of noise associated with development, paragraph 6.7.4 provides guidance on noise generation near protected areas:

'The planning system should maximise its contribution to achieving the wellbeing goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so. '

Local Planning Policy

8.2.9 Local planning policies relevant to the noise and vibration assessment are summarised below.

Wrexham County Borough Council

8.2.10 The Proposed Development Site lies within the administrative area of Wrexham County Borough Council. Local planning policy is set out in the Wrexham Unitary Development Plan (1999 – 2011) (UDP), returned to 'adopted development plan' status in June 2025. The policy relevant to this chapter is Policy GDP1: *Development Objectives.*

8.2.11 Policy GDP1 sets out eleven objectives for all developments to adhere to, including:

f) Ensure the safety and amenity of the public and safeguard the environment from the adverse effects of pollution of water, land or air, hazards from industry and quarrying, and associated noise, odour or vibration arising from development.

Guidance

8.2.12 Guidance relevant to the noise and vibration assessment is summarised below.

Technical Advice Note (Wales) 11 - Noise

8.2.13 This note provides advice on how the planning system in Wales can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business.

8.2.14 It outlines some of the main considerations which local planning authorities should consider in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources.

British Standard 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Part 1: Noise' (BS 5228-1:2009+A1:2014)[i]

8.2.15 Part 1 of BS 5228:2009+A1:2014 relates to the potential effects of existing and proposed noise sensitive human receptors as a result of noise and vibration arising from construction activities. This includes construction vehicles travelling on haulage routes to and from the construction site.

British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' (BS 4142:2014+A1:2019)[ii]

8.2.16 BS 4142:2014+A1:2019 is the principal assessment methodology used to carry out assessments of sound of an industrial and/or commercial nature. This standard allows for the assessment of this sound at proposed new residential dwellings. It provides guidance on how to undertake the monitoring, modelling and assessment of industrial and commercial sound sources affecting NSRs.

ISO 9613-2:2024 'Acoustics - Attenuation of sound during propagation outdoors: Part 2: Engineering method for the prediction of sound pressure levels outdoors' (ISO 9613-2:2024)[iii]

8.2.17 Outlines the method for calculating the attenuation of sound during outdoor propagation, taking into account geometrical divergence, atmospheric absorption, ground effects, reflections from surfaces and screening by obstacles.

8.3 Assessment Methodology

Study Area

8.3.1 The study area comprises the NSRs located adjacent to the Site that are anticipated to experience a potential noise impact as a result of the construction, operation and decommissioning of the Proposed Development. The assessment considers the nearest NSRs to the Site, which are broadly located within Middle Sontley, Gyfelia, Stryt-yr-hwch, Crabtree Green, Eyton, Cock Bank, Royton, Porthwgan and surrounding areas. This incorporates an area within approximately 500m from the Site boundary. NSRs located at a greater separation distance from the Site boundary would expect to be subject to lower noise and vibration effects than those assessed.

8.3.2 All identified NSRs are residential in use and are considered to be of high receptor sensitivity within this ES Chapter.

Scope of Assessment

8.3.3 In the context of this assessment, noise is defined as unwanted or undesirable sound derived from sources such as road traffic, commercial/industrial processes or construction works that interfere with normal activities, including conversation, sleep or recreation. Vibration is defined as the transmission of energy through the medium of ground or air resulting in small movements of the transmitting medium, such as a building, which can cause discomfort to people or even damage to structures if the movements are large enough.

Effects Considered Within the Scope

8.3.4 The potentially significant effects considered within the scope, relating to the Proposed Development include:

- Potential effects on existing dwellings as a result of noise from construction works; and
- Potential effects on existing dwellings as a result of sound from commercial plant during the operational phase.

Effects Not Considered Within the Scope

8.3.5 Consideration of the following potential effects has concluded that they are unlikely to be significant, therefore they do not require further assessment:

- Potential effects on existing dwellings as a result of changes in road traffic noise during the construction and operational phases;
- Potential effects on existing dwellings as a result of vibration from construction works; and
- Potential effects on existing dwellings as a result of operational vibration.

8.3.6 The prediction of future noise levels generated by the construction, operational and decommissioning phases of the Proposed Development and the significance of their potential effects have been assessed in accordance with the appropriate British Standards, which are discussed below.

Assessment Methodology

Construction & Decommissioning Noise

8.3.7 Noise levels generated by construction and decommissioning plant and activities have the potential to impact upon nearby NSRs.

8.3.8 The construction period is expected to be between 39-52 weeks in duration.

8.3.9 Construction activities are proposed to take place between 07:30-18:00 Monday to Friday, 08:00-14:00 on Saturdays, with no works on Sundays or Bank Holidays.

8.3.10 A detailed construction programme is not fully developed, therefore the construction noise assessment has been undertaken using an indicative construction plant list, and associated sound power level information detailed within BS 5228-1:2009+A1:2014.

8.3.11 The sound power level information has been used to predict construction noise levels at the closest NSRs using Cadna/A noise modelling software.

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

8.3.13 The magnitude of the potential impact on sensitive receptors would depend upon a number of variables, the following of which are of particular relevance to this assessment:

- The amount of noise generated by plant and equipment being used at the Site, generally expressed as a sound power level;
- The periods of operation of the plant at the Site, known as the 'on-time';
- The distance between the noise source and the receptor, known as the 'stand-off';
- The attenuation due to ground absorption or barrier screening effects; and
- The reflection of noise due to the presence of hard vertical faces such as walls.

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

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

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

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

8.3.16 Annex E.2 goes on to state:

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

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

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

Commercial Operation / Process Sound

8.3.19 British Standard 4142:2014+A1:2019 *'Method for Rating and Assessing Industrial and Commercial Sound*' ('BS 4142:2014+A1:2019') sets out a method to assess the

likely effect of sound from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises, on people who might be inside or outside a dwelling or premises used for residential purposes in the vicinity.

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

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

8.3.22 BS 4142:2014+A1:2019 states:

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

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

- *'Typically, the greater this difference, the greater the magnitude of the impact.'*
- *'A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.'*
- *'A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.'*
- *'The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'*

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

Assessment of Significance / Assessment Criteria

Construction & Decommissioning Noise

8.3.25 Annex E of BS 5228-1 outlines the 'ABC Method' as a methodology for assessing construction noise. Table E.1 of BS 5228-1 sets out significance effect threshold values at residential receptors. The process for determining this requires the determination of the ambient noise level at the relevant receptor (rounded to the nearest 5 decibels ('dB')), which is used to set an appropriate threshold value (in dB) for the NSRs. This is then compared to the construction site noise level.

8.3.26 With reference to the measured ambient noise levels presented in Table 8.6, all NSRs have been determined to fall within Category A. Construction noise levels should therefore aim to not exceed 65 dB $L_{Aeq,T}$.

8.3.27 The relevant statistics from Table E.1 are set out in the Table 8.1 below. Compliance with these guidance levels would ensure that no significant adverse effects are experienced at the NSRs. As stated in BS 5228-1, if the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. Other project-specific factors, such as the number of receptors affected and the duration and character of the activities should be considered in the determination of significant effects.

Table 8.1 – Construction Noise Impact Significance Criteria

Period	Threshold value, dB $L_{Aeq,T}$		
	Category A	Category B	Category C
Daytime (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
NOTE 1 A significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.			
NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.			
NOTE 3 Applied to residential receptors only.			
A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			

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

Commercial Operation / Process Sound

8.3.28 The impact significance of commercial operation / process sound is set out in Table 8. 2, below.

Table 8. 2 – BS 4142:2014+A1:2019 Impact Significance Criteria

Rating Level Relative to Background Sound Level	BS 4142:2014+A1:2019 Impact Categorisation	Likely Significance of Effect
>=+10 dB	Significant Adverse Impact	Significant, depending on the context
<+10 dB	Adverse to Significant Adverse Impact	More Likely to be Significant. Consideration of other factors including context required.
<=+5 dB	Low to Adverse Impact	Less likely to be Significant. Consideration of other factors including context required.
<=0 dB	Low Impact	Not Significant

Assumptions and Limitations

8.3.29 In terms of limitations; as the precise infrastructure components/models for the Development have not yet been specified, the assessment considers a maximum acoustic performance specification that will feed into the procurement process for the site equipment.

8.3.30 With regard to assumptions; traffic numbers will be low during construction/decommissioning and particularly during operation, with existing highway routes being utilised to minimise levels of on-site construction traffic activity. During the construction period there are expected to be approximately 24- two-way delivery-related HGV movements per weekday and 14 two-way movements per Saturday, on average. This equates to approximately 2 two-way movements per hour. In terms of light vehicle movements, a total of 40 two-way trips per day are expected. It is not considered likely that this increase in flows would be perceptible on the existing road network.

8.3.31 Taking the above into account, road traffic noise during construction/decommissioning and operation of the Development has been scoped out of the assessment as significant effects are not anticipated.

8.3.32 Due to the relatively low impact construction techniques (micro-piling) typically used for this type of development, this technique gives rise to vibration levels that are sufficiently low so as to ensure that significant effects are considered unlikely at the NSRs. Taking this into account, the assessment of construction vibration has been scoped out of the assessment.

8.4 Consultation and Engagement

8.4.1 A scoping exercise was undertaken to establish the content, approach and methods to be followed within this ES.

8.4.2 A Scoping Report (**ES Appendix XX**) was submitted to Planning and Environment Decisions Wales (PEDW) on 03 February 2025. The report sets out the findings of the scoping exercise and detailed the proposed approach to the assessment of potential noise effects associated with the construction, operation, and decommissioning of the Proposed Development.

8.4.3 A Scoping Direction was received on 03 April 2025 (**ES Appendix XX**). The feedback received from PEDW, WCBC and stakeholders within the Scoping Direction, and the Applicant's responses are presented in **ES Appendix XX**. PEDW agreed with the approach to scope Noise and Vibration into the ES.

8.4.4 The survey and assessment scope and methodology were agreed with an Enforcement Officer at Wrexham County Borough Council on 19 May 2025.

8.5 Baseline

8.5.1 A baseline sound measurement exercise was undertaken at key receptor locations in and around the Site, between 22 May 2024 and 28 May 2024. Details of the baseline sound survey can be found in the following section.

8.5.2 Measurements were taken at seven discrete locations (see **ES Figure 8-4 to 8-6**), representative of the closest potentially affected NSR locations to the Proposed Development. These are residential receptors and are shown on **ES Figure 8-1 to 8-3**, relative to the Site boundary.

8.5.3 All sound measurements were undertaken by a consultant certified as competent in environmental sound monitoring, and, in accordance with the principles of British Standard 7445: 2003: *'Description and Measurement of Environmental Noise'*[iv].

8.5.4 All sound measurement equipment used during the sound survey conformed to Class 1 specifications of British Standard EN 61672-1:2013: *'Electroacoustics. Sound Level Meters*. Part 1 *Specifications*' (BS EN 61672-1:2013)[v]. Sound calibrators conformed to Class 1 specifications of British Standard EN IEC 60942:2018 '*Electroacoustics – Sound calibrators*' (BS EN IEC 60942:2018)[vi]. A full inventory of this equipment is shown in Table 8.3.

Table 8.3 – Inventory of Sound Measurement Equipment

Position	Make, Model, Description	Serial Number	Calibration Certificate Number	Calibration Due
MP1	Rion NL-52 Sound Level Meter	00810575	CONF032202	19/03/2026
	Rion NH-25 Preamplifier	11118		
	Rion UC-59 Microphone	19968		
MP2	Rion NL-52 Sound Level Meter	00943282	1142906	04/04/2025
	Rion NH-25 Preamplifier	43298		
	Rion UC-59 Microphone	7045		
MP3	Rion NL-52 Sound Level Meter	00965097	1141900	20/03/2025
	Rion NH-25 Preamplifier	65324		
	Rion UC-59 Microphone	10223		
MP4	Rion NL-52 Sound Level Meter	00810638	CONF032203	19/03/2026
	Rion NH-25 Preamplifier	11181		
	Rion UC-59 Microphone	20046		
MP5	Rion NL-52 Sound Level Meter	00965159	1143097	10/04/2025
	Rion NH-25 Preamplifier	65386		
	Rion UC-59 Microphone	18640		
MP6	Rion NL-52 Sound Level Meter	01009671	1141898	20/03/2025
	Rion NH-25 Preamplifier	9976		
	Rion UC-59 Microphone	18146		
MP7	Svantek 955 Sound Level Meter	23676	1140235	19/02/2025
	Svantek SV 12L Preamplifier	25615		
	ACO 7052E Microphone	49543		
All	Cirrus CR:515 Acoustic Calibrator	82506	1149834	16/10/2024

8.5.5 Measurement equipment used during the survey was field calibrated at the start and end of the measurement period. The field calibrator used had been laboratory calibrated within the 12 months preceding the measurements.

