Moyvannan Electricity Substation

Environmental Impact Assessment Report

Chapter 11: Noise & Vibration

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11.1 Introduction

11.1.1 Background and Objectives

This chapter describes the assessment undertaken of the likely noise and vibration effects arising from the construction, operation and decommissioning of the Moyvannon Electricity Substation.

This chapter provides a baseline assessment of the environmental setting of the project in terms of noise and vibration and discusses the likely and significant effects that the construction and operation of the project will have on them. Where required, appropriate mitigation measures to limit any significant noise and vibration impacts identified, are presented. The residual effects and cumulative effects of the project post-mitigation are also assessed.

11.1.2 Statement of Authority

This chapter has been prepared by Mike Simms BE MEngSc MIOA MIET, Principal Acoustic Consultant at AWN Consulting Ltd. Mike has worked in the field of acoustics for over 20-years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, wind energy, industrial, commercial and residential.

The attended baseline monitoring was carried out by Robert Holohan, Acoustic Consultant with AWN Consulting. Robert has a BA(Hons) in Geography and Business Marketing from Maynooth University as well as an environmental science background from his MSc in Coastal and Marine Environments from the University of Galway. From his studies, he has gathered extensive experience in environmental mapping and surveying using drone and satellite imagery and has worked on producing impact assessments for both coastal and residential areas.

The unattended baseline noise monitoring was undertaken by Cormac McPhillips, Technical Services Manager at Galetech Energy Services (GES). Cormac has extensive experience of undertaking noise monitoring programmes in accordance with relevant standards and best practice methods.

11.1.3 Description of the Project

The project site is located in rural Co. Roscommon, approximately 8 kilometres (km) northwest of Athlone, c. 6km south of Lecarrow and immediately north/northeast of Brideswell. In summary, the project comprises the following main components as described in full at Chapter 3:-

- A 110kV 'loop-in/loop-out' electricity substation;
- Approximately 270m of 110kV underground electricity line between the electricity substation and the Athlone-Lanesborough overhead transmission line and the provision of 2 no. interface masts;
- Approximately 7.5km of underground electricity line between the electricity substation and the permitted Seven Hills Wind Farm grid connection infrastructure; and,
- All associated and ancillary site development, access, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The entirety of the project is located within the administrative area of County

Roscommon; while electrical equipment suppliers, construction material suppliers and candidate quarries which may supply aggregates are located nationwide. As there is no likelihood of the works associated with the supply of such materials, including their delivery, resulting in significant population & human health effects, areas outside of County Roscommon have, therefore, been screened out from further assessment within this chapter.

11.2 Methodology

11.2.1 Proposed Approach

The following methodology has been adopted for this assessment:-

- Review appropriate guidance in order to identify appropriate noise and vibration criteria for the site operations;
- Carry out baseline noise monitoring at a location representative of nearest sensitive properties to identify existing levels of noise in the vicinity; and,
- Comment on predicted noise levels against the appropriate construction and operational phase criteria and outline required mitigation measures (if any).

Annex 11.1 (Volume II) presents a glossary of the acoustic terminology used throughout this document. In the first instance, it is considered appropriate to review some fundamentals of acoustics.

11.2.2 Fundamentals of Acoustics

A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. To take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3 dB.

The frequency of sound, which is the rate at which a sound wave oscillates, is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level must be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. The 'A-weighting' system, defined in the international standard BS ISO 226:2003 Acoustics - Normal Equal-loudness Level Contours, has been found to provide the best correlations with human response to perceived loudness. SPLs measured using 'A-weighting' are expressed in terms of dB(A).

An indication of the level of some common sounds on the dB(A) scale is presented at Figure 11.1 and shows a quiet bedroom at around 35dB(A), a nearby (at 7m) noisy HGV at 90dB(A) and a pneumatic drill (at 7m) at about 100dB(A).

