

11. NOISE AND VIBRATION

11.1 INTRODUCTION

This chapter of the EIAR describes the assessment undertaken of the likely significant noise and vibration effects from the proposed project. A full description of the proposed project is provided in Chapter 2 (Description of the Proposed Project).

Noise and vibration impact assessments have been prepared for the operational, construction, and decommissioning phases of the proposed project on the nearby noise sensitive locations (NSLs). To inform this assessment, noise surveys have been conducted at seven representative NSLs surrounding the proposed wind farm site (see Sections 11.4.1.1 and 11.4.2). Noise predictions have been prepared for all key elements of the proposed project that have the potential for noise impacts and effects. Vibration impacts and effects have been assessed. Due to the separation distances between project elements and sensitive receptors, the probability of any significant vibration impacts or effects is considered unlikely.

For a glossary of terms used in this chapter please refer to Appendix 11.1.

This chapter is supported by the material presented in the following appendices:

- Appendix 11-1 Glossary of Acoustic Terms
- Appendix 11-2: Operational Noise Study Area
- Appendix 11-3: Background Noise Survey
- Appendix 11-4: Noise Modelling Input Data
- Appendix 11-5: Assigned Background Noise Levels
- Appendix 11-6: Predicted Noise Levels
- Appendix 11-7: Predicted Noise Contour
- Appendix 11-8: Lidar Installation Report
- Appendix 11-9: Draft Protocol for Managing Complaints for relating to AM and Tonality

11.1.1 Statement of Authority

This chapter of the EIAR has been prepared by Dermot Blunnie of AWN Consulting, with input from Miguel Cartuyvels, and reviewed by Mike Simms.

Dermot Blunnie (Associate (Acoustics)) holds a BEng (Hons) in Sound Engineering, MSc in Applied Acoustics and has completed the Institute of Acoustics (IOA) Diploma in Acoustics and Noise Control. He has been working in the field of acoustics since 2008 and is a member of the Institute of Engineers Ireland (MIEI) and the Institute of Acoustics (MIOA). He has extensive knowledge and experience in relation to commissioning noise monitoring and impact assessment of wind farms as well as a detailed knowledge of acoustic standards and proprietary noise modelling software packages. He has commissioned noise surveys and completed noise impact assessments for numerous wind farm projects within Ireland.

Miguel Cartuyvels (Acoustic Consultant) holds a BEng (Hons) in Industrial Engineering and is a member (TechIOA) of the Institute of Acoustics. Miguel has worked in the field of acoustics since 2021, where he has contributed to numerous projects related to environmental surveying, noise modelling, and impact assessment for various sectors, including wind energy, industrial, commercial, and residential.



Mike Simms (Principal Acoustic Consultant) holds a BE and MEngSc in Mechanical Engineering and is a member of the Institute of Acoustics (MIOA) and of the Institution of Engineering and Technology (MIET). 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.

11.1.2 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 enormous range of pressure levels that can be detected by the ear, it is widely accepted that sound levels are measured and expressed using a decibel scale i.e., 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 0 dB (for the threshold of hearing) to 120 dB (for the threshold of pain). In general, a subjective impression of a doubling of loudness corresponds to a tenfold increase in sound energy, which equates to a 10 dB increase in SPL. It should be noted that a doubling in sound energy, such as may be caused by a doubling of traffic flows, will increase the SPL by 3 dB. This results in the subjective impression of a slight increase in noise level.

The frequency of sound 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 250 Hz. 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 in Figure 11-1.



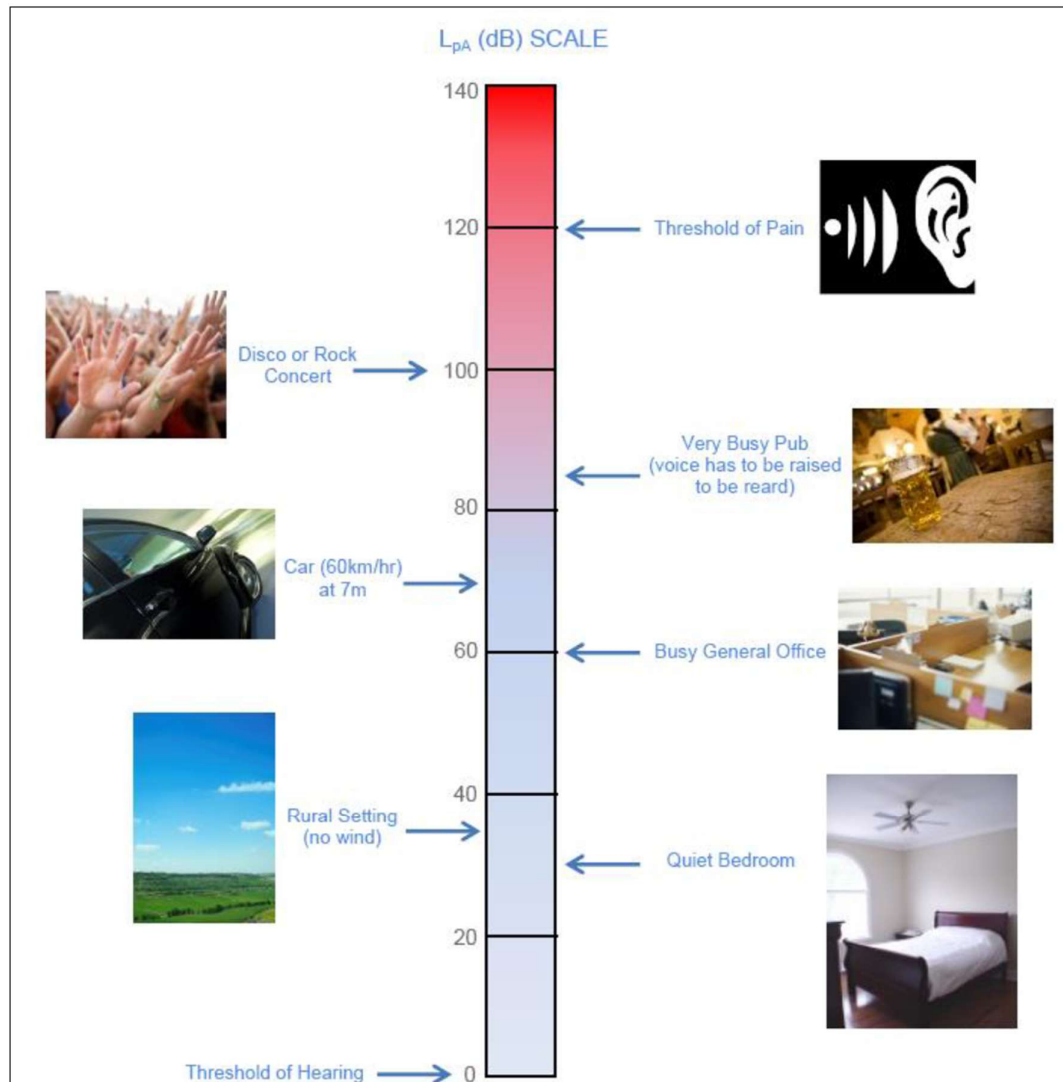


Figure 11-1 : dB(A) Scale & Indicative Noise Levels¹

11.2 CONSULTATION

During the consultation process there were no feedback from Local Authorities, Government Departments, NGOs or Stakeholders that affected the assessment and preparation of the Noise and Vibration assessment for this EIAR. Refer to Chapter 1 (Introduction) for full details of consultations.

11.3 LEGISLATION, POLICY AND GUIDANCE

The assessment of effects for the proposed project has been undertaken with reference to published standards and guidelines that are applicable to the development and/or considered

¹ - (EPA: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 - 2016))



to represent best practice for the assessment of environmental noise and vibration impacts. The following guidance documents have been consulted when preparing this chapter of the EIAR and the specific details are presented where relevant in Section 11.3.2:

- EPA Guidelines on the Information to be contained in Environmental Impact Statements, Environmental Protection Agency, 2022 (Hereafter EPA 2022);
- *Wind Energy Development Guidelines for Planning Authorities*, Department of the Environment, Heritage, and Local Government 2006 (Hereafter WEDG06);
- *The Assessment and Rating of Noise from Wind Farms*, Department of Trade, and Industry (UK) Energy Technology Support Unit 1996 (Hereafter ETSU-R-97)²;
- *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* 2013 and its *Supplementary Guidance Notes* 2024 (Hereafter IOA GPG);
- *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*, Transport Infrastructure Ireland (TII) (formerly National Roads Authority 20004 (Hereafter TII 2004).
- *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*, Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA) 2014 (Hereafter TII 2014);
- British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise* (Hereafter BS5228-1)
- British Standard BS 5228-2:2009+A1:2014 *Code of practice for vibration control on construction and open sites – Vibration* (Hereafter BS5228-2);
- British Standard BS 7385 – *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* BSI, 1993 (Hereafter BS7385);
- *Design Manual for Roads and Bridges* Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (National England (now National Highways)) 2020 (Hereafter DMRB);
- ISO 1996: 2017: *Acoustics – Description, measurement, and assessment of environmental noise* (Hereafter ISO-1996:2017);
- EPA document *Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites* NG3EPA, 2011 (Hereafter NG3);
- EPA document *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* NG4EPA, 2016 (Hereafter NG4);
- BS 4142:2014: *Methods for rating and assessing industrial and commercial sound* (Hereafter BS4142)
- Institute of Acoustics Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) document *A Method for Rating Amplitude Modulation in Wind Turbine* 2016 (IOA AMWG); and

² A draft update of the guidance ‘Assessment and Rating of Wind Turbine Noise’ (2025) was published for consultation on 4 July 2025. This draft update to ETSU-R-97 is a UK consultation document and is not applicable to wind energy assessments in Ireland. In line with its draft status, and the advice within the document that it should not be used by planning authorities, the consultation draft has not been considered in this assessment.