8.5.6 The weather conditions during the survey were monitored via the deployment of a rain tipping gauge and anemometer, thus ensuring the exclusion of any weather affected periods from the dataset. The microphones were fitted with protective windshields for the measurements.

8.5.7 The measurement positions are described below and identified on **ES Figure 8-4 to 8-6**:

- MP1 – A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located at the north western boundary of the WAA. The microphone was located at approximately 60 metres from the carriageway edge of the A483.

  The acoustic environment was dominated by road traffic noise from the A483;

- MP2 – A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located at the eastern boundary of the WAA. The microphone was located at approximately 400 metres from the carriageway edge of the A483.

  The acoustic environment was dominated by road traffic noise from the A483, with contributions from a nearby farm located approximately 50 metres to the north.

- MP3 – A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located at the northern boundary of the CAA. The microphone was located at approximately 7 metres from the carriageway edge of the track to the north.

  The acoustic environment was predominantly influenced by wildlife sounds. There was intermittent road traffic noise from the B road located to the west.

- MP4 - A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located at the north eastern boundary of the CAA. The microphone was

located at approximately 300 metres south of the carriageway edge of Bwgan-Ddu Lane.

The acoustic environment consisted predominately of bird song and wildlife sounds.

- MP5 – A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located in the centre of the CAA. The microphone was located at approximately 20 metres from the unnamed road to the west.

  The acoustic environment was influenced by road traffic noise and bird song.

- MP6 – A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located at the western boundary of the EAA. The microphone was located approximately 7 metres south of Kiln Lane.

  The acoustic environment was primarily influenced by road traffic noise.

- MP7 - A partially attended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located in the centre of the EAA.

  The acoustic environment was dominated by road traffic noise from the B5130.

Summary of Results

8.5.8 The summarised results of the environmental sound measurements are presented in Table 8.4, with a measured time history and statistical analyses presented within **ES Appendix 8.2**. Values have been rounded to the nearest whole number.

Table 8.4 – Summary of Sound Measurement Results

Position	NSR Proxy Location Refs	Period	Sound Level, dB		
			$L_{Aeq,T}$	$L_{A90,T}$	L_{AFmax}
MP1	1, 2, 7, 8	Day: 07:00-23:00	63	57	76
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	63	-	-
		Night: 23:00-07:00	56	46	72
MP2	3 - 6	Day: 07:00-23:00	55	48	74

Position	NSR Proxy Location Refs	Period	Sound Level, dB		
			$L_{Aeq,T}$	$L_{A90,T}$	L_{AFmax}
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	56	-	-
		Night: 23:00-07:00	51	40	69
MP3	13, 14	Day: 07:00-23:00	49	38	71
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	50	-	-
		Night: 23:00-07:00	47	32	68
MP4	15 - 17	Day: 07:00-23:00	51	36	76
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	52	-	-
		Night: 23:00-07:00	50	30	73
MP5	18 - 27	Day: 07:00-23:00	52	41	76
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	53	-	-
		Night: 23:00-07:00	49	33	73
MP6	28 – 32, 35	Day: 07:00-23:00	54	38	71
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	56	-	-
		Night: 23:00-07:00	43	29	63
MP7	33, 34, 36 - 40	Day: 07:00-23:00	53	37	72
		BS 5228-1 Construction Period: Daytime 07:00-19:00 and Saturdays 07:00-13:00	54	-	-
		Night: 23:00-07:00	51	29	73

Future Baseline

8.5.9 The future baseline, in the absence of any development at the Site or its immediate surrounding area is not anticipated to significantly change. The presence of transport infrastructure, which governs the prevailing sound environment is anticipated to continue to dominate the acoustic environment of the area, with any changes being linked to changes in road traffic profiles.

8.5.10 Although vehicle technology is changing, with electric vehicles gradually becoming more popular, the nature of traffic in the area is not expected to be significantly affected by this change, due to the speed of flow ensuring that aerodynamic and tyre noise dominates.

8.6 Initial Development Design and Impact Avoidance/Reduction Measures

8.6.1 General design measures to avoid or minimise the potential for significant effects are described in **ES Chapter 4.0: Proposed Development.**

8.6.2 Initial development design and impact avoidance/reduction measures can be broken down into three types as follows:

i) Primary Mitigation: measures which form an inherent part of the project design.
ii) Secondary Mitigation: measures that require further activity to achieve the anticipated outcome (e.g. details provided via planning condition).
iii) Tertiary Mitigation: measures required by legislation or typical best practice.

8.6.3 Initial mitigation measures relevant to the consideration of noise impacts are described below.

Construction & Decommissioning Noise

Outline Construction Environmental Management Plan

8.6.4 An outline Construction Environmental Management Plan (oCEMP) is provided with this DNS application [ADD REF] and presents the outline approach to and the application of environmental management and mitigation for the construction of the Proposed Development. The oCEMP will be subject to planning condition, adopted by the Principal Contractor and expanded to include a series of detailed management plans. The oCEMP is therefore classified as primary mitigation, with the detailed CEMP (which will be a 'live' document) classified as secondary mitigation.

8.6.5 Good practice measures relating to noise and vibration impacts, comprising BPM, have been incorporated into the oCEMP, as described below.

8.6.6 Effective co-ordination and time management of construction operations would be important in avoiding noise and vibration nuisance to surrounding uses. Early and helpful communications with the surrounding receptors would assist reducing potential for and in managing any complaints arising during the construction works of the Proposed Development.

8.6.7 Contractors would be required to ensure that works are carried out in accordance with BPM as stipulated in the Control of Pollution Act 1974. A full explanation of

measures to control construction noise would be incorporated within the detailed CEMP and detailed in all demolition and construction method statements.

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

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

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

8.6.10 Should any non-routine activities be identified that would make it impracticable to work to the target criterion, provisions would be set out in advance and with the agreement of WCBC, to minimise and noise or vibration impacts.

8.6.11 Noise monitoring would be carried out during particularly noisy phases of work and when work is undertaken in close proximity to the Site boundary so that such situations can be actively managed in accordance with the CEMP for the Site.

8.6.12 For any proposed construction works to be undertaken outside of the permitted working day, particularly at night, prior consent would be sought from WCBC. Dispensation procedures for works would be agreed in advance and included within Construction Method Statements and the CEMP or Section 61 Agreement where

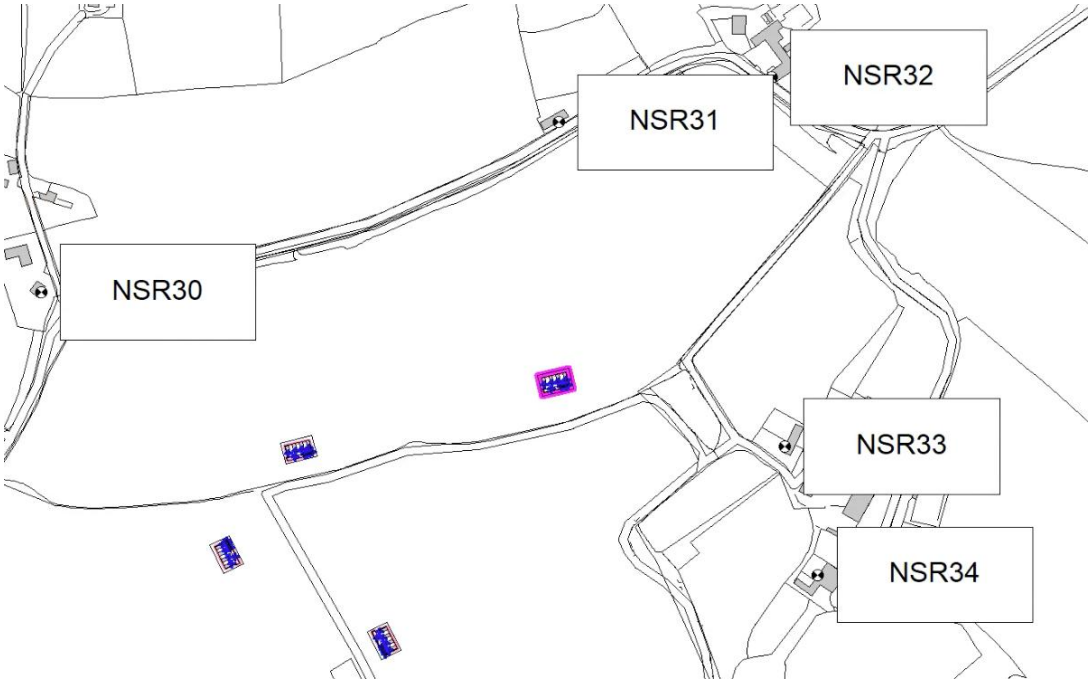
adopted. Section 61 of the Control of Pollution Act, 1974, allows a contractor to apply to WCBC for prior consent for construction works.

i) Deliveries and removal of material off-site, would be subject to the following controls:
ii) Ensuring that construction traffic is parked off the public highway;
iii) Controlling the discharge of trucks from Site to avoid congestion; and
iv) Implementing traffic management systems at the entrance to the Site at all times to control the traffic into the Site.

Operational Sound

8.6.13 For the operational phase of the Proposed Development, a 4m high acoustic barrier has been included around the hybrid-inverter battery station south of NSR31 in the EAA (as shown in pink in Image 8.1 below), in addition to the acoustically appropriate specification of the equipment and acoustically sympathetic design.

Image 8.1 - Location of 4m High Acoustic Barrier



Further Mitigation, Monitoring and Enhancement

8.6.14 Any further mitigation and (where necessary) enhancement measures identified to address the initial environmental effects of the Proposed Development are considered at Section 8.10 of this chapter.

8.7 Assessment of Effects

Construction Phase

8.7.1 Construction noise levels have been predicted at the closest identified NSRs based on the construction activities and programme set out in **ES Chapter 4.0: Scheme Description** , and in accordance with BS 5228.

8.7.2 Works will be undertaken between 07:30 and 18:00 from Monday to Friday, and between 08:00 and 14:00 on Saturdays, with any works agreed outside these hours to be agreed with the Local Planning Authority.

8.7.3 In order to assess the realistic 'worst-case' scenario for the assessment of the Proposed Development's likely significant effects resulting from construction noise, worst-case construction noise levels during the erection of infrastructure have been predicted at the closest NSRs. Detail of relevant activities to be undertaken during this phase are detailed in **ES Chapter 4.0: Scheme Description.**

Sound Source Data

8.7.4 The source data associated with the most significant items of plant to be used near to the closest NSRs during the construction works, has been taken from BS 5228-1, and is set out below in Table 8.5.

Table 8.5 – Construction Noise Source Data

Plant	BS 5228 Reference	Quantity	% On Time	Sound Power Level, L_{WA} dB
BESS Construction				
Tracked Crane	Table D.7 Ref 120	1	80	104
Dozer	Table C.2 Ref 12	1	80	109
Excavator	Table D.3 Ref 88	1	80	107
Dump Truck (tipping)	Table C.2 Ref 30	1	80	107
HGV Movements	Table C.6 Ref 21	1	80	108
Road Roller	Table D.3 Ref 114	1	80	108
Asphalt Paver	Table C.5 Ref 31	1	80	105
Solar Construction				
Steelwork Power Tools	Table C.4 Ref 71	1	40	113
Piling Rig	Table C.3 Ref 14	1	50	111
Generator	Table D.7 Ref 53	1	100	102
Telehandler	Table C.4 Ref 44	2	50	107

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

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

Construction Noise Level Summary

8.7.7 A summary of the predicted construction noise levels at a statistically representative selection of NSRs, which lie directly adjacent to the Site boundary shown in Figure 8.1 is provided in Table 8.6 below. These NSRs have been presented as they represent a realistic 'worst-case' scenario due to their proximity to the Site boundary.