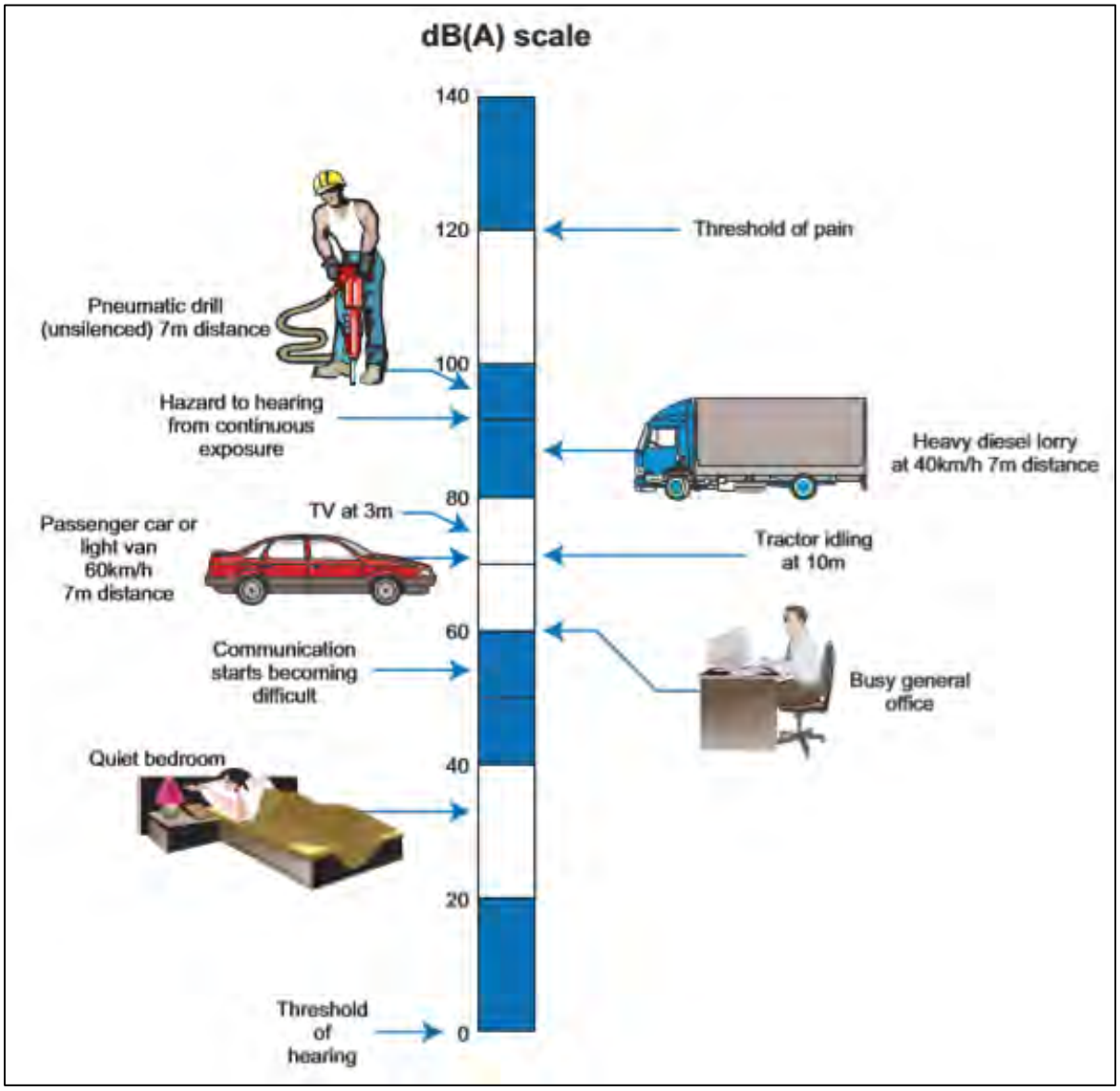

Figure 11.1: The Level of Typical Common Sounds on the dB(A) scale

Source: NRA Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, 2014)

11.3 Guidance Documents and Assessment Criteria

The following sections review best practice guidance that is commonly adopted in relation to developments such as the subject project.

11.3.1 Construction Phase

11.3.1.1 Electricity Substation Construction Noise Threshold

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities or An Bord Pleanála normally control construction activities by imposing limits on the hours of operation and/or applying noise limits for construction noise at noise-sensitive locations.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for the electricity substation are taken from BS 5228-

1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise* (Annex E, Section E.3.2).

The approach adopted in BS 5228-1 calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a Construction Noise Threshold (CNT) noise value that, if exceeded at a location, indicates a likely significant noise impact is associated with the construction activities, depending on the context. It should be noted that, in accordance with BS 5228-1 guidance, these assessment criteria are only applicable to residential receptors.

Table 11.1 sets out the values which, when exceeded, signify a likely significant effect at the facades of residential receptors. These values relate to construction noise levels only and not the cumulative noise level due to construction noise plus existing ambient noise.

Assessment category and threshold value period (T)	Threshold values, $L_{Aeq,T}$ dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

Table 11.1: Example Threshold of Significant Effects at Dwellings

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

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

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

Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

The approach is described as follows: for the applicable assessment period (in this instance, daytime), the ambient noise level is determined and rounded to the nearest 5dB. Baseline monitoring carried out as part of this assessment (refer to Section 11.4) indicates that the threshold values for Category A are appropriate in terms of the nearest noise sensitive locations being considered in this instance.

The CNT for the electricity substation works, which will take place during daytime periods only, is therefore 65 dB $L_{Aeq,T}$.