- ISO 9613-2:2024: *Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors* (Hereafter ISO-9613-2)

General context guidance in the following documents has also been considered but not directly applied:

- World Health Organisation (WHO) *Environmental Noise Guidelines for the European Region* 2018 (Hereafter WHO 2018);
- *Draft Revised Wind Energy Development Guidelines* 2019 Department of Housing, Local Government and Heritage (Hereafter Draft WEDG19)
- Department for Business, Energy & Industrial Strategy Wind Turbine AM Review: Phase 2 Report Project Number: 3514482A Issue: 3 Issued August 2016 (Hereafter BEIS AM Review Phase 2); and
- International Electrotechnical Commission (IEC) Technical Specification 61400-11-2 (Edition 1.0, 2024) *Wind Energy Generation Systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics in receptor position* (Hereafter TS 61400-11-2)

11.3.1 Environmental Protection Agency (EPA) Description of Effects

The significance of effects of the proposed project shall be described in accordance with the EPA 2022 guidance document. Details of the methodology for describing the significance of the effects are provided in Chapter 1 (Introduction).

The effects associated with the proposed project are described in the relevant sections of this chapter in accordance with the EPA guidance set out in Chapter 1 (Introduction) of the EIAR.

11.3.2 Guidance Documents and Assessment Criteria

The following sections review best practice guidance that is commonly adopted in relation to wind energy developments and confirms the proposed criteria and assessment thresholds for the noise and vibration.

11.3.2.1 Construction and Decommissioning Phase – Noise

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 typically control construction activities by restricting the hours during which construction activities can take place and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels can be found in the BS5528-1. This standard is commonly accepted as best practice and used in Ireland.

An approach in BS5528-1 calls for the designation of receptors into a specific category (A, B or C) based on the existing ambient noise levels at the receptor in the absence of construction noise. A threshold noise value is applied to each category. An exceedance of the construction noise threshold (CNT) at the façade of a noise sensitive location (NSL) during construction may indicate a potentially significant noise impact associated with the construction activities. The



CNT values recommended by BS5228-1 are depicted in Table 11-1. The CNT values are applicable to both construction and decommissioning noise. This assessment method is proposed for residential receptors only.

Table 11-1: Example Threshold of Potential Significant Effect at Dwellings

Assessment category and threshold value period (T)	Threshold value, in $L_{Aeq,T}$ 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

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

Note 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.

Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) 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 following steps are applied to implement the A B C method from BS5228-1:

For each period (e.g., daytime) the ambient noise level is determined and rounded to the nearest 5 dB. At some NSLs, particularly those located close to a busy road network, the existing ambient noise levels are expected to be relatively high. However, given the rural nature of the site in general, the existing daytime ambient noise levels are generally expected in the range of 30 to 55 dB $L_{Aeq,1hr}$. Therefore, for the purposes of this assessment and to adopt a conservative approach, all properties will be assigned a Category A designation setting the initial CNT for daytime periods at 65 dB $L_{Aeq,T}$.

BS 5228-1 states that:

“If the site noise level exceeds the appropriate category value [the CNT], then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.”

If the specific construction noise level exceeds the CNT, then a potential significant impact is identified. To determine the significance of effects, it is important to consider the duration and magnitude of the impacts as described in Section 11.3.2.4.2.

11.3.2.2 Linear Construction Works

A fixed noise limit is proposed for elements of the construction that are linear and progressive in nature, including:

- The proposed Grid Connection Route (GCR);
- Internal underground cabling;
- Construction and upgrade of site access roads.

This approach is deemed appropriate as noise from these activities is variable, typically short in duration, and only at its highest when closest to the NSL. As the works progress, the distance



between the construction activities and the NSL increases, resulting in reduced noise levels and a shorter duration of exposure to noise impacts. To set an appropriate fixed noise limit, reference is made to paragraph E.2 BS 5228-1.

General Principle:

“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.”

Recommended Daytime Limits (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;*
- *75 decibels (dBA) in urban areas near main roads in heavy industrial areas.”*

TII 2004 guidance proposes a daytime period (Monday to Friday 0700 – 1900 hrs) with a construction noise limit of 70 dB $L_{Aeq,1hr}$.

Considering the above guidance, a construction noise limit of 70 dB $L_{Aeq,1hr}$ is proposed for linear construction activities.

Noise levels above 70 dB $L_{Aeq,1hr}$ may indicate a significant impact depending on the duration and frequency of occurrence.

11.3.2.3 Additional Vehicular Activity on Public Roads Construction Phase

There are no specific guidelines or limits relating to traffic related sources along the local or surrounding roads. Given that traffic from the proposed project will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the proposed project.

In the absence of any national guidelines in Ireland, for the assessment of potential noise impacts from construction related traffic along public roads it is proposed to adopt guidance from DMRB. The DMRB guidance is considered appropriate and best practice as it provides a well-established, internationally recognised framework with objective criteria for assessing construction noise and vibration impacts, which aligns closely with the relevant significance effects from EPA 2022.

Table 11-2 taken from DMRB offers guidance as to the likely short-term impact associated with any change in traffic noise level.

Table 11-2: Likely Impacts Associated with Change in Traffic Noise Level (Source: DMRB).

Change in Sound Level (dB $L_{A10, 18hr}$)	Magnitude of Impact	Initial Significance Rating
Less than 1.0	Negligible	Not significant
1 – 2.9	Minor	
3 – 4.9	Moderate	Significant
Greater than or equal to 5.0	Major	



The DMRB guidance will be used to assess the predicted increases in traffic levels on public roads associated with the proposed project and comment on the likely ‘short-term’ impacts during the construction phase. Where a major or moderate impact or an initial significance rating of ‘Significant’ is identified, reference will be made to the overall predicted noise level from construction traffic in the context of the construction noise threshold values outlined in this Section 11.3.2.1.

11.3.2.4 Factors to Consider when Assessing Construction Noise Impacts

11.3.2.4.1 Interpretation of the CNT

To assist with interpretation of a predicted construction noise level (CNL), relative to the CNT, reference is made to Table 3.16 in DMRB which forms the basis of and been adapted by AWN to include the relevant significance effects from EPA 2022 to assess the likely magnitude of impact associated with construction activities, as presented in Table 11-3.

Table 11-3: Description of the magnitude of impacts. Adapted from DMRB Table 3.16

Construction Noise Level (CNL)	Magnitude of Impact (DMRB)	Determined EPA Significance of Effect	Determination
Below or equal Baseline Noise Level	Negligible	Not Significant	Depending on range of the CNL, the baseline noise level and the duration of the impact
Above Baseline and below or equal to CNT	Minor	Not Significant to Slight	
Above CNT and below or equal to CNT + 5dB	Moderate	Moderate to Significant	
Above CNT + 5dB	Major	Significant to Very Significant	

The DMRB guidance in conjunction with EPA 2022 as outlined will be used to assess the predicted construction noise levels at NSLs and comment on the likely effects during the construction stages

11.3.2.4.2 Consideration of Duration When Assessing Effects

Section 3.19 of DMRB states that construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or
- A total number of days exceeding 40 in any 6 consecutive months.

11.3.2.5 Construction Phase – Vibration

With respect to this development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

In the absence of statutory Irish guidelines for the assessment of construction-related vibration, the following published standards and guidance have been considered in the assessment. These documents provide industry-recognised thresholds and assessment methodologies that align



with EIAR requirements: Guidance relevant to acceptable vibration within buildings is contained in the following standards:

- BS 7385
- BS 5228-2
- TII 2004

BS7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15 mm/s at 4 Hz rising to 20 mm/s at 15 Hz and 50 mm/s at 40 Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS5228-2 recommends that, for soundly constructed residential properties and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e., non-structural) damage should be taken as a peak particle velocity of 15 mm/s for transient vibration at frequencies below 15 Hz and 20 mm/s at frequencies above 15 Hz. Below these vibration magnitudes minor damage is unlikely, although the standard notes that where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

TII 2004 also contains information on the permissible construction vibration levels during the construction phase as shown in Table 11-4.