Table 8.6 – Predicted Construction Noise Level Summary

NSR	Solar Construction, dB $L_{Aeq,T}$	BESS Construction, dB $L_{Aeq,T}$
NSR1	56	55
NSR2	54	53
NSR3	53	54
NSR4	52	53
NSR5	65	62
NSR6	53	55
NSR7	56	53
NSR8	55	55
NSR9	54	54
NSR10	64	63
NSR11	57	60
NSR12	61	48
NSR13	64	63
NSR14	60	56
NSR15	49	50
NSR16	49	50
NSR17	47	49
NSR18	57	52
NSR19	53	52
NSR20	60	60
NSR21	61	61
NSR22	61	62
NSR23	63	63
NSR24	58	57
NSR25	61	62
NSR26	57	57

NSR	Solar Construction, dB $L_{Aeq,T}$	BESS Construction, dB $L_{Aeq,T}$
NSR27	57	57
NSR28	55	56
NSR29	61	59
NSR30	63	60
NSR31	64	59
NSR32	65	60
NSR33	61	60
NSR34	57	56
NSR35	53	55
NSR36	51	53
NSR37	49	52
NSR38	54	56
NSR39	60	60
NSR40	58	59

8.7.8 The predictions presented in Table 8.6 identify that noise levels are not predicted to exceed the adopted 65 dB(A) limit when works are undertaken within the Site at the closest point to off-site NSRs. Construction noise effects are therefore considered as 'not significant'.

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

Operational Phase

Sound Source Data

8.7.10 The sound source levels used in the assessment are set out in Table 8.7. It is important to note that these are candidate plant selections, used for the purposes of this assessment and that individual plant specifications may differ. Sound from tracking motors is insignificant and is therefore not assessed.

Table 8.7 – Sound Source Data

Plant	Quantity	Sound Power Level per Unit, L_{WA} dB
Hybrid Compound		
Containerised Inverter Station - Daytime	26	88
Containerised Inverter Station – Night-time	26	84
Battery Cooling System - Daytime	104	79
Battery Cooling System – Night-time	104	73
DC-DC Converter - Daytime	104	77

Plant	Quantity	Sound Power Level per Unit, L_{WA} dB
DC-DC Converter – Night-time	104	77
Standalone Point Sources		
132 kilovolt ('kV') Substation Transformer	1	77

Calculation Process

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

Model Assumptions

8.7.12 Given that the ground condition of the land between the Site and nearest NSRs is predominantly soft, the ground factor has been set to G=1, within the calculation software (with the exception of the area around the hybrid-inverter battery stations which have been set to G=0.2 assuming hard ground), with 2 orders of reflection. Full octave frequency spectra have been used in the calculations.

8.7.13 It has been assumed that all plant will operate simultaneously, representing a worst-case scenario, although this is an unlikely occurrence as all of the hybrid-inverter battery stations are independent of each other and usually operate as per demand and for a short period of time.

8.7.14 In order to accurately model the land surrounding the Site, an AutoCAD DXF drawing was produced, which was based on data provided by the Ordnance Survey, along with associated LIDAR Composite DTM topographic contours sourced from the Defra Data Services Platform.

Specific Sound Level Maps

8.7.15 The sound maps showing the daytime and night-time specific sound level emissions at 4 metres above ground, associated with the Proposed Development for the EAA, CAA and WAAs are shown in **ES Figures 8-7 to 8-12**.

Specific Sound Level Summary

8.7.16 A summary of the predicted specific sound levels at the identified NSRs, based on the sound maps shown in **ES Figures 8-7 to 8-12** is shown in Table 8.8.

Table 8.8 – Specific Sound Level Summary

Receptor	Predicted Specific Sound Level, dB $L_{Aeq,T}$	
	Daytime	Night-time
NSR1	27	23
NSR2	24	21
NSR3	24	21
NSR4	23	19
NSR5	37	33
NSR6	22	19
NSR7	25	22
NSR8	30	27
NSR9	23	19
NSR10	34	31
NSR11	29	25
NSR12	26	22
NSR13	34	31
NSR14	28	25
NSR15	22	18
NSR16	21	18
NSR17	21	17
NSR18	28	24
NSR19	27	23
NSR20	33	30
NSR21	34	31
NSR22	34	31
NSR23	35	31
NSR24	32	28
NSR25	33	30
NSR26	29	26
NSR27	30	26
NSR28	28	24
NSR29	29	26
NSR30	32	29
NSR31	31	27
NSR32	29	25
NSR33	32	28
NSR34	31	27
NSR35	26	23
NSR36	22	18
NSR37	23	19
NSR38	24	20
NSR39	32	29
NSR40	31	27

Rating Penalty Principle

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

"Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;

b) objective method for tonality;

c) reference method."

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

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

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

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

- Tonality: A rating penalty of +2 dB is applicable for a tone which is "*just perceptible*", +4 dB where a tone is "*clearly perceptible*", and +6 dB where a tone is "*highly perceptible*".

- Impulsivity: A rating penalty of +3 dB is applicable for impulsivity which is *"just perceptible"*, +6 dB where it is *"clearly perceptible*", and +9 dB where it is *"highly perceptible"*.

- Intermittency: BS 4142:2014+A1:2019 states that when the *"specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.*"

- Other Sound Characteristics: BS 4142:2014+A1:2019 states that where *"the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distance against the residual acoustic environment, a penalty of +3 dB can be applied*".

Rating Penalty Assessment

8.7.20 Considering the above, an assessment of the various sound sources associated with the Proposed Development, in terms of whether any rating penalties are applicable, has been carried out and has been detailed in Table 8.9 below.

Table 8.9 – Rating Penalty Assessment

Source	Tonality	Impulsivity	Intermittency	Other Sound Characteristics	Discussion
PV Inverters and Transformers	0 dB	0 dB	0 dB	0 dB	The inverters and transformers housed within the containerised inverter stations (hybrid-inverter battery stations) will operate as demand requires. However, once operating, these do not cycle on and off. Tonality is unlikely to be perceptible, as although there is a potential mid-low-frequency bias at source, the residual acoustic environment will substantially mask any significant tones.
Battery Energy Storage System ('BESS') Plant and 132/33kV Substation	0 dB	0 dB	0 dB	0 dB	The battery cooling systems typically operate continuously during the majority of the charging/ discharging periods.

					They might switch on/off, but not simultaneously, during cool down periods when they are less noisy, and therefore the intermittency is not expected to be readily noticeable at the NSR locations. Potential low-frequency bias might exist at source, but due to the distance to NSRs, the residual acoustic environment will mask any significant tones or low frequency characteristics.

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

Uncertainty in Calculations: Measurement Uncertainty

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

> *b) the complexity and level of variability of the residual acoustic environment;*
>
> *d) the location(s) selected for taking the measurements;*
>
> *g) the measurement time intervals;*
>
> *h) the range of times when the measurements have been taken;*
>
> *i) the range of suitable weather conditions during which measurements have been taken;*
>
> *k) the level of rounding of each measurement recorded; and*
>
> *l) the instrumentation used.'*

8.7.23 Each of the relevant measurement uncertainty factors outlined above have been considered and discussed in Table 8.10.

Table 8.10 – Measurement Uncertainty Factors

Measurement Uncertainty Factor Reference	Level of Uncertainty	Discussion
b) the complexity and level of variability of the residual acoustic environment	0 dB	Residual acoustic environment is relatively constant, and therefore no correction for a complex residual acoustic environment is required.
d) the location(s) selected for taking the measurements	0 dB	Measuring at locations representative of the closest affected NSRs to the Site has enabled the determination of robust background sound levels.
g) the measurement time intervals	0 dB	Measurement time intervals were set in accordance with BS 4142:2014+A1:2019, and therefore no further correction is required.
h) the range of times when the measurements have been taken	0 dB	Measurements were undertaken over seven consecutive daytime and night-time periods.
i) the range of suitable weather conditions during which measurements have been taken	0 dB	Where periods of wind or precipitation were measured, these were removed from the dataset.
k) the level of rounding of each measurement recorded	0 dB	Measured values were rounded to 0.1 dB, therefore rounding would not have had a significant impact on the overall typical background sound levels.
l) the instrumentation .used	0 dB	The sound measurement equipment conformed to Class 1 specifications of BS EN 61672-1:2013), and were deployed with appropriate wind shields. Sound calibrators conformed to Class 1 specifications of BS EN IEC 60942:2018

8.7.24 In this instance the level of measurement uncertainty is not expected to affect the conclusions of the assessment.

Uncertainty in Calculations: Calculation Uncertainty

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

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

e) error in the calculation process.'

8.7.26 Each of the calculation uncertainty factors outlined above have been considered and discussed in Table 8.11.

Table 8.11 – Calculation Uncertainty Factors

Calculation Uncertainty Factor Reference	Level of Uncertainty	Discussion
b) uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels	0 dB	Sound source levels for all plant are worst-case candidate data to be achieved by the Proposed Development.
c) uncertainty in the calculation method	0 dB	Calculations were undertaken in accordance with ISO 9613-2, which is considered a “validated method” by BS 4142:2014+A1:2019. Restricting attention to moderate downwind conditions of propagation, limits the effect of variable meteorological conditions along the propagation path on sound attenuation to reasonable values.
d) simplifying the real situation to "fit" the model (user influence on modelling)	0 dB	The real situation has been simplified for the purposes of this assessment.
e) error in the calculation process	±1 dB	ISO 9613-2 estimates the accuracy of use of the calculation method, which varies based on the separation distance between the source and receiver, up to a maximum of 1km.

8.7.27 In this instance the level of calculation uncertainty is not expected to affect the conclusions of the assessment. It is also noted that because the assessment considers a worst-case scenario, such as downwind sound propagation (which in reality cannot happen at all NSRs at the same time) the relevance of the uncertainty is further reduced.

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

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

8.7.29 The resultant assessment summary, during the daytime period, is shown in Table 8.12.

Table 8.12 – Daytime BS 4142:2014+A1:2019 Assessment

Receptor	Rating Level, dB $L_{Ar,Tr}$	Background Sound Level, dB $L_{A90,T}$	Excess of Rating over Background Sound Level, dB
NSR1	27	57	-30

Receptor	Rating Level, dB $L_{Ar,Tr}$	Background Sound Level, dB $L_{A90,T}$	Excess of Rating over Background Sound Level, dB
NSR2	24	57	-33
NSR3	24	48	-24
NSR4	23	48	-25
NSR5	37	48	-11
NSR6	22	48	-26
NSR7	25	57	-32
NSR8	30	57	-27
NSR9	23	41	-18
NSR10	34	41	-7
NSR11	29	41	-12
NSR12	26	41	-15
NSR13	34	38	-4
NSR14	28	38	-10
NSR15	22	36	-14
NSR16	21	36	-15
NSR17	21	36	-15
NSR18	28	41	-13
NSR19	27	41	-14
NSR20	33	41	-8
NSR21	34	41	-7
NSR22	34	41	-7
NSR23	35	41	-6
NSR24	32	41	-9
NSR25	33	41	-8
NSR26	29	41	-12
NSR27	30	41	-11
NSR28	28	38	-10
NSR29	29	38	-9
NSR30	32	38	-6
NSR31	31	38	-7
NSR32	29	38	-9
NSR33	32	37	-5
NSR34	31	37	-6
NSR35	26	38	-12
NSR36	22	37	-15
NSR37	23	37	-14
NSR38	24	37	-13
NSR39	32	37	-5
NSR40	31	37	-6

8.7.30 As shown in Table 8.12, during the daytime period, the Proposed Development is predicted to have a 'low impact' at the NSRs with reference to BS 4142:2014+A1:2019 methodology. Operational effects during the daytime are therefore considered to be ‘not significant’.