11.3.1.2 Underground Electricity Line Construction Noise Threshold

For the construction of the underground electricity line, reference has been made to the Transport Infrastructure Ireland (formerly NRA) (TII) document *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (TII, 2014) for appropriate criteria. The TII guidelines define states that construction noise limits are to be applied to the facade of dwellings. Whilst this document is specifically intended for the purposes of New National Road Schemes; given that the underground electricity line consists of a linear scheme, and in the absence of other national guidelines relating to the specific project under consideration, the guidelines are assessed a relevant to determine the likelihood of significant noise effects arising from the underground electricity line. These maximum permissible noise levels are set out at Table 11.2.

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq,1hr}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrss	70	80
Monday to Friday 19:00 to 22:00hrs	60	65
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60	65

Table 11.2: Maximum Permissible Noise Levels at the Façade of Dwellings during Construction of Linear Projects

For underground electricity line works, which will take place during daytime periods only, the CNT is 70dB $L_{Aeq,1hr}$ for weekdays and 65dB $L_{Aeq,1hr}$ for Saturdays.

11.3.1.3 Interpretation of Construction Noise Thresholds

In order to assist with interpretation of CNTs, Table 11.3 provides guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of United Kingdom Highways England (now National Highways) (UKHE) *Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2* (UKHE, 2020); this guidance has been adapted to include the relevant significance of effect levels from the EPA Guidelines (EPA 2022).

Guidelines for Noise Impact Magnitude Assessment of Significance (DMRB)	CNT per Assessment Category and Threshold Value Period	EPA EIAR Significance Effects	Determination of Significance in EIA terms
Negligible	Below or equal to baseline noise level	Not Significant	Not Significant
Minor	Above baseline noise level and below or equal to CNT	Slight to Moderate	CNTs at the upper end of this range will result in higher likely impacts, therefore this range is categorised as Slight to Moderate, acknowledging that values approaching the CNT are greater than Slight. In accordance with *DMRB Noise and Vibration* (UKHA 2020) and BS 5228-1 ((BSI 2009 +A1 2014a), noise levels below the CNT are deemed 'Not Significant'.
Moderate	Above CNT and below or equal to CNT +5dB	Moderate to Significant	Depending on CNT, duration and baseline noise level. In accordance with the *DMRB Noise and Vibration* (UKHA 2020), construction noise impacts shall constitute a significant effect where it is determined that a moderate or major magnitude of impact will occur for a duration exceeding: Ten or more days or night in any 15 no. consecutive day or nights; and A total number of days exceeding 40 no. in any 6 no. consecutive months.
Major	Above CNT +5 to +15 dB	Significant, to Very Significant	
	Above CNT +15 dB	Very Significant to Profound	

Table 11.3: Construction Noise Significance Criteria

The adapted DMRB Noise and Vibration (UKHA 2020) guidance outlined is used to assess the predicted construction noise levels at NSLs and comment on the likely

effects during the construction phase.

11.3.1.4 Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to the project, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:-

- *British Standard BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993); and
- *British Standard BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2009+A1:2014).

BS7385-2 and BS5228-2 advise that, for soundly constructed residential properties and similar light-framed structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above for transient vibration.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values at Table B.2 of BS5228-2 may need to be reduced by up to 50%. On a cautious basis, therefore, continuous vibration limits are set as 50% of those for transient vibration across all frequency ranges. For buildings or structures that are structurally unsound, lower vibration magnitudes will apply, typically 50% of those for structurally sound buildings. Protected or historic buildings are not automatically assumed to be more vulnerable to vibration unless they have existing structural defects.

The TII guidelines also provide information on permissible vibration levels during the construction phase, as detailed at Table 11.4.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Table 11.4: Allowable Transient Vibration at Properties

11.3.2 Construction Traffic

Vehicular movement to and from the construction works for the project will make use of the existing road network. In order to assess the potential noise impact of this additional traffic at NSLs, the following guidelines are referenced; DMRB Noise and Vibration (United Kingdom Highways England (now National Highways), 2020) and the EPA EIAR Guidelines (EPA, 2022). Due to the short-term period over which this impact occurs, the magnitude of impacts is assessed against the 'short term' period in accordance with the DMRB document. Table 11.5 sets out the classification of changes in noise level to impact on human perception based on the guidance contained in these documents.

Change in Sound Level (dB)	Subjective Reaction	DMRB Magnitude of Impact (Short-term)	EPA Significance of Effect
Less than 1 dB	Inaudible	Negligible	Imperceptible
1 – 2.9	Barely Perceptible	Minor	Not Significant
3 – 4.9	Perceptible	Moderate	Slight, Moderate
≥ 5	Up to a doubling of loudness	Major	Significant

Table 11.5: Classification of magnitude of traffic noise changes in the short-term

11.3.3 Operational Phase

11.3.3.1 Noise – Electricity Substation

As the electricity substation will not generate any noise during the operational phase due, predominately, to the absence of an electrical transformer or other noise-generating electrical equipment, an assessment of operational phase noise levels is not required.