Table 11-4: Allowable Vibration at Sensitive Properties (TII 2004)

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

In accordance with the suggested vibration criteria discussed above from BS7385, BS5228-2 and TII 2004, the values in Table 11-4 are considered appropriate for this assessment as they provide nationally recognised, conservative PPV thresholds specifically developed for Irish infrastructure and construction works, ensuring a robust assessment in the absence of statutory Irish vibration limits.

11.3.2.6 Operational Phase Noise – Wind Turbines

The noise assessment documented in this chapter complies with guidance in relation to acceptable levels of noise from wind farms as contained in WEDG06. The WED06 guidelines are broadly in line with the recommendations set out in ETSU-R-97. The ETSU-R-97 document has been used to supplement the guidance contained within the WEDG06, where appropriate and necessary.

11.3.2.6.1 The Assessment and Rating of Noise from Wind Farms – ETSU-R-97

The core of the noise guidance contained within the WEDG06 is broadly based on ETSU-R-97 however the turbine noise limits values vary.



ETSU-R-97 advises regulating wind turbine noise by establishing noise limits at the properties most sensitive to noise. The document suggests that applying fixed noise limits across all wind speeds may not be appropriate for wind turbine projects. Instead, it recommends setting noise limits in relation to the prevailing background noise levels at sensitive locations. A crucial step in assessing noise for wind energy projects involves identifying the existing background noise levels through on-site surveys.

Page 58 of ETSU-R-97 states: “...*absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question...*”. Therefore, the cumulative noise contribution from all wind turbine development in the area should be considered for inclusion in the assessment.

The ETSU-R-97 guidance allows for a higher level of turbine noise operation at properties that have an involvement in the proposed project, both as a higher fixed level of 45 dB L_{A90} and/or a higher level above the prevailing background noise level.

11.3.2.6.2 *Institute of Acoustics Good Practice Guide*

The original ETSU-R-97 concepts underwent a thorough standardisation and modernisation in 2013 with publication of the IOA GPG including 6 Supplementary Guidance Notes published in 2014. These documents bring together the combined experience of acoustic consultants in the UK and Ireland in the application of the assessment methods. Numerous improvements in the accuracy and robustness are described including the treatment of wind shear and the general adaptation to larger wind turbines. The guidance contained within IOA GPG is considered to represent best practice and has been adopted in this assessment.

11.3.2.6.3 *Background Noise Surveys*

The IOA GPG provided guidance on the duration and requirements for background noise surveys and states that at a minimum, continuous background noise monitoring should be carried out for typically a two-week period and should capture a representative sample of wind speeds in the area (i.e., from cut in speeds to the wind speed that generate the highest sound power output from the proposed turbine(s)). Background noise measurements (i.e., $L_{A90,10min}$) should be related to wind speed measurements that are collated at the site of the wind turbine development. Regression analysis is used on the data sets to calculate background noise levels at different wind speeds; the resulting background noise curve can be used to establish appropriate turbine noise criteria at each location.

For guidance on the methodology for the background noise survey, the IOA GPG has been adopted.

11.3.2.6.4 *Noise Prediction Calculations*

The noise levels associated with the wind turbines should be calculated in accordance with ISO 9613-2 including Annex D corrections. This is a noise prediction standard that considers noise attenuation offered, amongst others, by distance, ground absorption, directivity, and atmospheric absorption. The IOA GPG states that when considering cumulative noise impacts, the effects of propagation in different wind directions can be considered. Any such direction attenuation factors, if used, should be clearly stated in any assessment.



Additional details on the noise prediction calculation settings are provided in Appendix 11.4.

11.3.2.6.5 Cumulative Assessment Screening

Existing, permitted and proposed wind turbine developments must be considered cumulatively in the noise impact assessment. To determine whether a particular wind farm development can be scoped out of the final assessment a '10 dB rule' is applied. The '10 dB rule,' is grounded in scientific principles and supported by best-practice guidance. It states that if the contribution from another wind farm is 10 dB below the cumulative turbine noise limits applied at NSLs within the study area, its contribution is insignificant to the overall cumulative turbine noise level, and it can therefore be scoped out of the final assessment.

Section 5.1 of the IOA GPG provides criteria to determine if a cumulative turbine noise assessment is necessary:

"5.1.4 During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.

5.1.5 Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary."

In the first instance the study area must be defined, the IOA GPG states that the 'study area' for background noise surveys (and noise assessment) should, as a minimum, be the area within which noise levels from the proposed, consented and existing wind turbines is greater than 35 dB L_{A90}.

In some circumstances the cumulative 35 dB L_{A90} area may extend beyond the area where the proposed turbines will have any significant effect. This initial study area can be refined by applying the '10 dB rule' such that the following statement is true:

The study area for operational turbine noise can be defined as the area within which the predicted turbine noise levels from the proposed, consented, and existing wind turbines is greater than 35 dB L_{A90}, and the predicted noise from the proposed turbines in isolation is within 10 dB of the proposed fixed lower threshold for turbine noise.

For example, where a fixed lower threshold of 40 dB applies, the maximum extent of the study area for the proposed project will correspond to the 30 dB L_{A90} noise contour of the proposed turbines in isolation.

An appraisal of the study area to determine whether a cumulative turbine noise impact assessment is required is presented Section 11.4.3.1.

11.3.2.6.6 Wind Energy Development Guidelines for Planning Authorities

Section 5.6 of the *Wind Energy Development Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government (2006) (WEDG06) addresses noise and outlines the appropriate noise criteria in relation to wind farm developments.



This following statement from WEDG06 represents the best practice daytime noise criterion curve in relation to wind farm developments.

“In general, a lower fixed limit of 45dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.”

In relation to night time periods the following guidance is given:

“A fixed limit of 43dB(A) will protect sleep inside properties during the night.”

This limit is defined in terms of the $L_{A90,10min}$ parameter. This represents the best practice night time noise criterion curve in relation to wind farm developments.

An important caveat should be noted as detailed in the following extract from WEDG06.

“However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30dB(A), it is recommended that the daytime level of the $L_{A90, 10min}$ of the wind energy development be limited to an absolute level within the range of 35 – 40dB(A).”

In summary, the WEDGs outlines the following guidance to identify appropriate wind turbine noise criteria curves at NSLs:

- An appropriate absolute limit level in the range of 35 – 40 dB L_{A90} for quiet daytime environments with background noise levels of less than 30 dB $L_{A90,10min}$;
- 45 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), for daytime environments with background noise levels equal to or greater than 30 dB $L_{A90,10min}$ and;
- 43 dB $L_{A90,10min}$ for night time periods or a maximum increase of 5 dB above background noise (whichever is higher).

While the caveat of an increase of 5dB(A) above background for night-time operation is not explicit within the WEDGs, an allowance for same is commonly applied in noise assessments prepared and is accepted as detailed in numerous examples of planning conditions issued by An Coimisiún Pleanála. This is supported by the guidance in ETSU-R-97 and the IOA GPG and is based on the principle that when background noise levels are sufficiently elevated, the potential impact of wind turbine noise is less significant, provided it does not exceed 5 dB above the background level. This approach is also consistent with the daytime criteria in WEDG06, which allow the limit to increase by up to 5 dB above background where this exceeds the fixed threshold level.

11.3.2.6.7 Comments on Planning Conditions for Noise at Wind Energy Developments within the Study Area

There are no known planning conditions relating to noise for the Lacka/Skehanagh Wind Farm. As a result, this assessment has applied WEDG06 noise limits to all receptors, based on



background noise levels measured at representative Noise Monitoring Locations (NMLs) surrounding the proposed project. This approach is considered best practice.

11.3.2.6.8 Future Potential Guidance Changes

In December 2019, the Draft WEDG19 were published for consultation and at the time of writing, no updated guidelines have been published. It is important to note that during the public consultation on the 2019 draft WEDGs, several concerns relating to the proposed approach of the 2019 draft WEDGs have been expressed by various parties. Specific concerns expressed by a group of acoustic professionals working in the field are most relevant. The group was made up of acousticians who act for wind farm developers, Councils, Government bodies and residents' groups (all of whom are members of the Institute of Acoustics, IOA. The group contained several of the authors / contributors to ETSU-R-97, the IOA Good Practice Guide (IOA GPG) and the IOA Amplitude Modulation Working Group, which are all referenced extensively in the draft guidelines. Comment on the statement from the party group can be reviewed at:

<https://www.ioa.org.uk/wind-energy-development-guidelines-wedg-consultation-irish-department-housing-planning-community-and>

Wherein it is stated that:

“a number of acousticians working in the field have raised serious concerns over the significant amount of technical errors, ambiguities and inconsistencies in the content of the draft WEDG and these were highlighted during the consultation process by a group of acousticians”

A copy of the group's consultation response in full can be viewed at:

<https://tneigroup-com.stackstaging.com/wp-content/uploads/2022/05/WEDG-consultation-joint-response-R0.pdf>

The following statements was submitted by the Minister for Housing, Local Government and Heritage during a Dail Eireann Debates on 19 June 2025³

“My Department is currently undertaking a focused review of the 2006 Wind Energy Development Guidelines. The review is addressing a number of key aspects of the Guidelines including noise, setback distance, shadow flicker, community obligation, community dividend and grid connections.