8.7.31 The resultant assessment summary, during the night-time period, is shown in Table 8.13.

Table 8.13 – Night-time BS 4142:2014+A1:2019 Assessment

Receptor	Rating Level, dB $L_{Ar,Tr}$	Background Sound Level, dB $L_{A90,T}$	Excess of Rating over Background Sound Level, dB
NSR1	23	46	-23
NSR2	21	46	-25
NSR3	21	40	-19
NSR4	19	40	-21
NSR5	33	40	-7
NSR6	19	40	-21
NSR7	22	46	-24
NSR8	27	46	-19
NSR9	19	33	-14
NSR10	31	33	-2
NSR11	25	33	-8
NSR12	22	33	-11
NSR13	31	32	-1
NSR14	25	32	-7
NSR15	18	30	-12
NSR16	18	30	-12
NSR17	17	30	-13
NSR18	24	33	-9
NSR19	23	33	-10
NSR20	30	33	-3
NSR21	31	33	-2
NSR22	31	33	-2
NSR23	31	33	-2
NSR24	28	33	-5
NSR25	30	33	-3
NSR26	26	33	-7
NSR27	26	33	-7
NSR28	24	29	-5
NSR29	26	29	-3
NSR30	29	29	0
NSR31	27	29	-2

Receptor	Rating Level, dB $L_{Ar,Tr}$	Background Sound Level, dB $L_{A90,T}$	Excess of Rating over Background Sound Level, dB
NSR32	25	29	-4
NSR33	28	29	-1
NSR34	27	29	-2
NSR35	23	29	-6
NSR36	18	29	-11
NSR37	19	29	-10
NSR38	20	29	-9
NSR39	29	29	0
NSR40	27	29	-2

8.7.32 As shown in Table 8.13, during the night-time period, the Proposed Development is predicted to have a 'low impact' at the NSRs with reference to BS 4142:2014+A1:2019 methodology. Operational effects during the night-time period are therefore considered to be ‘not significant’.

Decommissioning Phase

8.7.33 Noise effects during the decommissioning phase of the Proposed Development, which would occur at the end of the Proposed Development's modelled operational lifespan of 40 years, are anticipated to be similar to those predicted for the Proposed Development's construction phase, which have been predicted to be ‘not significant’. Many of the Proposed Development's construction phase activities will be replicated for the decommissioning phase, but in reverse. There is the potential for benefits from technological advancements that are likely to have occurred in the intervening period between the Proposed Development's construction and decommissioning that would be anticipated to reduce noise generation, as well as the duration of the required activities. However, as a 'worst-case' scenario, if such technological advancements do not occur, the Proposed Development's noise effects during decommissioning would be no greater than for the construction phase and therefore considered to be ‘not significant’.

8.8 Inter-relationship Effects

8.8.1 There is the potential for visual effects due to the proposed noise mitigation measures during the operational phase (4m high noise barrier). This is considered in the visual impact assessment.

8.8.2 There is the potential for noise effects to be influenced by road traffic flows during both construction and operational phases. The noise assessment has taken the likely road traffic flows into consideration.

8.8.3 There were no noise-sensitive ecological receptors identified within the study area therefore noise effects on biodiversity have not been considered relevant within this ES Chapter.

8.9 Cumulative Effects

Construction Phase

8.9.1 Any cumulative effects during construction are anticipated to be minimal. However, careful co-ordination with any developers for any proposed development on land adjacent to the Site should be undertaken if appropriate during the construction phases, should they overlap, so as to ensure that work phasing is appropriately scheduled so as to minimise concentrations of work in any given area and spikes in construction traffic.

Operational Phase

8.9.2 The noise effects of the operational phase of the Proposed Development in cumulation with the cumulative schemes set out in Table 8.14 have been considered. Further assessment of cumulative effects has been scoped out, either due to their distance from the Proposed Development (at least 1km) and/or having incomparable noise impact profiles with the Proposed Development. Operating solar farms are not known to vibrate significantly. Therefore, vibration has been scoped out of this assessment.

Table 8-14 – Initial List of Schemes for Consideration in Cumulative Assessment

Reference on ES Figure 2.1	Application Reference	Project Detail	Status	Included in Scope?
1.	DNS/3253253	Plas Power Estate Solar Farm	Pre-Application (EIA Development)	Yes
2.	P/2020/0363	Glasshouse with packing facility and offices, energy centre, recovery plant and reservoirs	Allowed at Appeal (Non-EIA)	Yes

3.	P/2022/0541	9.9MW Solar Farm	Approved (Non-EIA)	Yes

8.10 Further Mitigation

8.10.1 No further mitigation is required to avoid or otherwise reduce potentially significant adverse effects from the Proposed Development.

8.11 Residual Effects

8.11.1 In the absence of any further mitigation measures, as set out in **Section 8.9** above, residual effects would remain as described in **Section 8.7.**

8.12 Conclusions

Construction Phase

8.12.1 The assessment has determined that during the construction and demolition of the Proposed Development, noise effects would expect to be 'not significant' at the nearest NSRs.

8.12.2 The adoption of BPM measures is expected to provide additional reductions in noise and vibration levels at the nearest NSRs. Such measures would be defined in the CEMP.

Operational Phase

8.12.3 The assessment has determined that during operation of the Proposed Development, noise effects would expect to be 'not significant' at the nearest NSRs.

8.12.4 This is subject to the implementation of appropriate mitigation including a 4m high acoustic barrier around the hybrid-inverter battery station to the south of NSR31 in the EAA, in addition to the acoustically appropriate specification of the equipment and acoustically sympathetic design.

Cumulative Effects

8.12.5 The assessment has considered noise effects during the operational phase of the Proposed Development in cumulation with cumulative schemes included within the scope. Further assessment of cumulative effects has been scoped out, either due to

their distance from the Proposed Development (at least 1km) and/or having incomparable noise impact profiles with the Proposed Development. Operating solar farms are not known to vibrate significantly. Therefore, vibration has been scoped out of this assessment.

8.12.6 Cumulative noise and vibration effects are therefore considered likely to be 'not significant'.

Appendix 8.1 – Glossary

TABLE A8.1: DEFINITION OF TERMS

Term	Definition
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa ($20x10^{-6}$ Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background sound.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

8.12.7 In order to assist the understanding of acoustic terminology and the relative change in sound, the following background information is provided.

8.12.8 The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE A8.2: TYPICAL SOUND LEVELS FOUND IN THE ENVIRONMENT

Sound Level	Location
0dB(A)	Threshold of hearing
20 to 30dB(A)	Quiet bedroom at night
30 to 40dB(A)	Living room during the day
40 to 50dB(A)	Typical office
50 to 60dB(A)	Inside a car
60 to 70dB(A)	Typical high street
70 to 90dB(A)	Inside factory
100 to 110dB(A)	Burglar alarm at 1m away
110 to 130dB(A)	Jet aircraft on take off
140dB(A)	Threshold of Pain

8.12.9 The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

8.12.10 In accordance with logarithmic addition, combining two sources with equal sound levels would result in an increase of 3 dB(A) in the sound level from a single source.

8.12.11 A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous sound which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in sound represents a subjective doubling of loudness.

8.12.12 A sound impact on a community is deemed to occur when a new sound is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient sound level occurs.

8.12.13 For levels of sound that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, road traffic noise is measured as the L_{A10}, the noise level exceeded for 10% of the measurement period. The L_{A90} is the level exceeded for 90% of the time and has been adopted to represent the background sound level in the absence of discrete

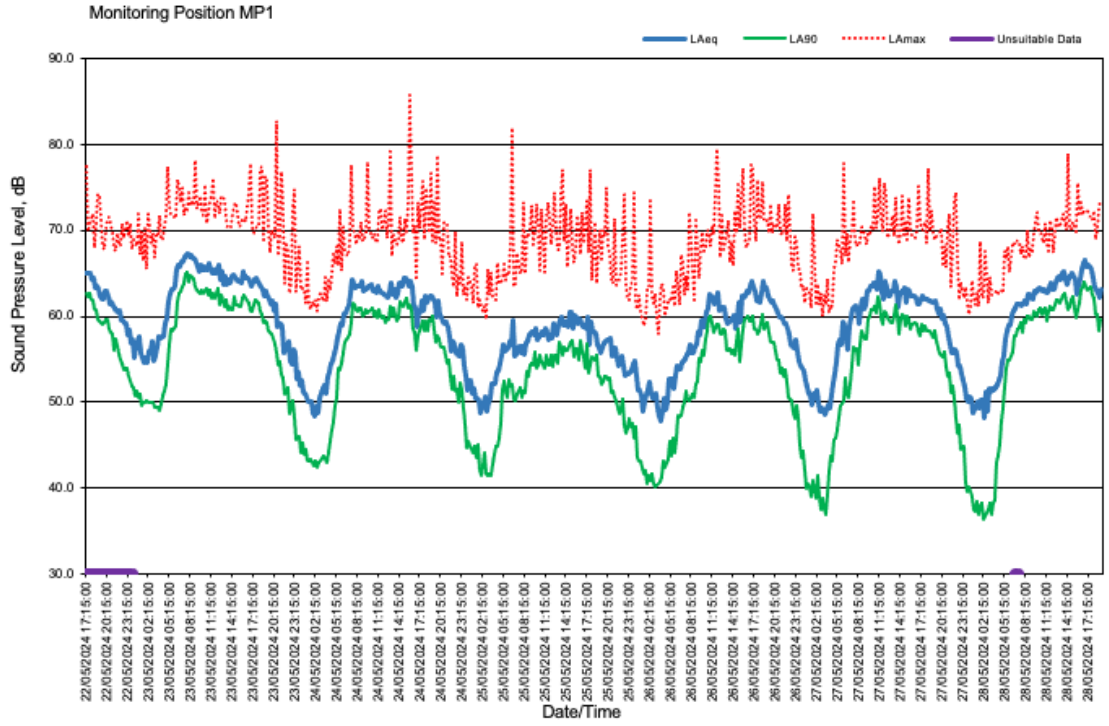
events. An alternative way of assessing the time varying sound levels is to use the equivalent continuous sound level, L_{Aeq}.