As such, no operational phase noise criteria are required for this element of the project.

11.3.3.2 Noise – Underground Cable

As the underground electricity line will not generate any noise during the operational phase due to the absence of moving parts and its sub-surface location, an assessment of operational phase noise levels is not required. Therefore, no operational phase noise criteria are required for this element of the project.

11.3.3.3 Additional Vehicular Traffic Activity on Public Roads

Once operational, the project will be visited periodically for maintenance purposes, with a total of 1-2 trips per week. The vehicle used will typically be a light goods vehicle (LGV) or van. The number of vehicle trips is not such that any significant additional noise levels are likely to be generated.

11.3.3.4 Vibration

There is no expected source of vibration associated with the operational phase, therefore, vibration criteria have not been specified for this phase of the project.

11.3.4 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and decommissioning of the electricity substation and associated infrastructure is not proposed. Therefore, the application of noise and vibration limit criteria are not required.

11.3.5 Forecasting Methods

Construction noise calculations have been conducted generally in accordance with *BS 5228: 2009+A1:2014: Code of practice for noise control on construction and open sites - Noise*.

Changes in road traffic noise on the local road network have been assessed using prediction guidance contained within Calculation of Road Traffic Noise (CRTN) issued

by the Department of Transport in 1988.

11.4 Description of the Existing Environment

As outlined above, prior to undertaking the assessment of likely noise effects, it is crucial to understand the typical background noise levels at the nearest NSLs to the project site. The background noise survey was conducted by installing an unattended sound level meter at a location representative of the quiet noise environment of the noise sensitive receptor locations.

The installation, retrieval and management of all measurement instrumentation detailed in this section has been carried out by GES. GES has confirmed that all measurement data collected during the baseline noise surveys has been carried out in accordance with ISO 1996-2:2007 ''*Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of environmental noise levels*''.

The analysis and assessment of the survey data has been carried out by AWN Consulting.

11.4.1 Unattended Noise Monitoring

11.4.1.1 Noise Measurement Location

The noise measurement location was selected by AWN Consulting. As the electricity substation operates continuously, it is important to capture the quietest daytime and night-time periods, free of influence from noise generated at the noise-sensitive locations themselves, for example by heating systems. The selected noise monitoring location was chosen to reflect the noise environment at the nearest dwelling, located to the south of the electricity substation. Coordinates for the noise measurement location are provided at Table 11.6.

Coordinates (ITM)	
Easting	Northing
597150	748451

Table 11.6: Noise Measurement Location

Significant noise sources in this area were noted to be distant traffic movements and wind generated noise from local foliage and other typical anthropogenic sources typically found in such rural settings. There was no perceptible source of vibration noted at the survey location.

Figure 11.2 illustrates the installed noise measurement apparatus. The location of the unattended noise monitor is illustrated at Figure 11.3

Figure 11.2: Unattended Noise Measurement Equipment

Figure 11.3: Unattended Noise Measurement Location

11.4.1.2 Measurement Period

Noise measurements were conducted over the period outlined at Table 11.7.

Start Date	End Date
16:40hrs on 12 February 2024	14:40hrs on 19 February 2024

Table 11.7: Measurement Period

11.4.1.3 Personnel and Instrumentation

All noise monitoring apparatus was installed and removed by GES with the following instrumentation being used.

Equipment	Serial Number
Svantek 977	46436

Table 11.8: Instrumentation Details

Prior to and after the survey, the measurement apparatus was checked and calibrated using a sound level calibrator where appropriate. Relevant calibration certificates are presented at Annex 11.2.

11.4.1.4 Procedure

Measurements were conducted at the measurement location outlined at Table 11.6 and over the time period outlined at Table 11.7. Noise levels were logged continuously at 10-minute interval periods for the duration of the survey. Survey personnel also noted the primary sources contributing to noise build-up during installation and removal.

11.4.1.5 Measurement Parameters

Several parameters were measured in order to interpret the noise levels. These included the following:-

- L_{Aeq}: This is the equivalent continuous A weighted sound pressure level. It is an average of the total sound energy (noise) measured over a specified time period; and,
- L_{A90}: Noise level exceeded for 90% of measurement period (steady underlying noise level).

The 'A' suffix denotes that the sound levels have been 'A-weighted' to account for the non-linear nature of human hearing. The 'F' suffix denotes that the parameter has been measured with 'Fast' time-weighting applied. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pascal (pa).

11.4.1.6 Results of Unattended Noise Survey

On review of the measured data, it is confirmed that the typical noise levels were as follows:-

- Daytime ambient noise levels of between 41 and 50dB $L_{Aeq,T}$;
- Daytime background noise levels of between 32 and 39dB $L_{A90,T}$;
- Night time ambient noise levels of between 32 and 42dB $L_{Aeq,T}$; and,
- Night time background noise levels of between 25 and 31dB $L_{A90,T}$.