My Department, in conjunction with the Department of the Climate, Energy and Environment (DCEE) which has primary responsibility for environmental noise matters, has been working to advance guidance on the noise aspect of the Guidelines, which is highly technical in nature. The two Departments have been engaging on proposals regarding the measurement and assessment of noise from wind turbines to ensure they are robust and fit for purpose having regard to, inter alia, the revised 2030 target to generate up to 80% of our electricity from renewable sources.

³ <https://www.oireachtas.ie/en/debates/question/2025-06-19/308/>



My Department, in conjunction with DCEE, will make any further changes to the draft Guidelines which are deemed necessary or appropriate in the wake of this work to ensure that the finalised Guidelines, once issued, are fit for purpose to provide guidance in line with renewable energy and climate targets, whilst having appropriate regard to the impacts of wind energy development, including in relation to noise annoyance.

The evolving policy and technical context including the new Planning and Development Act 2024, which was signed by the President on 17 October 2024, and the revision of the National Planning Framework (NPF) reinforces the need to ensure that the finalised Guidelines, once issued, are fit for purpose.

In addition to this work, and in line with EU Directive requirements, a strategic environmental assessment (SEA) is being carried out on the draft Guidelines as part of the review process. In this regard, my Department intends to undertake a public consultation on updated draft Guidelines as part of the SEA process whereby all interested parties will have an opportunity to submit observations on the draft Guidelines. Finalised Guidelines will be prepared following detailed analysis and consideration of the submissions received during the consultation phase.

More generally, with regard to the planning process and ensuring that the views of communities concerning wind energy developments are heard and given appropriate consideration, I wish to highlight that public participation is a crucial element of all substantive decision-making processes under the Planning and Development Act 2000, and the recently enacted Planning and Development Act 2024. As part of the process to review city and county development plans, it is open to members of the public to make an observation or submission on the draft development plan. The development plan sets out land use zoning objectives and outlines the types of potential development, including ancillary developments, which might be suitable for a particular area, and may include objectives for wind energy development. In addition, it is open to any member of the public to make an observation or submission on a planning application, including in relation to a proposed wind energy development, and the planning authority is statutorily obliged to consider such observation or submission before making a decision on the application.

My Department notes the commitment in the recently published Programme for Government 2025 – Securing Ireland’s Future to prioritise the publication of the Wind Energy Development Guidelines, having regard to international best practice and standards. In light of this commitment, my Department is working towards concluding the finalisation of review of the Guidelines as a matter of priority, having regard to the intended public consultation and the finalisation of associated reforms and reviews including the revision of the NPF. When finalised, the revised Guidelines will be issued under section 28 of the Planning and Development Act 2000, as amended or, subject to commencement of the Planning and Development Act 2024, as a National Planning Statement, as appropriate. The current 2006 Wind Energy Development Guidelines remain in force, pending the finalisation of the review.”

The assessment of wind turbine noise presented in this EIAR is based on the guidance outlined in WEDG06 and has been supplemented with best practice guidance from ESTU-R-97 and the IOA GPG. If updated Wind Energy Guidelines are published during the application process for the proposed project it is anticipated that any relevant changes affecting the noise will be addressed through an appropriate planning condition, or where a supplementary assessment is necessary, through provision of additional information.



11.3.2.6.9 World Health Organization (WHO) Noise Guidelines for the European Region

The WHO Environmental Noise Guidelines for the European Region 2018 (WHO 2018) provide guidance on protecting human health from exposure to environmental noise. They set health-based recommendations based on average environmental noise exposure of several sources of environmental noise, including wind turbine noise. Recommendations are rated as either ‘strong’ or ‘conditional’.

A strong recommendation, “can be adopted as policy in most situations” whereas a conditional recommendation, “requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply”.

The objective of the WHO 2018 is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

In relation to wind turbine noise, the WHO Guideline Development Group (GDG) state the following:

“For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB L_{den} , as wind turbine noise above this level is associated with adverse health effects.

No recommendation is made for average night noise exposure L_{night} of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.

To reduce health effects, the GDG conditionally recommends that policy-makers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another.”

The quality of evidence used by the WHO to support the recommendation of a 45 dB L_{den} exposure threshold for wind turbine noise is classified within the guidelines as ‘low’. The document also acknowledges that no evidence is available to justify implementing the L_{den} parameter as an appropriate noise criterion for wind turbines.

The WHO 2018 aim is to support the legislation and policy-making process on local, national, and international level, thus shall be considered by Irish policy makers for any future revisions of Irish National Guidelines.

There is potential for increased uncertainty due to the parameter used by the WHO for assessment of exposure (i.e., L_{den}), which it is acknowledged may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes, as stated below, from within WHO 2018:

“Even though correlations between noise indicators tend to be high (especially between L_{Aeq} -like indicators) and conversions between indicators do not normally influence the correlations between the noise indicator and a particular health effect, important assumptions remain when exposure to wind turbine noise in L_{den} is converted from original sound pressure level values. The conversion requires, as variable, the statistical distribution of annual wind speed at a particular height, which depends on the type of wind turbine and meteorological conditions at a particular geographical location. Such input variables may not be directly applicable for use in other sites. They are sometimes used without specific validation for a particular area, however, because of practical limitations or lack of data and resources. This can lead to increased uncertainty in the assessment of the relationship between wind turbine noise exposure and health outcomes. Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.”

“...Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region.”

The WHO-recommended average noise exposure level (i.e. 45 dB L_{den}) is not an appropriate target noise criterion for an existing or proposed wind turbine development in Ireland. It is not industry best practice to implement an L_{den} limit for wind turbine noise, as it is considered a poor characterisation of wind turbine noise. The WHO 2018 recommendation for average noise exposure of 45 dB L_{den} is conditional, meaning that the available scientific data for wind turbine noise was not strong enough to justify a strong recommendation.

11.3.2.6.10 Low Frequency Noise and Infrasound

Low Frequency Noise is noise that is dominated by frequency components less than approximately 200 Hz whereas infrasound is typically described as sound at frequencies below 20 Hz. In relation to infrasound, the following extract from the EPA’s NG3 document is noted here:

“There is similarly no significant infrasound from wind turbines. Infrasound is high level sound at frequencies below 20 Hz. This was a prominent feature of passive yaw “downwind” turbines where the blades were positioned downwind of the tower which resulted in a characteristic “thump” as each blade passed through the wake caused by the turbine tower. With modern active yaw turbines (i.e. the blades are upwind of the tower and the turbine is turned to face into the wind by a wind direction sensor on the nacelle activating a yaw motor) this is no longer a significant feature.”

An IOA statement in Respect of Wind Farm Noise Assessment dated December 2024 and published on the IOA website stated the following in relation to Infrasound and Low Frequency noise:

“The IOA is aware that there is some information presented at planning inquiries suggesting the potential for physiological health effects from infrasound from wind turbines. It is current advice to members that there is no need to assess infrasound as part of the noise impact assessment process, as the absolute levels are well below those reported to trigger physiological health effects based on peer reviewed research to date.”

“The IOA is aware that there is some information presented at planning inquiries suggesting the potential for physiological health effects from low frequency noise from wind turbines. It is current advice to members that there is no need to assess low frequency noise as part of the noise impact assessment process, as the absolute levels, whilst potentially audible at typical receptor distances, are well below those reported to trigger physiological health effects based on peer reviewed research to date.”

Based on best available guidance and research, there are no likely significant effects associated with low frequency noise or infrasound from windfarms. Therefore, there are no criteria proposed to assess low frequency noise or infrasound as part of the EIAR; this approach is standard industry practices in Ireland when assessing wind turbine noise at planning stage.

11.3.2.6.11 Tonicity

A tone is the concentration of acoustic energy into a very narrow frequency range, with a noticeable character (such as a “hum” or “whine” for example). The audibility of any tones can be assessed by comparing the narrow band level of such tones with the masking level contained in a band of frequencies around the tone. Several objective methodologies to assess tonal audibility are available, such as the one included in ETSU-R-97 or that of ISO 1996-2 (2017)⁴.

Mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise which can be characterised in some cases by its tonal content, particularly if resonances in the mechanical noise are not suitably controlled. However, modern turbine designs have evolved to minimise mechanical noise radiation and resonances are normally minimised through design.

Wind farm noise guidelines such as those of ETSU-R-97 assume that the wind turbine noise does not normally contain clearly audible tones. It is not possible to predict the occurrence of tonality on a project reliably at the planning stage. The unlikely occurrence of tonality in the wind turbines of the proposed project will be managed through the commitments provided by the Applicant in Section 11.7.2.2.

⁴ International Organization for Standardization (ISO), ISO 1996-2 (2017), Acoustics – Description, measurement and assessment of environmental noise, Part 2: Determination of sound pressure levels.