8.12.14 This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

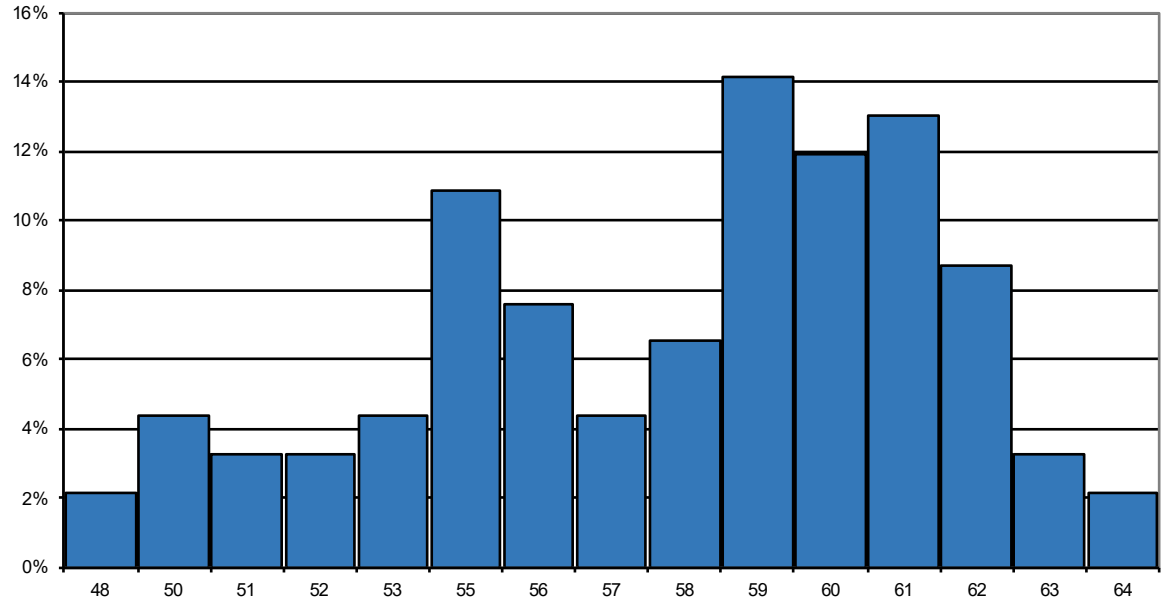
8.12.15 To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

8.12.16 Note that the time constant and the period of the sound measurement should be specified. For example, BS 4142:2014+A1:2019 specifies background sound measurement periods of 1 hour during the daytime and 15 minutes during the night-time. The sound levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The sound measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

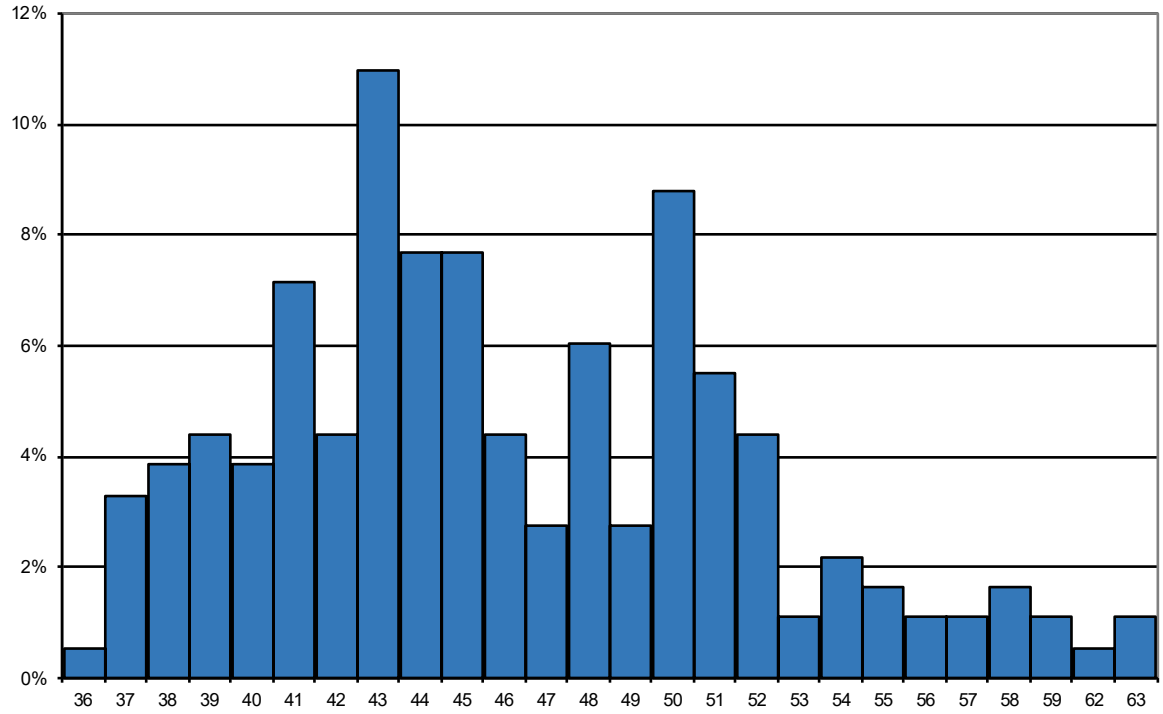
Appendix 8.2 – Measured Sound Data

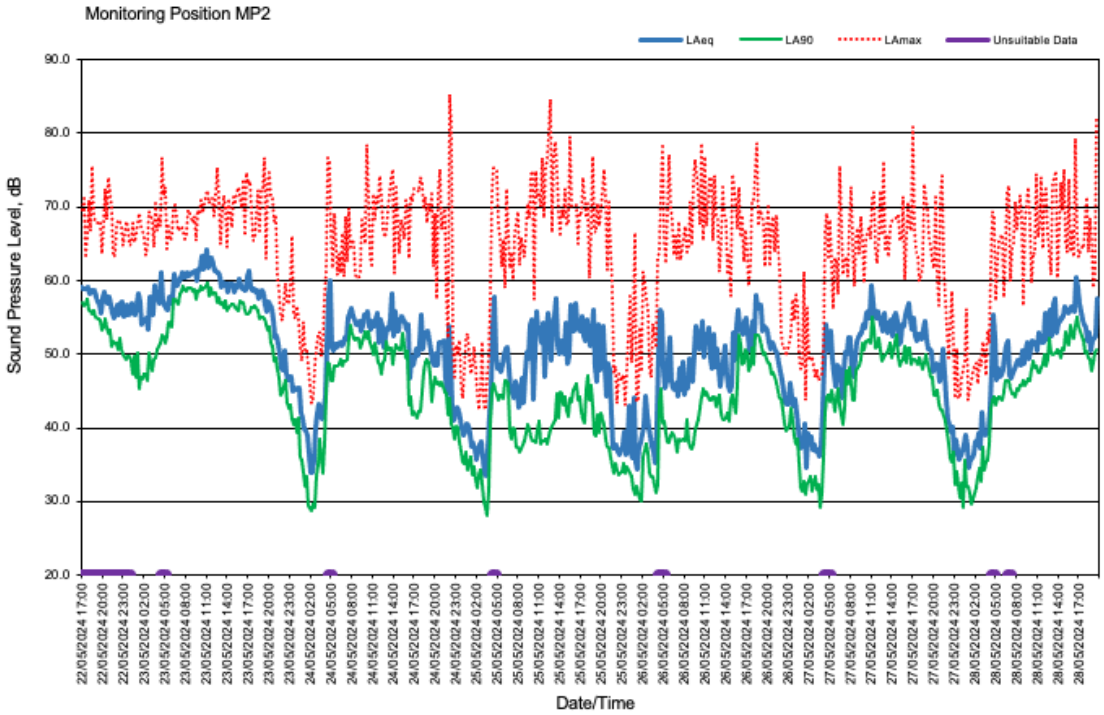


MP1 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound

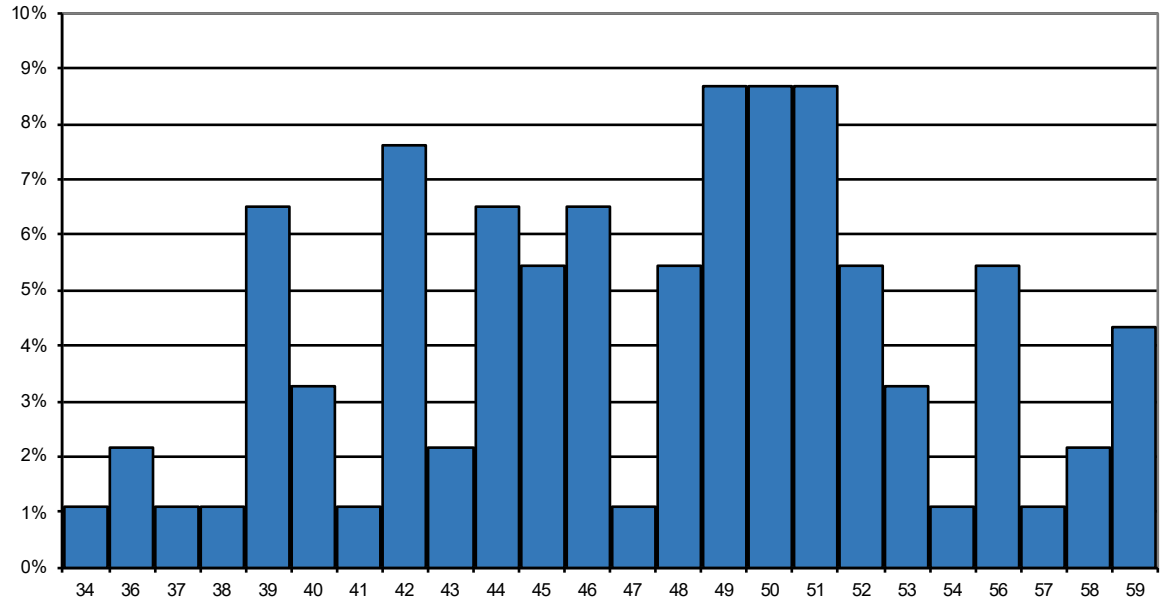


MP1 - Statistical Analysis of Night-time (23:00-07:00) $L_{A90,15min}$ Background Sound