Date	$L_{Aeq,16hr}$	L_{A90} (Arithmetic Average)

Monday 12 February 2024	39	32
Tuesday 13 February 2024	42	37
Wednesday 14 February 2024	46	39
Thursday 15 February 2024	41	32
Friday 16 February 2024	44	35
Saturday 17 February 2024	46	35
Sunday 18 February 2024	44	33
Monday 19 February 2024	50	36
Overall	45	35

Table 11.9: Daytime Measured Noise Levels

Date	$L_{Aeq,16hr}$	L_{A90} (Arithmetic Average)
Monday 12 to Tuesday 13 February 2024	32	25
Tuesday 13 to Wednesday 14 February 2024	34	26
Wednesday 14 to Thursday 15 February 2024	40	31
Thursday 15 to Friday 16 February 2024	42	30
Friday 16 to Saturday 17 February 2024	32	25
Saturday 17 to Sunday 18 February 2024	34	24
Sunday 18 to Monday 19 February 2024	43	32
Overall	39	28

Table 11.10: Night-time Measured Noise Levels

11.4.2 Attended Noise Monitoring

11.4.2.1 Noise Measurement Locations

A noise survey to quantify the existing baseline noise environment at NSLs in proximity to the underground electricity line route was conducted by AWN Consulting. The survey was carried out in general accordance with ISO 1996: *Description, measurement, and assessment of environmental noise*. The details of the baseline noise survey are presented in the following sections.

4 no. attended measurement locations were selected to inform the assessment and to obtain a representative baseline of noise levels at typical noise sensitive locations. The noise monitoring locations were identified on review of the route such that samples of various noise environments were obtained across the study area. The selection of monitoring locations was supplemented by reviewing aerial images of the study area and other online sources of information (e.g., Google Earth). Figure 11.4 identifies the 4 no. measurement locations (AT1-AT4) and Table 11.11 confirms the coordinates of the Attended Noise Monitoring Locations.

Location Reference	Coordinates (ITM)	
	Easting	Northing
AT1	596898	747242
AT2	594772	747684
AT3	594649	746195
AT4	594039	744657