11.3.2.6.12 *Amplitude Modulation*

In the context of this assessment, amplitude modulation (AM) is defined in the IOA AMWG document as:

“Periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency (BPF) of the turbine rotor(s).”

The result is a regular fluctuation in amplitude at the Blade Passing Frequency (BPF) of the wind turbine blades (the rate at which the blades of the turbine pass a fixed point). For a three-bladed turbine rotating at 20 rpm, this equates to a modulation frequency of 1 Hz.

Previous definitions for AM distinguished between two distinct types:

Normal AM: An inherent characteristic of wind turbine noise, often described as “blade swish.” This effect is typically observed relatively close to the turbine and is produced as the trailing edge of the blade rotates toward and then away from the observer.

Other AM: A more pronounced form of AM, generally observed at greater distances from the turbine or turbines. It is often perceived as a periodic low-frequency “thumping” or “whoomphing.”

While AM is acknowledged as an intrinsic feature of wind turbine noise, the earlier terms Normal AM and Other AM were used to distinguish between the typical (expected AM), and the more pronounced form that may cause disturbance. Normal AM is accounted for in noise impact assessments, whereas Other AM may require additional mitigation if it presents at NSL during turbine operation.

The IOA AMWG now provides a clear, objective definition and rating method for AM, reducing the need for the older terminology.

11.3.2.6.13 *Frequency of Occurrence of AM*

UK research by Salford University commissioned by the Department of Environment Food and Rural Affairs (DEFRA), the Department of Business, Enterprise and Regulatory Reform (BERR) and the Department of Communities and Local Government (CLG) investigated the issue of AM associated with wind turbine noise. The results were reviewed and published in the report ‘Research into Aerodynamic Modulation of Wind Turbine Noise’ (2007). The conclusions of this report were that aerodynamic modulation was only considered to be an issue at four, and a possible issue at a further eight, of 133 sites in the UK that were operational at the time of the study and considered within the review. At the four sites where AM was confirmed as an issue, it was considered that conditions associated with this AM might occur between 7 and 15% of the time. It also emerged that for three out of the four sites the complaints have subsided, in one case due to the introduction of a turbine control system.

It is not possible to predict an occurrence of AM at the planning stage. The RenewableUK Research Document states the following in relation to matter:



- Page 68 Module F “even on those limited sites where it has been reported, its frequency of occurrence appears to be at best infrequent and intermittent.”
- Page 6 Module F “It has also been the experience of the project team that, even at those wind farm sites where AM has been reported or identified to be an issue, its occurrence may be relatively infrequent. Thus, the capture of time periods when subjectively significant AM occurs may involve elapsed periods of several weeks or even months.”
- Page 61 Module F “There is nothing at the planning stage that can presently be used to indicate a positive likelihood of OAM occurring at any given proposed wind farm site, based either on the site’s general characteristics or on the known characteristics of the wind turbines to be installed.”

11.3.2.6.14 Concluding Comments on AM

Current research and guidance relating to wind turbine noise AM are ongoing. Among the most recent notable contributions is the IOA AMWG’s 2016 publication, which outlines an objective measurement and rating approach known as the Reference Method. The IOA AMWG does not propose thresholds for adverse community response or recommend specific limits for AM. The purpose of the group is to consolidate existing research and to establish a consistent methodology for the objective measurement and rating of AM.

A 2016 report commissioned by the UK government BEIS AM Review Phase 2 recommended the use of a penalty scheme as a potential planning condition for AM to cover periods of complaints due to unacceptable AM. This penalty scheme is based on the AMWG method and other potential AM rating methods were dismissed as not sufficiently robust and was not adopted by the UK or devolved Governments. The report included the following caveat:

“Any condition developed using the elements proposed in this study should be subject to a period of testing and review. The period should cover a number of sites where the condition has been implemented and would be typically in the order of 2-5 years from planning approval being granted.”

It is noted that the WSP report recommended that AM be controlled specifically during period of complaints. The key point is that while AM may occur during the operation of the wind farm, it may not necessarily result in adverse impacts because the frequency of occurrence, the level and/or duration of the AM may not be sufficient to trigger such impacts, or it may occur at locations where no sensitive receptors are present. The WSP report states “at present it is not possible to predict whether AM will or will not be prevalent on a site”.

As per the discussion on the research presented in this Section, AM is considered an atypical phenomenon associated with wind turbines, and the duration, conditions and specific location or locations at which it may presents cannot be predicted at the planning stage. For these reasons, the assessment of AM is typically triggered in response to complaints where the contributing factors aligning to the period of the complaint such as meteorological conditions and turbine operations can be investigated.

The International Electrotechnical Commission (IEC) published Technical Specification 61400-11-2 (Edition 1.0, 2024) Wind Energy Generation Systems – Part 11-2: Acoustic noise



measurement techniques – Measurement of wind turbine sound characteristics in receptor position, in 2024. This document introduces a standardised methodology for measuring and rating AM at receptor locations. The method broadly aligns with the AMWG approach but includes some minor differences.

To date there is no clear industry and Governmental consensus on how AM should be regulated or managed through the planning and operational stage. Planning conditions imposing AM limits are therefore not considered best practice. In the absence of clear policy in Ireland to control AM from wind turbines, the commitments outlined in the Section 11.7.2.2., where a monitoring protocol in agreement with the local authority. The monitoring protocol discussed in Section 11.7.2.2 will include the use of best-practice robust, precise, enforceable, reasonable and measurable method.

11.3.2.7 Operational Phase Noise – Fixed Plant Items

There is no published statutory Irish guidance relating to the maximum permissible noise level from fixed mechanical and electrical plant that would be associated with the proposed Substation and Battery Energy Storage System (fixed mechanical and electrical plant). In the absence of specific noise limits, appropriate criteria relating to fixed mechanical and electrical plant, reference is made to best practice guidance contained in the following published guidelines and standards.

11.3.2.7.1 EPA NG4

In order to establish whether the NSLs would be considered ‘low background noise’ areas as defined in the EPA NG4 guidance, the noise levels measured during the environmental noise survey need to fall within each of the following criteria:

- Arithmetic Average of L_{A90} During Daytime Period ≤ 40 dB L_{A90} , and;
- Arithmetic Average of L_{A90} During Evening Period ≤ 35 dB L_{A90} , and;
- Arithmetic Average of L_{A90} During Night-time Period ≤ 30 dB L_{A90} .

Determining Appropriate Noise Criteria

Table 11-5 outlines the noise emission limit criteria detailed in the NG4 document.

Table 11-5: NG4 Approach for Determining Appropriate Noise Criteria

Scenario	Daytime Noise Criterion, dB $L_{Ar,T}$	Evening Noise Criterion, dB $L_{Ar,T}$	Night Noise Criterion, dB $L_{Aeq,T}$
	(07:00 to 19:00hrs)	(19:00 to 23:00hrs)	(23:00 to 07:00hrs)
Areas of Low Background Noise	45	40	35
All other Areas	55	50	45

It is important to consider the likelihood of adverse noise impacts when assessing noise from fixed plant. The NG4 refers to the assessment method prescribed in BS 4142:2014: *Methods for rating and assessing industrial and commercial sound* that can be used to assess the likelihood of complaints from specific plant noise sources.



11.3.2.7.2 BS 4142

BS 4142 is the industry standard method for analysing fixed plant sound emissions to residential receptors. BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

For a BS 4142 assessment it is necessary to compare the measured external background sound level (i.e. the $L_{A90,T}$ level measured in the absence of plant items) to the rating level ($L_{Ar,T}$) of the various plant items, when operational. Where sound emissions are found to be tonal, impulsive, intermittent or to have other sound characteristics that are readily distinctive against the residual acoustic environment, BS 4142 recommends that penalties be applied to the specific level to arrive at the rating level.

The subjective method for applying a penalty for tonal sound characteristics outlined in BS4142 recommends the application of a 2 dB penalty for a tone which is just perceptible at the receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible. In relation to intermittency, BS 4142 recommends that if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied. The following definitions as discussed in BS 4142 as summarised below:

<i>“ ambient sound level, $L_{Aeq,T}$</i>	<i>equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at any given time, usually from many sources near and far, at the assessment location over a given time interval, T.</i>
<i>residual sound level, $L_{Aeq,T}$</i>	<i>equivalent continuous A-weighted sound pressure level of the residual sound (i.e. ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound) at the assessment location over a given time interval, T.</i>
<i>specific sound level, $L_{Aeq, Tr}$</i>	<i>equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, Tr.</i>
<i>Rating level, $L_{Ar,T}$</i>	<i>specific sound level plus any adjustment for the characteristic features of the sound.</i>
<i>background sound level, $L_{A90,T}$</i>	<i>A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.”</i>

To establish an initial estimate of impact, BS 4142 states the following:



“Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following.

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

Note Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”

BS4142 contains the following pertinent factor that must be considered with respect to the context of the sound, which is relevant to this assessment as the background noise levels are typically low at NSLs during periods of low wind speeds:

“The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.”