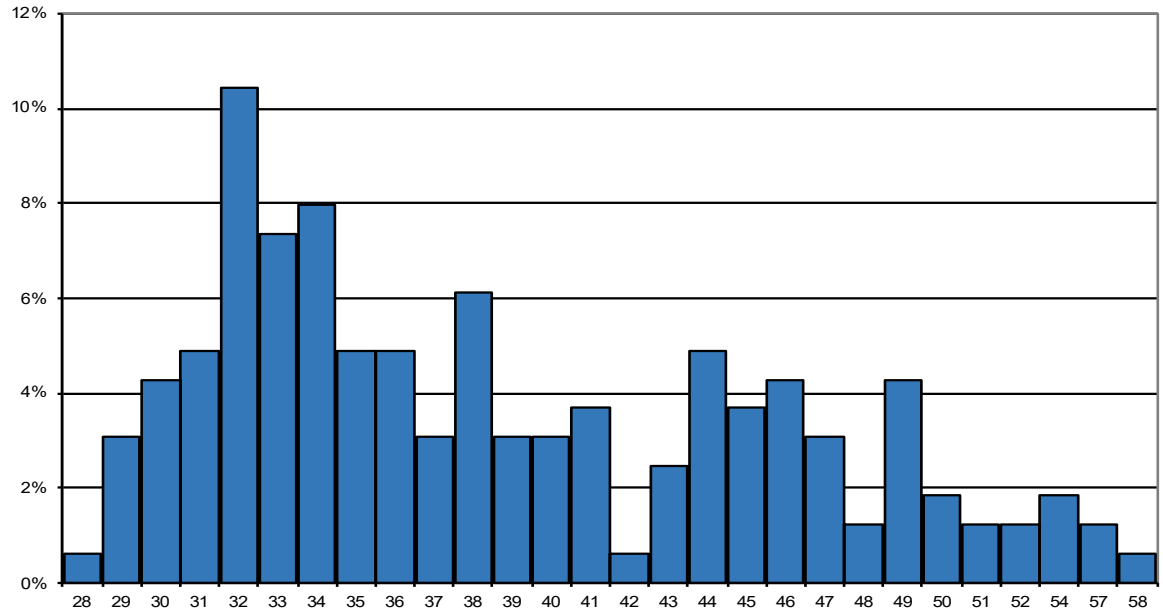


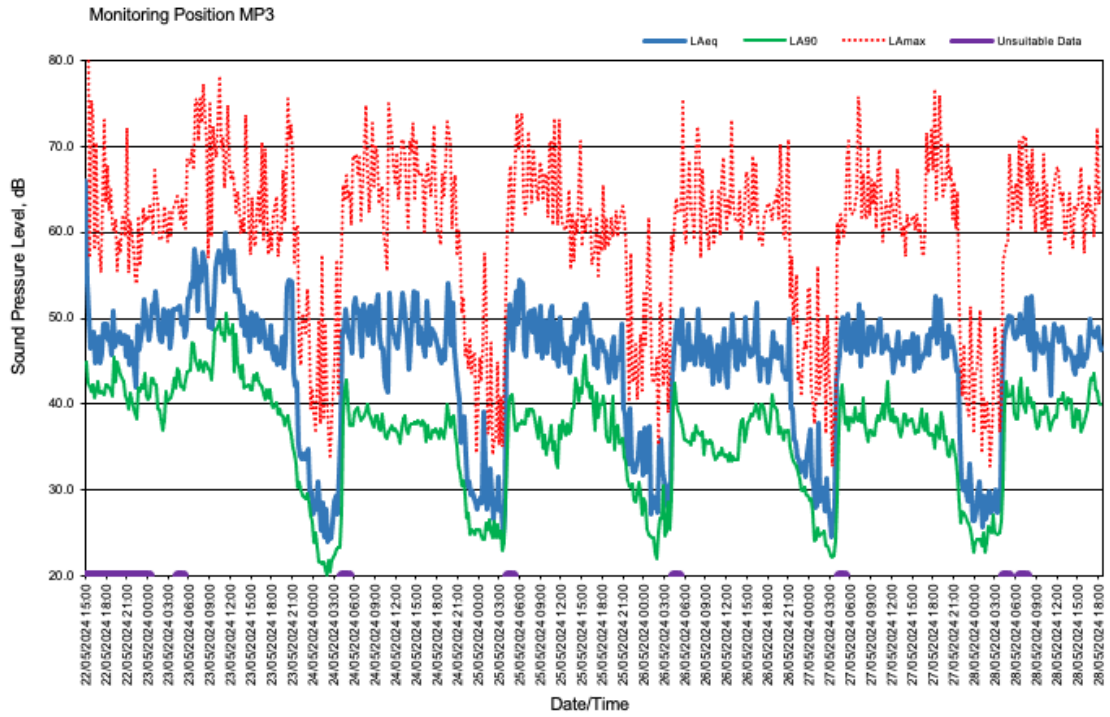


MP2 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound

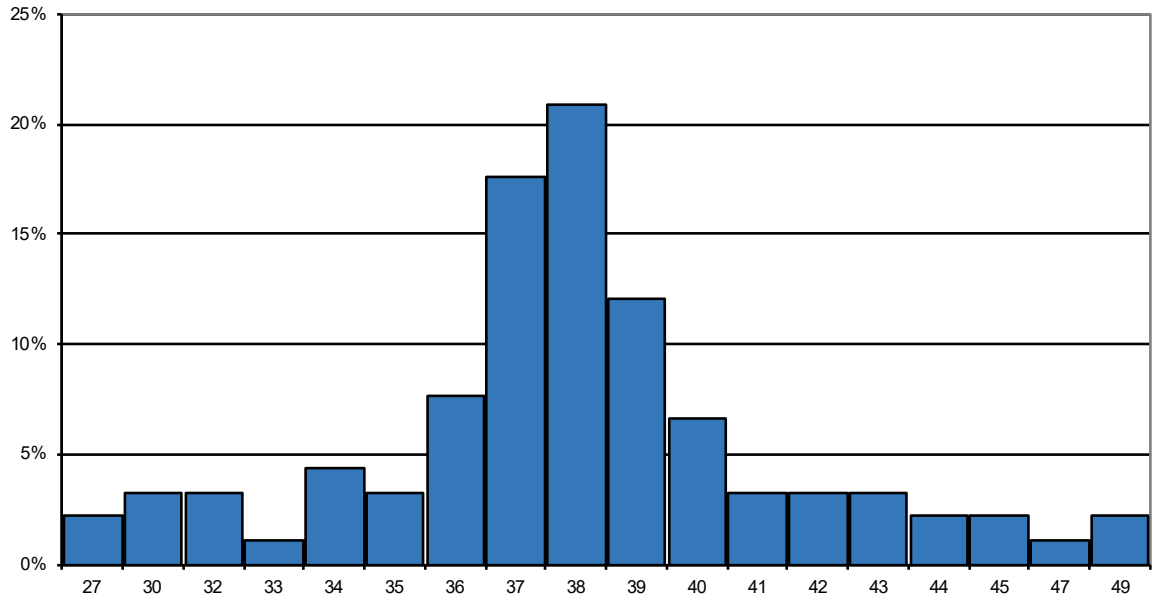


MP2 - Statistical Analysis of Night-time (23:00-07:00) $L_{A90,15min}$ Background Sound

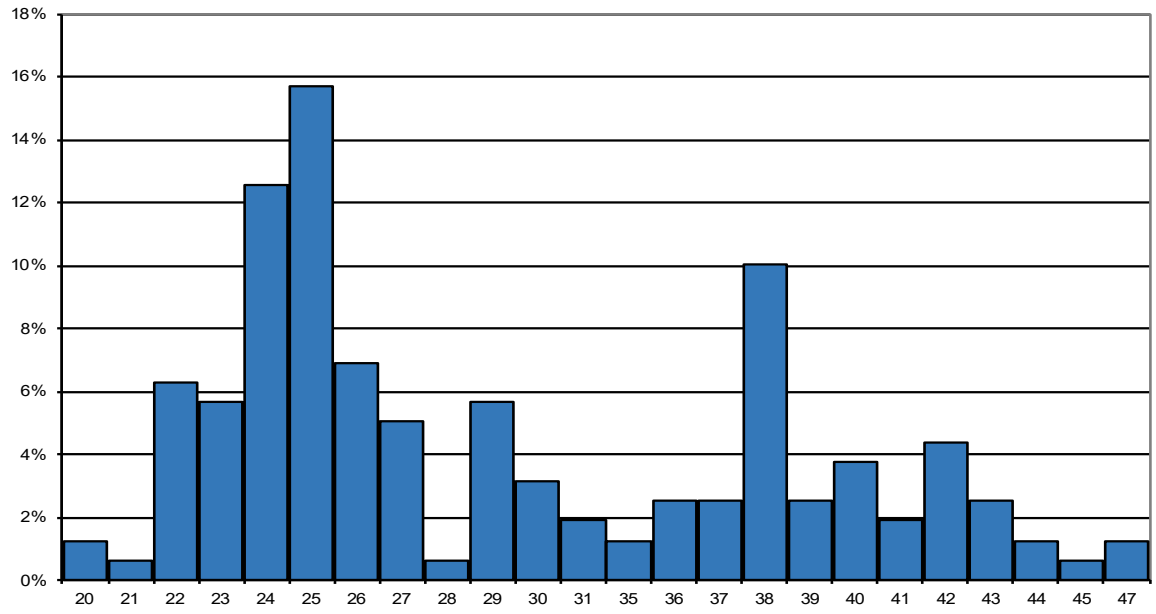


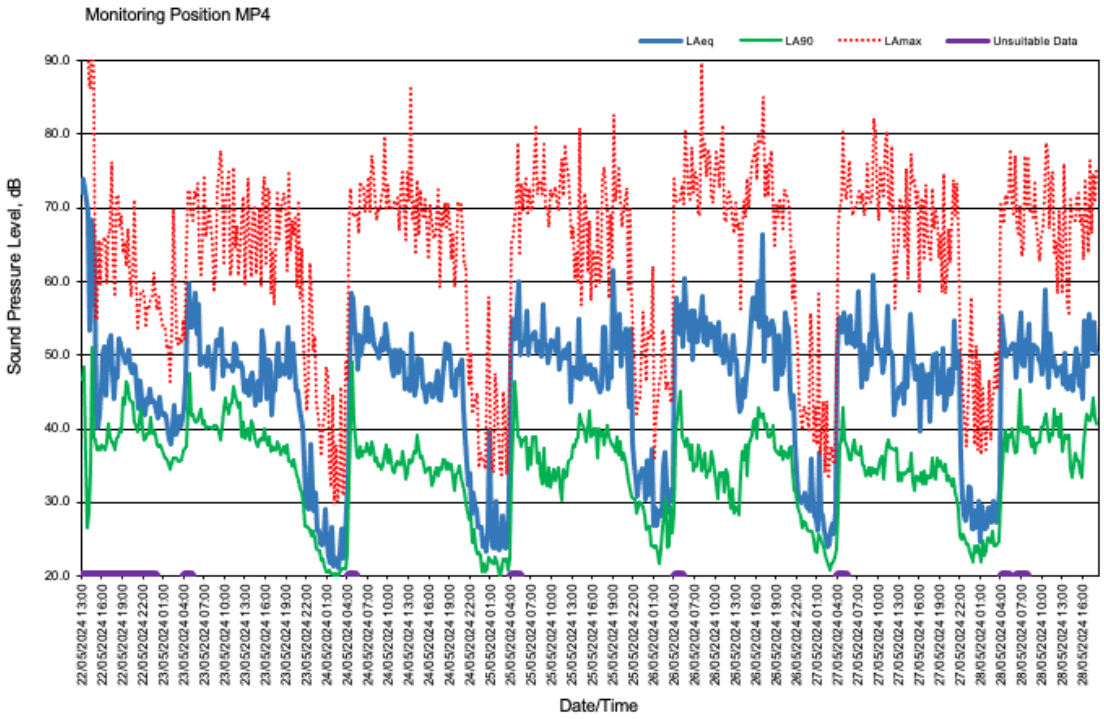


MP3 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound

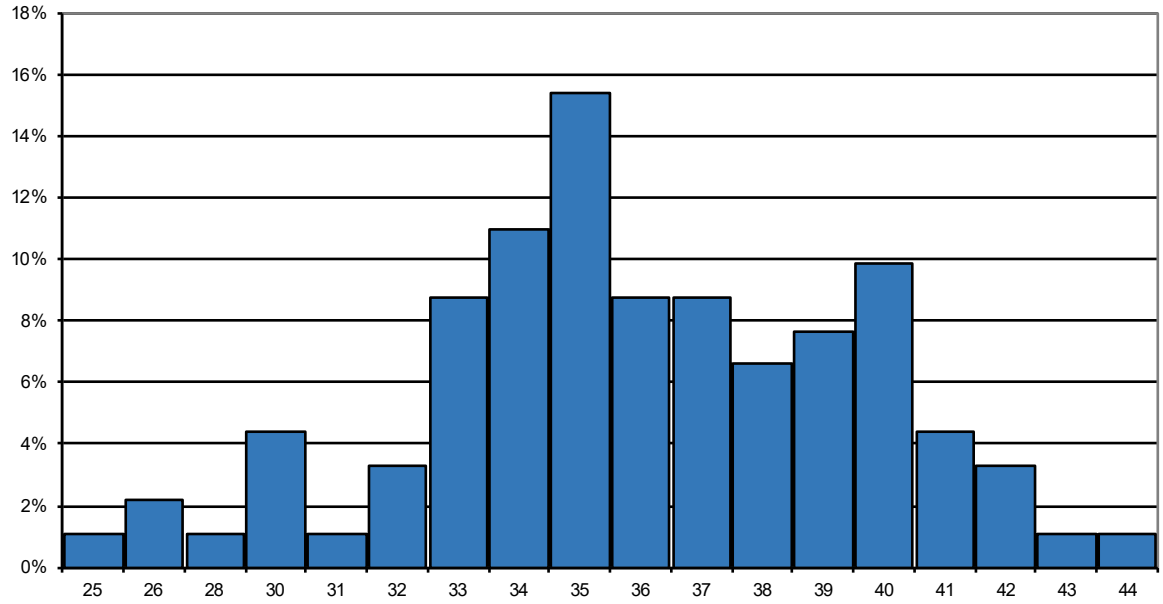


MP3 - Statistical Analysis of Night-time (23:00-07:00) $L_{A90,15min}$ Background Sound