Table 11.11: Attended Noise Monitoring Locations

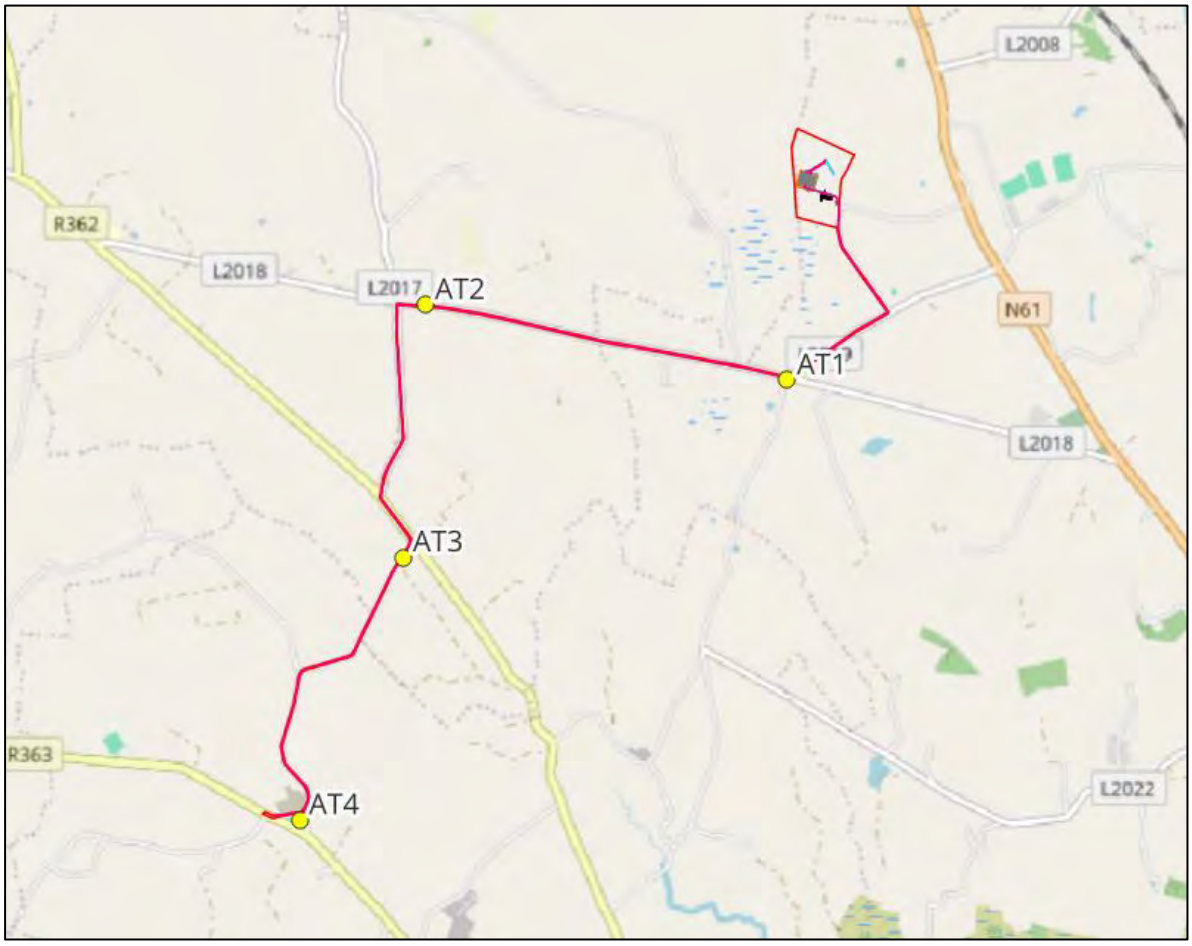

Figure 11.4: Attended Noise Monitoring Locations

11.4.2.2 Survey Periods

Attended noise surveys were undertaken at 4 no. locations; AT1, AT2, AT3 and AT4; to obtain typical baseline noise levels at noise sensitive locations. The surveys were carried out over the following periods.

Location	Start Date / Time
AT1	13:27–15 :43 on 16 January 2024
AT2	10:50–12:52 on 23 April 2024
AT3	11:10–13:12 on 23 April 2024
AT4	11:30–13:32 on 23 April 2024

Table 11.12 Attended Noise Monitoring Locations Survey Periods

11.4.2.3 Personnel and Instrumentation

The attended noise measurements were undertaken using the following instrumentation by AWN Consulting staff.

Type	Manufacturer	Equipment Model	Serial Number	Calibration Date
Sound Level Meter	RION	NL-52	00976162	29/09/2023
Calibrator	RION	NC-75	34313057	25/10/2023

Table 11.13 Attended Noise Monitoring Instrumentation

The sound level meter was mounted on a tripod approximately 1.5m above ground level and at least 4m away from any reflective surfaces other than the ground.

11.4.2.4 Procedure

The survey data was saved to the instrument memory for later analysis. Survey personnel noted the primary sources contributing to noise build-up during installation and removal.

11.4.2.5 Measurement Parameters

Similar to the unattended survey discussed at Section 11.4.1.5, the L_{Aeq} and L_{A90} parameters were recorded.

11.4.2.6 Meteorological Conditions

The weather during the survey period was dry with varying cloud cover. Wind speeds were generally low during the surveys and the lowest background noise levels have been selected as the basis for assessment.

11.4.2.7 Baseline Noise Survey Results

Noise levels measured along the route of the underground electricity line have been collated in order to determine the prevailing baseline ambient and background noise levels. These are presented at Table 11.14.

Location	Period	Average Baseline Noise Levels (dB)	
		L_{Aeq}	L_{A90}
AT1	Day	57	39
AT2	Day	59	31
AT3	Day	48	32
AT4	Day	50	35

Table 11.14 Measure Baseline Noise Levels During the Attended Surveys

11.4.3 Vibration

There are no significant sources of vibration present in the receiving environment and, therefore, it is not assessed as necessary to measure baseline vibration.

11.5 Description of Likely Effects

11.5.1 Do Nothing Scenario

If the project is not progressed, the existing noise environment in the vicinity of the subject site and noise sensitive receptors will remain unchanged.

11.5.2 Construction Phase

A variety of items of plant and machinery will be in use for the purposes of site preparation and construction of the project. There will be vehicular movements to and from the site that will make use of existing roads. Due to the nature of these activities, the generation of significant levels of noise is possible.

11.5.2.1 Electricity Substation

Noise levels associated with construction have been calculated in accordance with

the methodology set out in BS 5228-1:2009+A1:2014. This standard sets out sound power and sound pressure levels for plant items normally encountered on construction sites which, in turn, enables the prediction of noise levels at selected locations. However, it is often not possible to conduct detailed prediction calculations for the construction phase of a project due to the fact that the noise emission levels for the assumed plant items are indicative, the programme for construction works has not been established fully and may change as the project develops (i.e. in the event that the construction contractor identifies alternative working methods or procedures). Noise predictions are therefore presented in outline form to highlight typical expected noise levels at noise sensitive receivers and to discuss the typical noise mitigation measures that can be utilised to reduce effects as far as is reasonably practicable.

The anticipated construction hours are 07:00 to 19:00hrs Monday to Friday and 07:00 to 13:00hrs on Saturday.

With reference to the measured noise levels at the nearest NSL's discussed in Section 11.4.1.6, ambient noise levels were in the range of 41 to 50dB $L_{Aeq,T}$. Using the criteria in Table 11.1, the daytime ambient noise environment is assessed as falling within Category A and the CNT is therefore set at 65dB $L_{Aeq,T}$ for daytime periods.