The assessment methodology described above (i.e. comparison of rated sound level to background sound level) is quoted in BS 4142 as representing a methodology to ‘obtain an initial estimate’ of impact. It is important to note that BS 4142 also comments that ‘Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration’. BS 4142 provides a list of potential pertinent factors that can influence the ‘initial estimate’.

The proposed limits values and criteria for noise from the proposed substation and BESS are confirmed in Section 11.6.4.2.1. The criteria have been derived in line with the EPA NG4 guidelines and the BS4142 standard.

11.3.2.8 Factors to Consider when Assessing Operational Noise Effects

11.3.2.8.1 Wind Turbine Noise

The applicable guidelines (WEDG06), along with additional best practice guidance discussed in Section 11.3.2.6, provide a framework for identifying appropriate noise limits at nearby NSLs. The turbines to be installed will be selected and designed to operate within these limits during



the operational phase of the proposed project. Where predicted turbine noise levels remain within best practice thresholds, the effect can be considered not significant.

Baseline noise levels at low wind speeds are expected to increase at certain Noise Sensitive Locations (NSLs) with the operation of the proposed project. However, it is acknowledged that the introduction of turbines will contribute new sound sources to the existing soundscape.

11.3.2.8.2 Fixed-Plant Items

The guidance discussed in Section 11.3.2.7 provides a framework in line with national guidelines for identifying appropriate noise limits at nearby NSLs.

All fixed plant will be designed and selected to operate within the proposed limit values and therefore the effect can be described as not significant.

Ambient noise levels during night time periods may increase at certain Noise Sensitive Locations (NSLs) with the operation of the proposed project. However, the resulting noise will be at a relatively low level. It is acknowledged that the introduction of the proposed project will contribute new sound sources to the existing soundscape.

11.3.2.9 Operational Phase Vibration

Vibration generated from the operation of a wind turbine unit will decrease rapidly with distance. Typically, at 100 m from a 1 MW turbine unit the level of vibration associated with a turbine is the order of 10^{-5} mm/s.

A report from Germany published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in 2016, "*low frequency noise incl. infrasound from wind turbines and other sources*" conducted vibration measurements study for an operational Nordex N117 – 2.4 MW wind turbine. The report concluded that at distances of less than 300 m from the turbine vibration levels had dropped so far that they could no longer be differentiated from the background vibration levels.

The shortest distance from any turbine in the proposed project to the nearest NSL is more than 550 m (distance from turbine T05 to NSL ref. H010 (Involved Landowner). At that distance, the level of vibration will be significantly below any thresholds for perceptibility. There are no likely significant effects in terms of vibration from the proposed project and vibration criteria are not specified for the operational phase of the proposed project.

An IOA statement in Respect of Wind Farm Noise Assessment dated December 2024 and published on the IOA website⁵ stated the following in relation to Vibration:

"Vibration from operational wind turbines has been measured by extremely sensitive measurement equipment such as seismic arrays. but in terms of human perception, measured vibration levels are well below perception thresholds even on the actual wind turbine sites. There is, therefore, no need to assess vibration affecting people for operational wind turbine developments."

⁵ <https://www.ioa.org.uk/publications/wind-turbine-noise>



There are no other sources likely to give rise to any perceptible vibration at NSLs during the operation of the proposed project. The assessment of operational phase vibration has therefore been scoped out of this assessment.

11.4 ASSESSMENT METHODOLOGY

The outline methodology adopted for this assessment is summarised as follows:

- Review of best practice guidance to identify appropriate noise and vibration criteria for the construction, operational and decommissioning phases;
- Characterise the receiving environment through baseline noise surveys at various NSLs surrounding the proposed project;
- Undertake predictive calculations to assess the potential effects associated with the construction phase of the proposed project;
- Undertake predictive calculations to assess the potential effects associated with the operation of the proposed project at NSLs;
- Undertake predictive calculations to assess the potential effects associated with the decommissioning of the proposed project at NSLs;
- Specify mitigation measures to reduce, where necessary, the identified potential outward effects relating to noise and vibration from the proposed project; and,
- Describe the significance of the residual noise and vibration effects associated with the proposed project.

11.4.1 Study Area

The study area for the noise and vibration impact assessment was defined by the area where there is potential for noise and vibration impacts at NSLs associated with the proposed project during the construction, decommissioning, and operational phases, and the turbine delivery route (TDR).

11.4.1.1 Operational Phase Noise

The method to define the study area is described in Section 11.3.2.6 The study area for the operational phase was determined as the area predicted to exceed 30 dB L_{A90} at the maximum predicted turbine noise emission level from the proposed project in isolation, i.e. the predicted noise from the proposed turbines in isolation is within 10 dB below of the proposed fixed lower threshold for turbine noise. Refer to Appendix 11-2 – Operational Noise Study Area which displays the relevant noise contours maps which identify this area.

The NSLs identified within this study area have been considered in the assessment of operational noise from the proposed fixed plant items i.e. the substation and BESS.

11.4.1.2 Construction and Decommissioning

During the construction and decommissioning phases, noise could occur at any location where activities occur as part of the proposed wind farm site, TDR, grid connection route (GCR) and along public roads where there are increases in traffic associated with the proposed project. There is also a potential for noise impacts from HGVs along the proposed TDR.

NSLs in proximity to specific construction activities and those situated along haul routes have the most potential to experience noise and vibration from the proposed project. Taking account of the works associated with the construction and decommissioning phases, the study area is based on the nearest NSLs to the working areas, these distances are confirmed in the relevant sections and representative of the closest identified NSL, or at defined set back distances from the proposed activities.

11.4.2 Background Noise Survey

A summary outlining key information of the background survey is presented in this section; full details of the background noise survey methodology, instrumentation, and results is provided in Appendix 11-3.

A background noise survey was undertaken to establish typical background noise levels at representative NSLs surrounding the proposed wind farm site. The background noise survey was conducted through installing unattended sound level meters at 7 no. representative locations in the surrounding area.

All measurement data collected during the background noise surveys has been carried out in accordance with the IOA GPG and accompanying *Supplementary Guidance Note 1: Data Collection* (2014) discussed in the following sections.

11.4.2.1 Choice of Measurement Locations

The noise monitoring locations were identified by preparing a preliminary noise model contour at an early stage of the assessment. The selection of the noise monitoring locations was informed by a site visit and supplemented by reviewing aerial images of the study area and other online sources of information (e.g., Google Earth and OSI Maps).

The co-ordinates for the selected noise monitoring locations are outlined in Table 11-6 and identified on a map in Figure 11-2.

Table 11-6: Noise Measurement Coordinates

Location Reference (Closest NSL)	Co-ordinates (ITM)	
	Easting	Northing
NML 1 (H010)	603,041	698,628
NML 2 (H141)	602,239	700,043
NML 3 (H173)	605,622	698,581
NML 4 (H017)	605,740	696,773
NML 5 (H289)	603,903	696,862
NML 6 (H109)	603,105	697,327
NML 7 (H225)	603,589	701,036





Figure 11-2: Map of Noise Monitoring Locations (NML)

11.4.2.2 Wind Measurements

Average wind speed and direction was measured in 10-minute intervals at an on-site Lidar system (Appendix 11-8) and provided to AWN. Wind speed measurements made at 100 m and 80 m were used to correct the wind speed up to a provisional assessment hub height (HH) of 105 m, as per the method B methodology described in the IOA GPG. The calculated HH wind speeds were then corrected to the ‘standardised’ 10 m wind speed in accordance with the IOA GPG. The ‘standardised’ wind speed is the industry standard in the UK and Ireland for referencing for wind speed with respect to wind turbines.

11.4.2.3 Rainfall Measurements

Rainfall loggers measured rainfall levels in 10-minute intervals for the duration of the survey. Additional details are provided in Appendix 11-3.

11.4.3 Analysis of Survey Data

As well as the location-specific filtering, the data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. An example of atypical sources would be short, isolated periods of raised noise levels attributable to local sources, agricultural activity, boiler flues, operation of gardening equipment etc. In addition, sample periods affected by rainfall or when rainfall resulted in prolonged periods of atypical noise levels have also been screened from the data sets. In this instance, periods comprising 10 minutes



before and after the rain was logged have been excluded. The assessment methods outlined above are in line with the guidance contained in the IOA GPG.

The results presented Appendix 11-3 and summarised in the following sections refers to the noise data collated during 'quiet periods' of the day and night as defined in the IOA GPG.

11.4.3.1 Noise from Existing Turbines

The existing Skehanagh Wind Farm is located to the southwest of the proposed wind farm site. In line with the guidance outlined in Section 11.3.2.6, contributions to measured noise levels from existing wind turbines must be excluded from the dataset when determining background noise levels. This ensures that the noise criteria are correctly applied to establish the permissible noise limits for the new wind turbine development. This has been accounted for in the assessment and additional details are provided in Appendix 11-3.