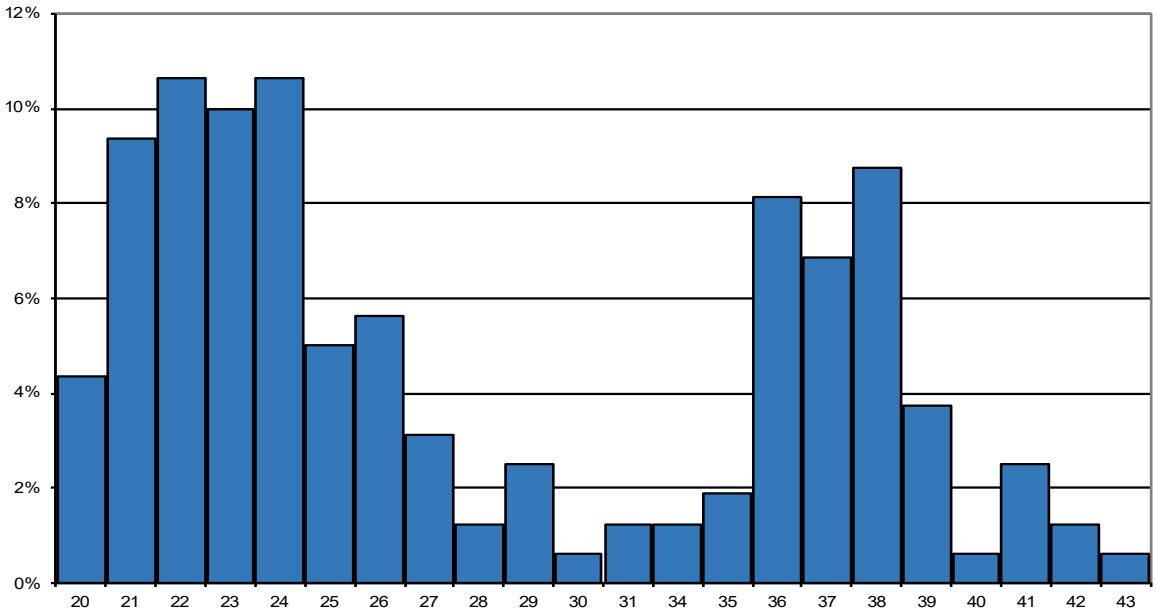


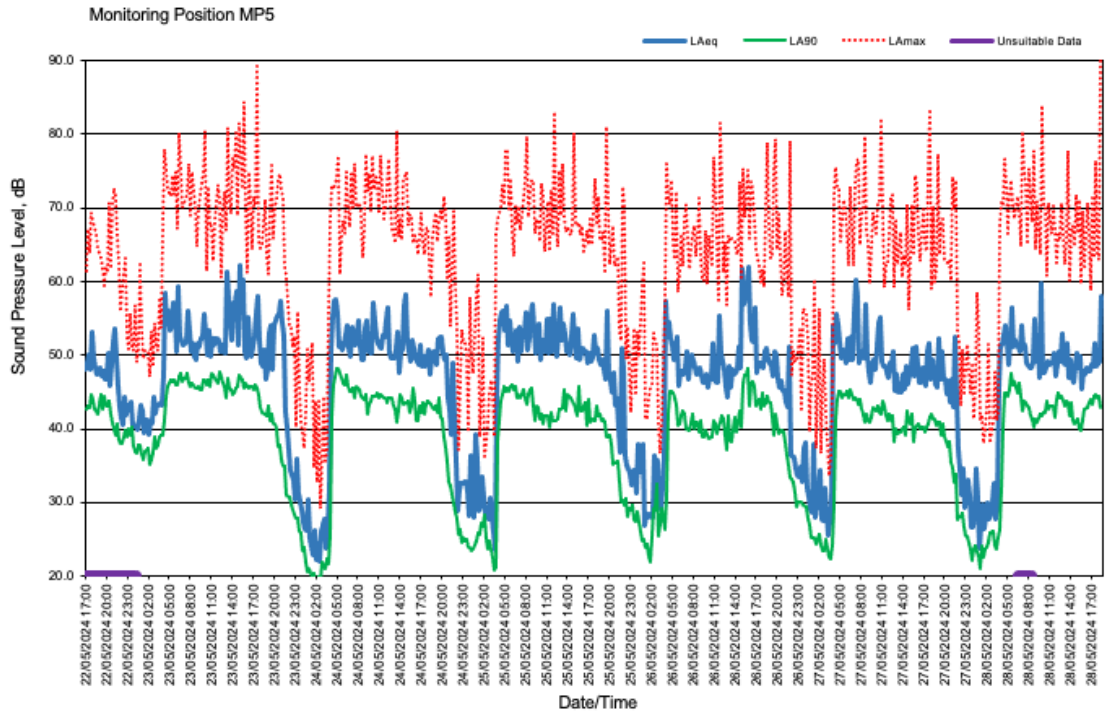


MP4 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound

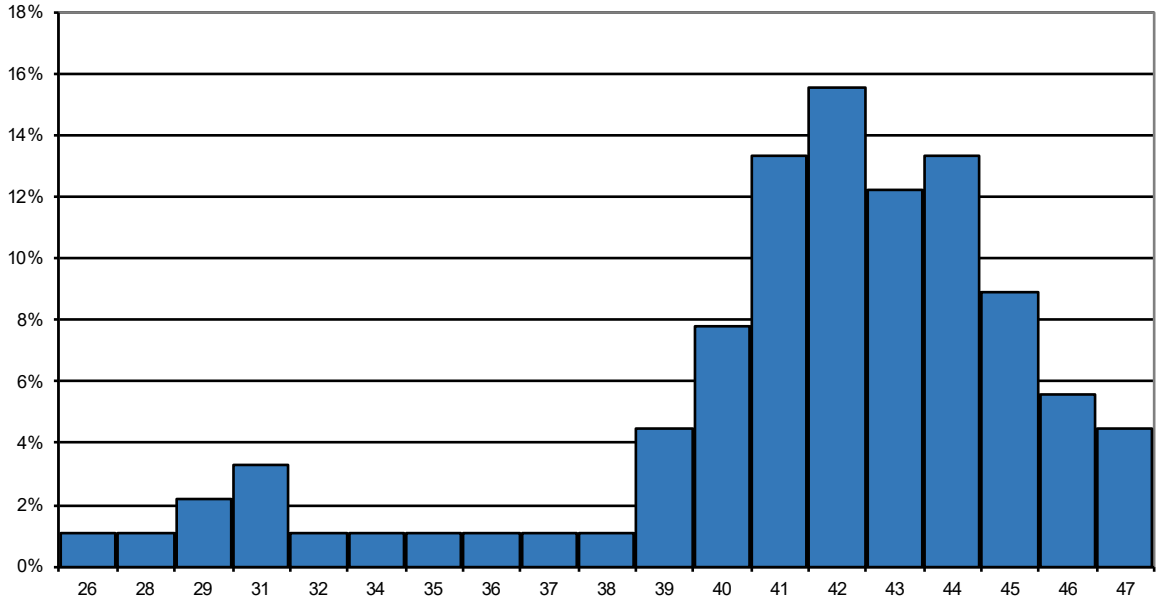


MP4 - Statistical Analysis of Night-time (23:00-07:00) $L_{A90,15min}$ Background Sound

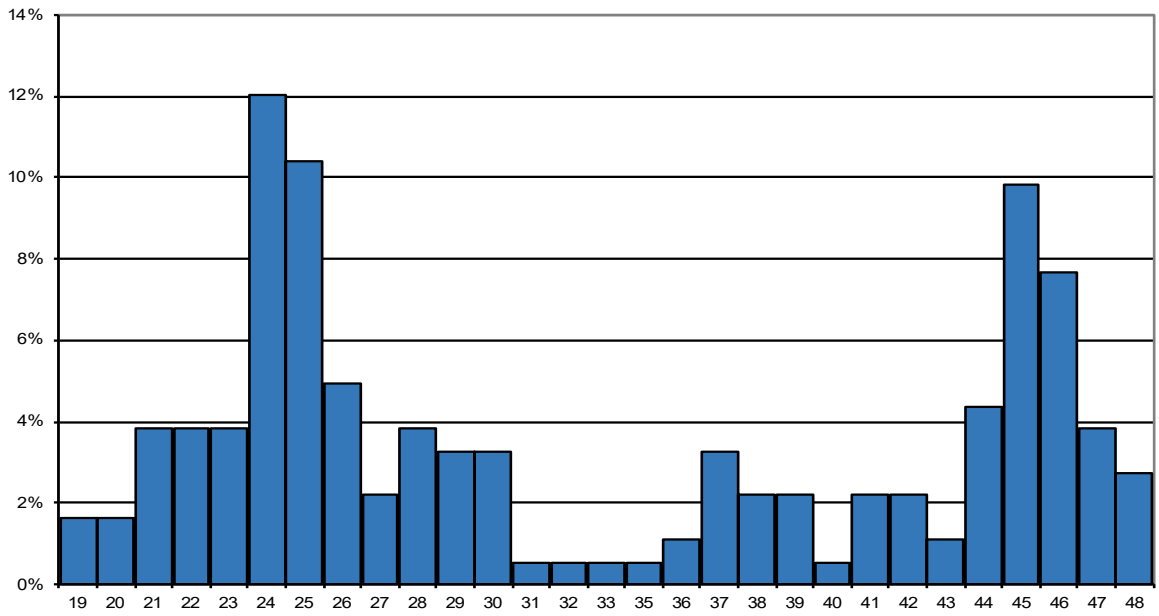


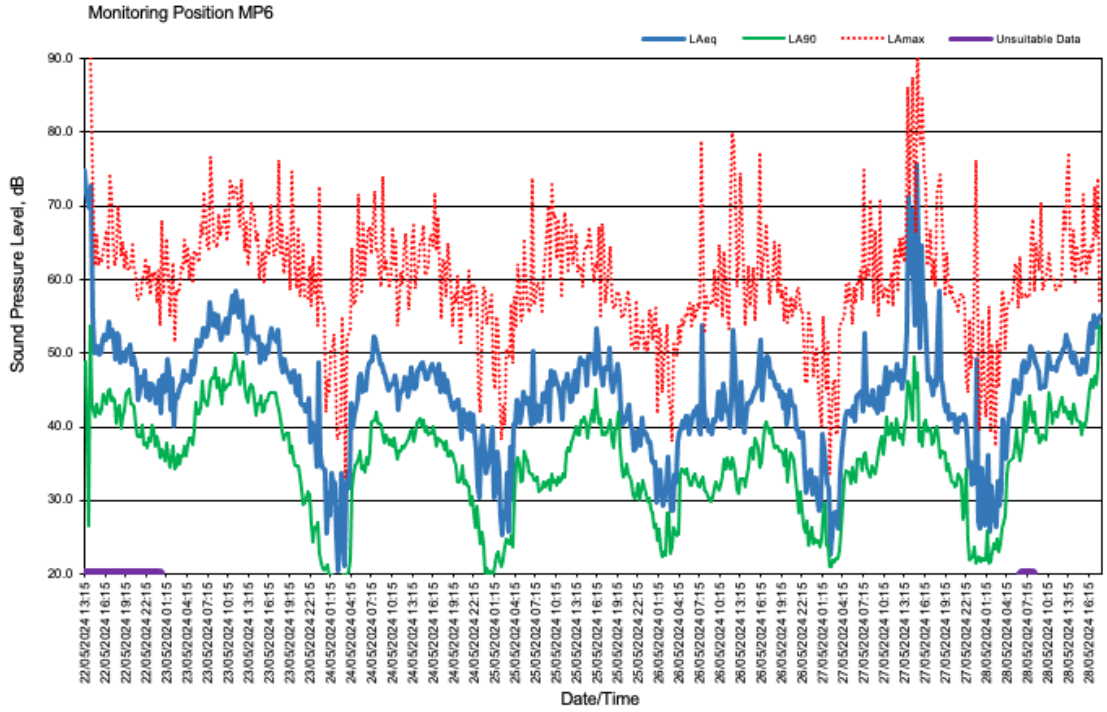


MP5 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound

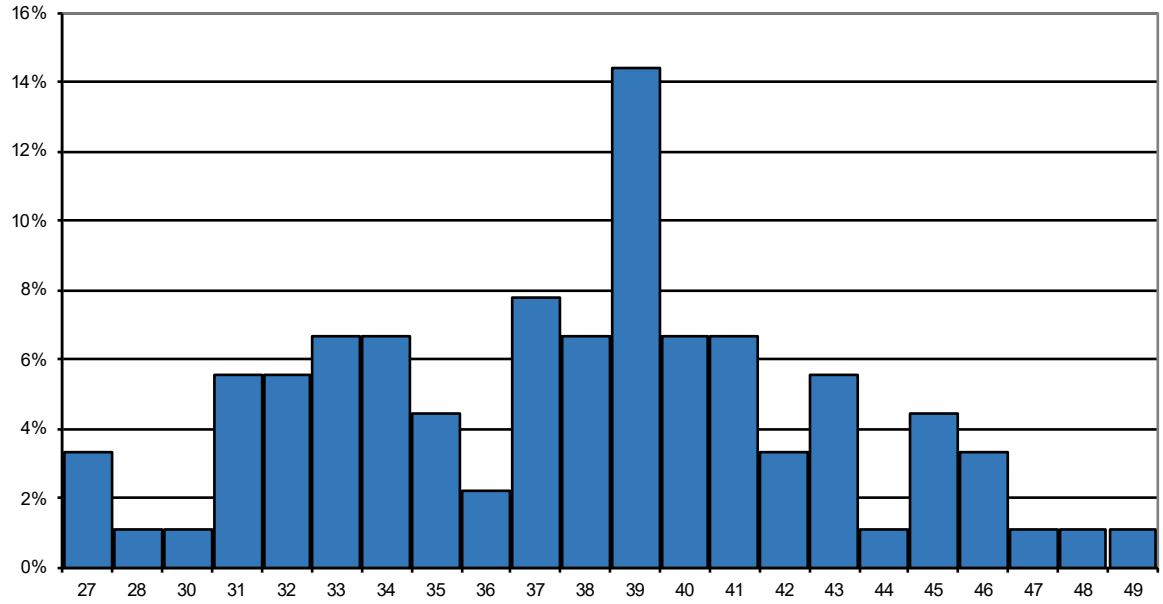


MP5 - Statistical Analysis of Night-time (23:00-07:00) $L_{A90,15min}$ Background Sound