Several noise sources that would be expected on a construction site of this nature have been identified and predictions of the likely noise emissions calculated at the closest sensitive receptor. In this scenario, the closest sensitive receptor is located approximately 215m south of the entrance to the electricity substation, as illustrated at Figure 11.5.

Figure 11.5: Closest Noise-sensitive Location to Substation

Table 11.15 presents outline noise calculations, considering the anticipated methods of construction. The calculations assume that plant items are operating for 66% of the time and that there is no acoustic screening (i.e. barriers) in place between the site works and the NSL.

Plant Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Noise Level at 215m (dB $L_{Aeq,T}$)
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	42
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	77	40
General Construction	All general activities plus	84	47

(Various)	deliveries of materials and plant		
Mobile Telescopic Crane (C4.64)	Lifting	75	38
Dewatering Pumps (D.7.70)	If required.	80	43
JCB (D.8.13)	For services, drainage and landscaping.	82	45
Vibrating Rollers (D.8.29)	Access track surfacing.	77	40
Combined L_{Aeq} from all works			52

Table 11.15: Indicative Noise Levels for Construction of Electricity Substation

The predicted noise levels are lower than the CNT of 65dB $L_{Aeq,T}$. According to the criteria at Table 11.3, the effect is assessed as 'not significant'.

With respect to guidance for the description of effects, the likely effect at the nearest NSL associated with the construction of the electricity substation are assessed to be negative, temporary and not significant.

11.5.2.2 Underground Electricity Line

Table 11.16 presents noise calculations for the construction of the underground electricity line considering the anticipated methods of construction. Calculations have been prepared taking account of the distances to the nearest NSLs and assume that plant items are operating for 66% of the time.

Plant Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$)	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (m)		
			20	25	40
Mini excavator with hydraulic breaker (C.5.2)	Breaking road surface	83	75	71	66
Wheeled excavator (C.5.11)	Removing broken surface	73	65	61	56
Vibratory Roller (C.5.26)	Rolling and compaction	77	69	65	60
HGV Movement (C.2.30)	Transporting material	79	71	67	62
Generator (C.2.44)	For general plant	77	69	65	60
Combined L_{Aeq} from all works			78	74	69

Table 11.16: Indicative Noise Levels for Construction of Underground Cable

As discussed in Section 11.3.1.2, the construction noise threshold for the electricity line works is 70dB $L_{Aeq,T}$. In this context, and based on Table 11.3, a predicted construction noise level of 70dB would indicate that at distances of 40m and greater, the noise effect is assessed as likely to be not significant.

At distance of 25m or less, the predicted construction noise level of 74dB would

indicate that this distance, the noise effect is potentially significant. However, it is important to note that the works for the construction of the underground electrical line will vary and will not be continuous in nature. The associated construction works will occur for short durations (rolling construction method, approx. 50–100 m per day) at varying distances from NSLs. Works will therefore be in the immediate proximity to the closest NSLs for limited amount of time, i.e. less than 1-day.

In conclusion, in accordance with Table 11.3, on the basis that the duration of the noise effect at any NSL will be short-term and temporary, a significant noise effect is not expected and mitigation measures are not required.

11.5.2.3 Vibration

While there are some activities proposed to be undertaken during the construction of the electricity substation which will result in the generation of vibration effects (e.g. compaction of access track aggregates); due to the localised nature of these works and the distance to nearby receptors, no vibration effects are assessed as likely to arise at sensitive locations during the construction phase. Notwithstanding the above, all construction activities undertaken will be required to operate below the recommended vibration criteria set out at Table 11.4.

11.5.3 Operational Phase

11.5.3.1 Noise

As the electricity substation does not contain a transformer or other noise generating equipment, no noise will be generated during the operational phase.

As such, the operational noise effects are assessed to be neutral, imperceptible and long-term.

11.5.4 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and decommissioning of the electricity substation and associated infrastructure is not proposed. Therefore, decommissioning phase effects will not occur.

11.5.5 Cumulative Effects

This assessment has considered the likely cumulative effects for the construction, operational and decommissioning phases of the project in combination with the permitted Seven Hills Wind Farm. Following a detailed evaluation, it is considered that there are no other existing, permitted or proposed developments in the local area; including those listed at Chapter 1; capable of contributing to cumulative noise or vibration effects. Other developments have been discounted from further assessment due to their specific type or nature or due to the separation distances involved.

11.5.5.1 Construction Phase

It is likely that the subject project will be constructed concurrently with the permitted Seven Hills Wind Farm. With reference to the predicted noise levels associated with the construction of the project as outlined at Section 11.5.2 the increased separation distance between receptors and Seven Hills Wind Farm construction activities, there is no likelihood of the total construction noise level increasing. In the village of Brideswell, at the interface between grid connection infrastructure permitted as part

of the Seven Hills Wind Farm and the subject project, it is assessed that construction activities would be undertaken consecutively and works would not be undertaken concurrently.