11.4.3.2 Consideration of Wind Shear

Wind shear is defined as the change of wind speed with height above ground. Site specific wind shear is captured in the background noise assessment through simultaneously measurement of deriving wind speeds adjust to hub height using the one of three methods described in the IOA GPG.

To ensure clearly and consistently defined wind speeds it is standard industry practice to convert and reference wind speeds to the 'Standardised Wind Speed'.

The Standardised Wind Speed is a wind speed measured at a height different than 10 m (generally measured at the turbine hub height) which is expressed to a reference height of 10 m in accordance with the IEC 61400-11 standard. The standardised equations used to determine the wind speed at standardised 10m above ground is presented in Appendix 11-3.

Any reference to wind speed in this chapter should be understood to be standardised wind speed at a height of 10 m height unless otherwise stated.

11.4.4 Construction Noise Calculations

A variety of plant items will be used for site preparation, construction, and associated works. Vehicular movements to and from the site will make use of existing roads. These activities have the potential to generate significant levels of noise.

In the absence of specific details on the plant items and construction methods to be employed, a set of assumptions must be made to predict and assess the likely noise emissions from these activities. The standard best practice approach is to predict typical noise levels at the NSLs using the guidance set out in BS5228-1.

The methodology adopted for the assessment of construction noise involves analysing the various elements of the construction phase in isolation. For each of the elements assessed in Section 11.6.2, the typical construction noise sources are assessed along with typical sound pressure levels from BS5228-1 at various distances from these works.



11.4.5 Operational Noise Calculations

A series of prediction models have been prepared to quantify the potential turbine noise level associated with the operational phase of the proposed project on the receiving environment. This section discusses the methodology used in the noise prediction modelling process.

11.4.5.1 Noise Prediction Software

The selected software, DGMR iNoise Enterprise (Version 2024.3) calculates noise levels in accordance with ISO 9613-24.

iNoise is a proprietary noise calculation package for computing noise levels and propagation of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard, in this case, ISO 9613-2:2024. The calculation setting applied will depend on the type of source under assessment.

11.4.5.2 Noise Prediction Model - Input Data and Assumptions

The settings applied in the calculations depend on the type of source under assessment. Full details of the calculation settings, input data and any assumptions made in the assessment are provided in Appendix 11-4. The assumptions made do not prevent the assessment from reaching an accurate conclusion regarding the likely significant effects.

11.4.5.2.1 Proposed Wind Turbine Details

Chapter 2 details the co-ordinates of the 11 number turbines of the proposed project.

The turbine noise assessment has been undertaken considering three turbine types, all having blades with serrated trailing edges. A summary of the turbine details is presented in Table 11-7 and Table 11-8. The dimensions of these turbines are within the proposed range of dimensions as described in Chapter 2 of this EIAR (Description of the Proposed Project).

Table 11-7: Details of turbine parameters and envelope considered in the assessment

Item Description	Details		
	Vestas - V150	Nordex - N163	Nordex - N149
Nominal Power (MW)	5.6	7.0	5.7
Rotor Diameter (m)	150	163	149
Tower Hub Height (m)	105	98.5	105
Tip height (m)	180	180	179.5

The turbine types and specifications in Table 11-7 are representative of the type of turbine that would be installed on the site taking into consideration the proposed dimensions and the nominal generation capacity.

Sound power levels for each of the turbines listed above referenced to wind speeds at standardised 10 m height (calculated in accordance with the IOAGPG), are presented in Table 11-8.



Table 11-8: LWA Levels for various hub heights (HH)

Wind Speed (m/s)	dB L _{WA} of Turbine Model at Standardized Wind Speeds for Stated Hub Height (m)		
	N149 (105 m HH)	V150 (105 m HH)	N163 (98.5 m HH)
3	94	94.7	95.8
4	95.2	96.6	97.1
5	99.8	101.5	101.7
6	104.2	104.1	106.1
7	105.6	104.9	107.4
8	105.6	104.9	107.4
≥9	105.6	104.9	107.4

Figure 11-3 presents a graph of the noise emissions for the turbines listed in Table 11-8.

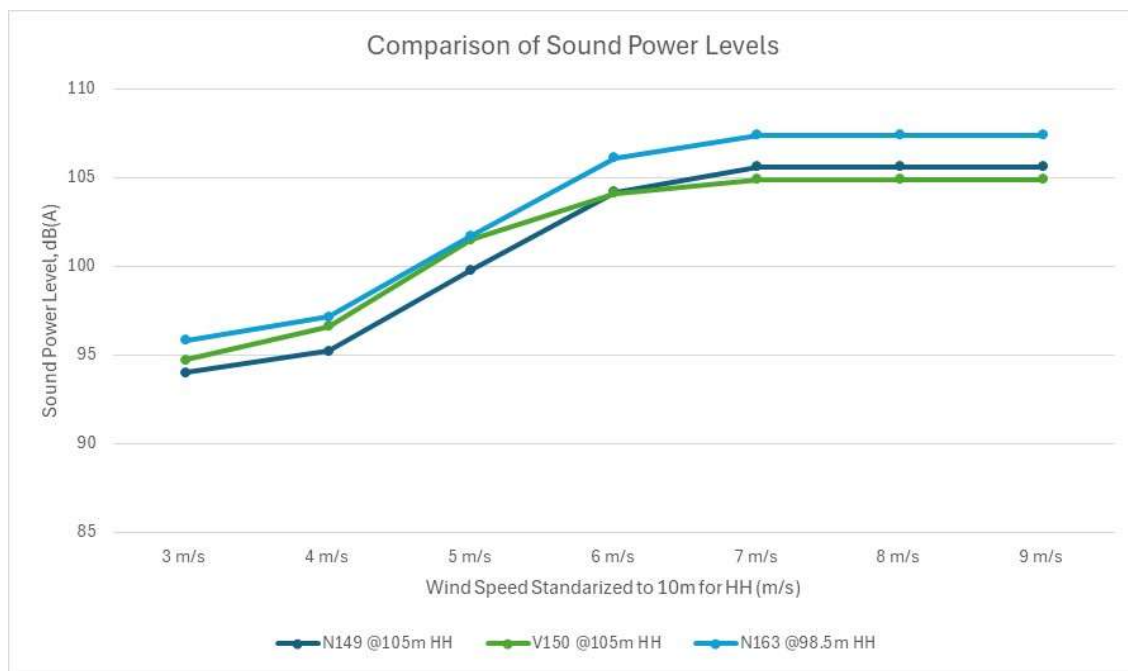


Figure 11-3: Sound Power Level of each of the 3 turbine types under consideration

The turbine with the highest overall sound power level is the N163 at 98.5m hub height.

For this assessment, all turbine options listed in Table 11-8 were modelled. The results confirmed that the N163 turbine model produced the highest predicted noise levels at NSLs.

As the N149 and V150 turbines exhibit lower noise emissions across their operational range, basing the assessment on the N163 model as a worst-case scenario provides a robust evaluation. This approach ensures that the highest potential noise emissions among all candidate turbines are accounted for.

Therefore, the noise impact assessment is representative of all candidate turbines in terms of the maximum potential turbine noise impact.



The manufacturer's turbine sound power levels (dB L_{WA}) are provided in terms of L_{Aeq} parameter. However, turbine noise criteria are expressed in terms of the L_{A90} parameter. According to best practice guidance in the IOA GPG, " *L_{A90} levels should be determined from calculated L_{Aeq} levels by subtraction of 2 dB*". This 2 dB adjustment is applied within the noise model calculations. All turbine noise predictions presented in this chapter are expressed using the L_{A90} parameter.

In accordance with guidance from the IOA GPG, an uncertainty factor should be considered in all turbine noise predictions. A +2 dB uncertainty correction has been applied in the modelling to all turbine sound power levels unless otherwise stated.

Best practice states that should any audible tonal component be present at an NSL from the operation of wind turbines, a penalty shall be added to the measured noise levels. The level of this penalty is described in ETSU-R-97 and relates to the extent by which tonal components exceed the threshold of audibility.

Current good practice recommends that tonal issues at wind farms are best addressed through appropriate planning conditions. A tonal penalty has not been included in the predicted noise levels for this assessment. A warranty will be provided by the manufacturer of the selected turbine to ensure that the noise output, including tonality, is controlled.

11.4.5.3 Cumulative Noise from Other Wind Turbine Developments

An appraisal of the study area has identified the following wind turbine development with the potential for cumulative noise impacts within the study area:

- Lacka/Skehanagh: Existing operational wind farm consisting of 8 no. Vestas V52 turbines with a Hub Height of 56.5 m, Rotor Diameter of 52 m and Tip Height of 82.5 m.
- Carrig Renewables ⁶ Wind Farm: Permitted 7-turbine wind farm southwest of Carrig village in Co Tipperary. An Coimisiún Pleanála (ACP) reference 318689.

Following best practice guidance discussed in Section 11.3.2.6, all turbines associated with the developments listed above have been included in the turbine noise assessment. The details and coordinates of the other wind turbines considered in the assessment are presented in Appendix 11-4.