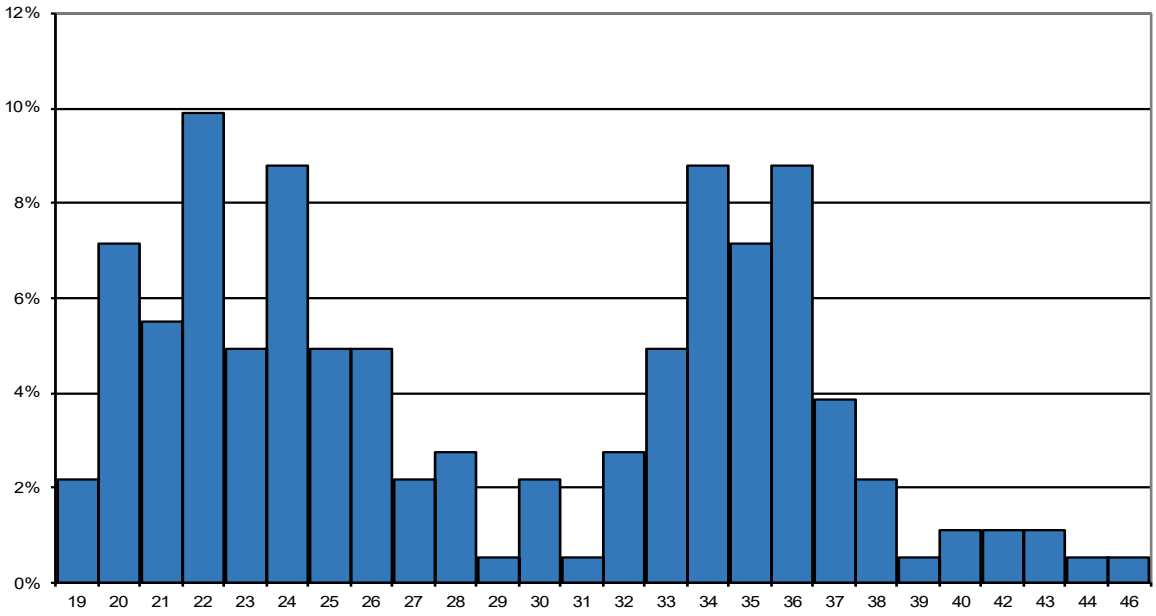


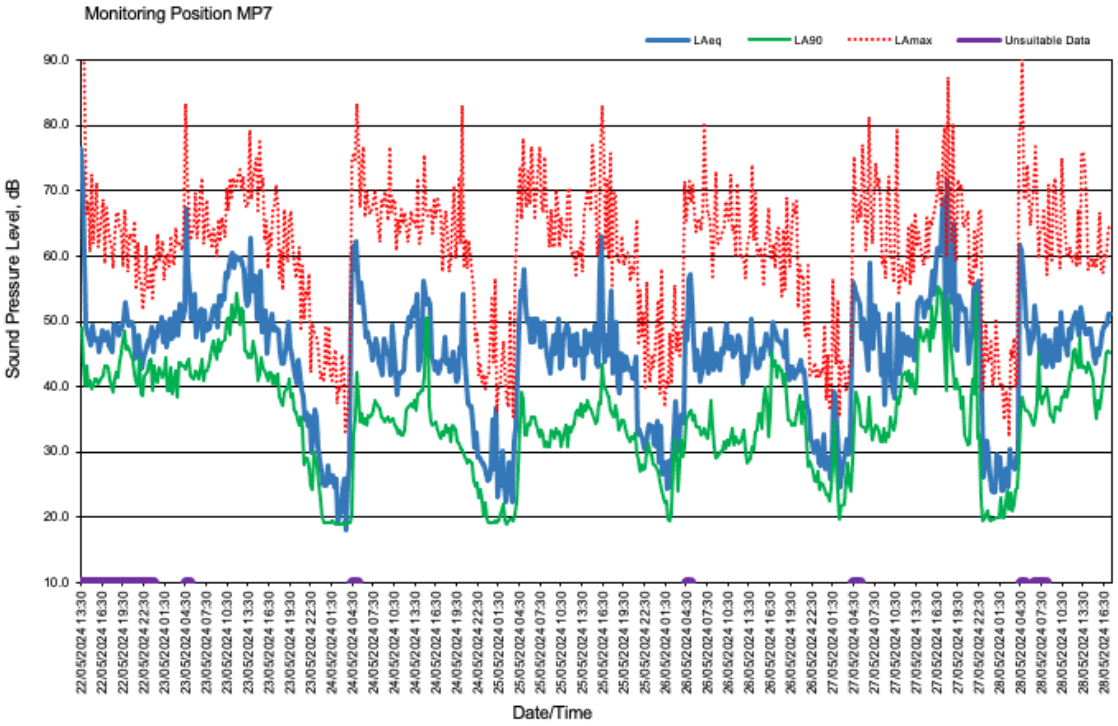


MP6 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound

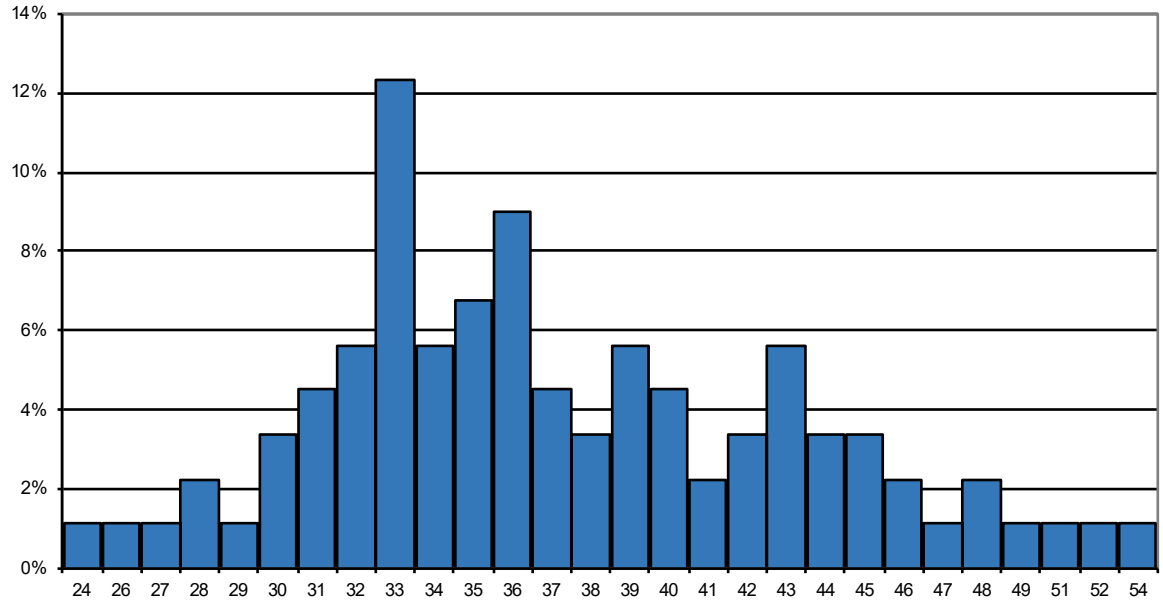


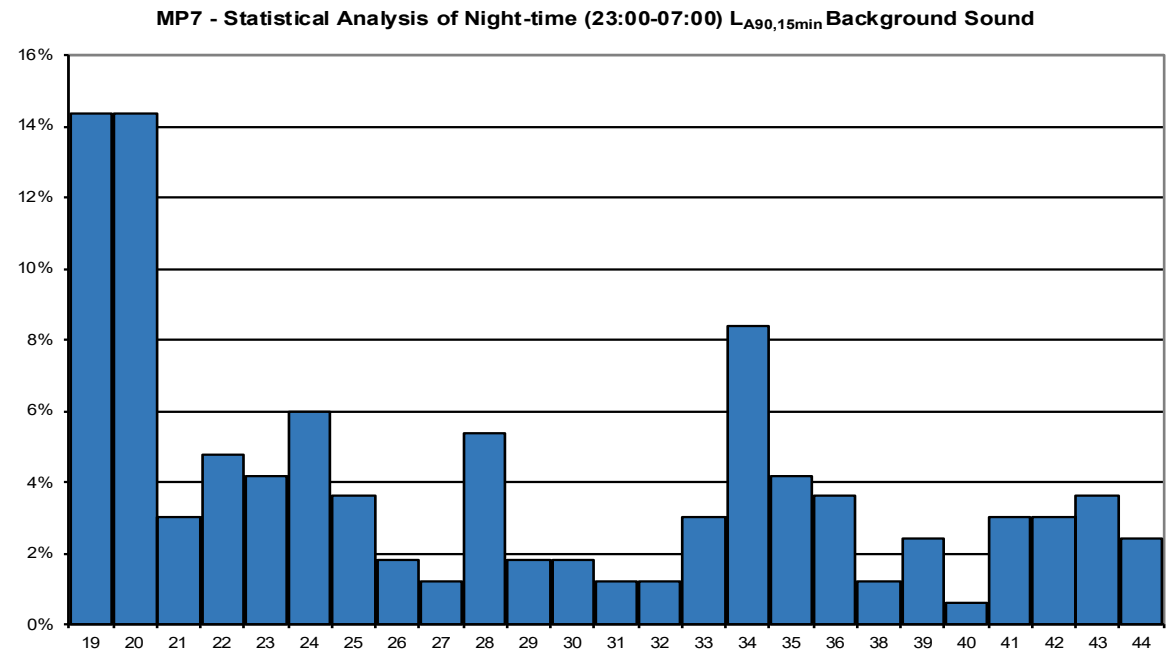
MP6 - Statistical Analysis of Night-time (23:00-07:00) $L_{A90,15min}$ Background Sound





MP7 - Statistical Analysis of Daytime (07:00-23:00) $L_{A90,15min}$ Background Sound





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

[ii] British Standards Institute (2019) British Standard 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

[iii] International Organization for Standardization (2024) ISO 9613-2:2024: 'Acoustics - Attenuation of sound during propagation outdoors: Part 2: Engineering method for the prediction of sound pressure levels outdoors'

[iv] British Standards Institute (2003) British Standard 7445: 2003: 'Description and measurement of environmental noise'

[v] British Standards Institute (2013) British Standard EN 61672: 2013: 'Electroacoustics. Sound level meters. Part 1: Specifications'

[vi] British Standards Institute (2018) British Standard EN IEC 60942:2018. 'Electroacoustics – Sound calibrators'