Therefore, should construction of the project occur concurrently with the construction of the Seven Hills Wind Farm (main wind farm site), it is assessed that there will be no cumulative effects that would give rise to likely significant effects at the nearest NSLs.

11.5.5.2 Operational Phase

As the project will not generate noise during the operational phase, cumulative noise effects are not likely to occur.

11.5.5.3 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and decommissioning of the electricity substation and associated infrastructure is not proposed. Therefore, cumulative decommissioning phase effects will not occur.

11.6 Mitigation and Monitoring Measures

11.6.1 Construction Phase

11.6.1.1 Noise

Section 11.5.2 has assessed that significant noise and vibration effects are not expected at NSLs. While specific noise mitigation measures are not required, the following sections present general guidance which will be followed by the contractor to ensure that no significant noise effects occur.

General Construction Noise Best-Practice Measures

The contractors involved in the construction phase will be obliged, under contract, to undertake specific noise abatement measures and comply with the recommendations of *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise*. The following list of measures will be implemented, as relevant, to ensure compliance with the relevant construction noise criteria:-

- No plant or machinery will be permitted to cause a public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use;
- Any plant, such as generators or pumps, which may be required to operate outside of general construction hours will be surrounded by an acoustic enclosure or portable screen;
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed at Table 11.1 using methods outlined in *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration*

control on construction and open sites – Noise; and,

- The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 and 19:00 Monday to Friday and between 07:00hrs and 13:00hrs on Saturdays (unless in the event of an emergency), with no operations on Sundays or public holidays.

Based on assessment of the geological composition of the site, it is concluded that rock-breaking will not be required. In the unlikely event that rock breaking is necessary, the following measures will be implemented to mitigate noise emissions:-

- Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency;
- Ensure all air lines are sealed;
- Use a dampened breaking bit to eliminate a 'ringing' sound; and,
- Erect an acoustic screen around breaking activities. Where possible, line of sight between top of machine and reception point should be obscured.

11.6.1.2 Vibration

Vibration from construction activities shall be limited to the values set out at Table 11.4. It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

Given the substantial distances between locations where vibration may be generated and the nearest sensitive locations, no significant effect is likely to be experienced. Therefore, no mitigation measures are proposed.

11.6.2 Operational Phase

There is no operational noise associated with the project and, therefore, no mitigation measures are required.

11.6.3 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and its decommissioning is not proposed. Therefore, no decommissioning phase mitigation measures are required.

11.6.4 Monitoring

11.6.4.1 Construction Phase

No monitoring of noise levels during the construction phase is proposed.

11.6.4.2 Operational Phase

No monitoring of noise levels during the operational phase is proposed.

11.6.4.3 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and its decommissioning is not proposed. Therefore, no decommissioning phase monitoring is required.

11.7 Residual Effects

This section outlines the likely residual noise and vibration effects associated with the project taking account of the proposed mitigation measures.

11.7.1 Do Nothing Scenario

If the project were not to proceed then the existing noise environment will remain unchanged.

11.7.2 Construction Phase

During the construction phase, there will likely be some effect on nearby noise sensitive locations due to noise emissions from site traffic and other activities. However, given that the construction phase is temporary in nature and the distances between the main construction works and nearby noise sensitive properties, it is assessed that the noise generated will not be excessively intrusive. Furthermore, the application of noise limits in accordance with best practice standards, construction hours and the implementation of appropriate noise and vibration mitigation measures, will ensure that noise and vibration effects are unlikely to be significant. The residual effects are assessed to be likely, negative, not significant, and temporary.

11.7.3 Operational Phase

As noise will not be generated during the operational phase, no residual effects are assessed as likely.

11.7.4 Decommissioning Phase

As set out at Chapter 3 (Sections 3.2 and 3.7), the project will form part of the national electricity network and its decommissioning is not proposed. Therefore, no decommissioning phase residual effects are assessed as likely.

11.7.5 Cumulative Effects

Having regard to the cumulative assessment undertaken above and the implementation of best practice and mitigation measures, residual cumulative effects are not assessed as likely to be significant.

11.8 Summary

This assessment has been undertaken for both the long-term operational and short-term construction and decommissioning phases of the project.

With mitigation measures in place where required, the predicted noise and vibration levels associated with the construction phase are assessed as likely to be within criteria thresholds. Notwithstanding the above, all construction activities will incorporate noise abatement measures where necessary and comply with the recommendations of *BS5228-1:2009+A1:2014*.

The assessment has concluded that there are no likely significant noise and vibration effects associated with the operation or decommissioning phases of the project individually or in combination with other existing, permitted or proposed developments.