11.4.5.4 Effects of Propagation from Wind Directions

As discussed in Section 11.3.2.6.4 When considering noise impacts of wind turbines, the effects of propagation in different wind directions can be considered. The day-to-day operations of the optimised development will not result in a worst-case condition of all noise locations being downwind of all turbines at the same time i.e. omni-directional predictions. Therefore, to address this issue, a review of expected noise levels downwind of the turbines has been prepared for various wind directions in accordance with the IOA GPG.

For any given wind direction, a property can be assigned one of the following classifications in relation to turbine noise propagation:

⁶ Atlantic Infrastructure Renewables



- Downwind (i.e. $0^\circ \pm 80^\circ$): no reduction in noise levels;
- Crosswind (i.e. $90^\circ \pm 10^\circ$ and $270^\circ \pm 10^\circ$): reduction of 2 dB, and;
- Upwind (i.e. $180^\circ \pm 80^\circ$): typically, up to 10 dB reduction depending on distance from turbine

Table 11-9 presents the directivity attenuation factor that has been applied to turbines when considering noise propagation in downwind conditions (full downwind is represented by 0° and full upwind is 180°).

Table 11-9: Turbine Directivity Attenuation with Consideration of Wind Direction

Wind Direction Sector	Degrees ($^\circ$)	Attenuation (dB)
Downwind	280 - 360 & 0 - 80	0
Crosswind	260 - 280 & 80 - 100	2
Upwind	230 - 250	5
	220	5.5
	210	6
	200	6.5
	190	7
	180	7.5

11.5 EXISTING ENVIRONMENT

This section of the chapter documents the typical background noise levels measured at NMLs representative of the nearest NSLs to the wind farm site. The NMLs locations are presented in Table 11-6. Appendix 11-3 presents the additional details and results of the background noise surveys undertaken in accordance with the methodology in Section 11.4.2.

11.5.1 Summary of Derived Background Noise Levels

The following section presents the various derived $L_{A90,10min}$ noise levels for each of the monitoring locations for daytime quiet periods and night time periods. These levels have been derived using regression analysis carried out on the data sets measured in line with best practice guidance and presented in this Section. The scatter graphs of each of each location is displayed in Appendix 11-3.

11.5.1.1 Summary of Derived Background Noise Levels

Table 11-10 presents the various derived $L_{A90,10min}$ noise levels for each of the monitoring locations for daytime quiet periods and night-time periods. These levels have been derived using regression analysis carried out on the data sets measured in line with guidance contained in the IOA GPG.



Values in parenthesis are used where, for higher wind speeds during day and night-time periods, the measurement obtained during the survey did not have sufficient data points at these wind speeds. In accordance with IOA GPG Supplementary Guidance Note 2: Data Processing & Derivation of ETSU-R-97 Background Curves, paragraph 2.9.1: “Where background noise data has not been collected for higher wind speeds it may be appropriate to cap the background noise curve (and therefore the associated noise limit)”.

Table 11-10: Derived Background Noise Levels of $L_{A90,10-min}$ for Various Wind Speeds

Location	Period	Derived $L_{A90, 10min}$ Levels (dB) at Various Standardised 10m Height Wind Speeds m/s for 105 m Hub Height						
		3	4	5	6	7	8	≥9
NML 1	Day	23.9	25.4	27.8	30.7	34.0	37.4	40.6
	Night	18.8	20.4	22.6	25.5	29.4	34.4	(34.4)
NML 2	Day	24.9	26.0	27.6	29.8	32.4	35.5	39.0
	Night	17.8	18.9	20.6	23.3	27.0	31.9	(31.9)
NML 3	Day	28.3	29.8	31.8	34.5	37.8	41.6	45.8
	Night	18.9	21.2	24.6	28.9	34.2	40.5	(40.5)
NML 4	Day	27.3	28.3	29.7	31.6	34.0	37.1	40.8
	Night	17.9	19.0	21.0	24.3	28.9	35.3	(35.3)
NML 5	Day	25.3	27.5	30.8	34.8	39.1	43.4	47.2
	Night	17.8	19.5	22.7	27.6	33.8	40.4	(40.4)
NML 6	Day	26.7	28.2	30.4	33.3	36.9	41.1	46.1
	Night	18.9	20.6	23.3	27.1	32	38.2	(38.2)
NML 7	Day	27.4	29.5	32.9	37.2	42.2	47.6	(47.6)
	Night	19.1	21.9	27.1	33.7	39.3	40.3	(40.3)

11.5.2 Wind Turbine Noise Limits

With respect to the relevant guidance documents outlined in Section 11.3.2.6.6 noise criteria have been established for the proposed project using the derived background level measured at representative NMLs and summarised in Table 11-10.

The turbine noise limits proposed are in line with the applicable WEDG06 guidelines and noise conditions applied to similar sites previously granted planning permission by An Bord Pleanála (now An Coimisiún Pleanála).

For the proposed project, it is considered that a lower daytime threshold of 40 dB L_{A90} is appropriate for low noise environments where the background noise is less than 30 dB(A), based on the following considerations:

- The EPA NG4 Guidance proposes a daytime noise criterion of 45 dB(A) in ‘areas of low background noise’. Turbine noise limits are stated in terms of the L_{A90} parameter while the NG4 daytime limit an L_{Aeq} . The accepted difference between L_{Aeq} and L_{A90} in wind turbine noise assessments is 2 dB; for example, 45 dB L_{Aeq} corresponds to 43 dB L_{A90} . This approach implies a 3 dB difference when comparing the parameter definitions used



in NG4 and WEDG06. Accordingly, the proposed lower daytime threshold of 40 dB L_{A90} is 3 dB more stringent than the equivalent daytime noise limit for low background noise areas as outlined in NG4.

- A lower threshold of 40 dB is commonly adopted in planning conditions for similar developments that have been granted planning permission by ACP in recent years for example, Derrinlough Wind Farm (ACP Ref: 306706-20), Coole Wind Farm (ACP Ref: PL25M.300686) Cloncreen (ACP Ref: PA0047), Meenbog (ACP Ref: PL05E.300460), Borrisbeg (ACP ref: 318704-23), Castlebanny Wind Farm (Planning Ref: 309306-21), Ballivor (ACP-316212-23) and the nearby Carrig Renewables Wind Farm (ACP Ref: 318689-23) (and which we understand is subject to a judicial review at the time of writing of this chapter).

Best practice for setting wind turbine noise limits at NSLs is that the limits should relate to the cumulative turbine noise level from all turbines. Therefore, the proposed noise limits shall be cumulative, accounting for all operational wind turbines. When setting appropriate turbine noise limits in accordance with the criteria from WEDG06 guidelines and best practice guidance, it is important to bear in mind that where an existing wind turbine development is the dominant source of turbine noise at a given NSL, this must be considered in the context of the planning condition for noise under which other developments operate.

The proposed turbine noise criteria should apply to the nearest NSLs where it can be reasonably determined that the noise contribution from the operation of proposed project is the dominant wind turbine source or has a significant contribution to the cumulative turbine noise level at a given NSL. The operational noise limits proposed for the proposed project at are:

Noise levels generated by the windfarm following commissioning by itself or in combination with other existing or permitted wind energy development in the vicinity when measured externally at noise sensitive locations, shall not exceed:

- 40 dB $L_{A90,10min}$ for daytime in quiet environments with typical background noise of less than 30 dB $L_{A90,10min}$.
- 45 dB $L_{A90,10min}$ or a maximum increase of 5 dB(A) above background noise (whichever is the higher), for daytime (0700 – 2300hrs) in environments with typical background noise greater than or equal to 30 dB $L_{A90,10min}$; and
- 43 dB $L_{A90,10min}$ for night-time periods (2300 – 0700hrs) or a maximum increase of 5 dB above background noise (whichever is higher).

In line with ETSU-R-97 guidance (see Section 11.3.2.6.1), a fixed lower threshold of 45 dB L_{A90} or a maximum increase of 5 dB above background noise (whichever is the higher) is proposed for NSLs identified as being involved in the project.

11.5.2.1 Assigning Representative Background Noise Levels

The derived turbine noise limits have been assigned to the various NSLs where noise monitoring has been undertaken. Where background noise measurements have been conducted in the vicinity and/or are judged to be typical/indicative of the background noise levels at other locations, these can be assigned to the nearby representative location for the purposes of



setting appropriate turbine noise limits for the assessment. That approach is in line with best practice guidance set out in the IOA GPG.

Appendix 11-5 presents confirmation of where representative background noise levels have been assigned to each of the relevant NSL's for the purpose of setting turbine noise limits. The assignment of noise limits is based on professional judgement in line with best practice guidance of representative background noise levels that were measured as part of the survey.

Table 11-11 outlines the operational noise limits derived for the assessment in accordance with applicable criteria. Turbine noise limits have been established for wind speeds between 3 and 9 m/s, covering the range from turbine cut-in up to the point where the turbine reaches its maximum sound power level.

In the absence of measured background noise data above 9 m/s, a conservative approach assumes that the background noise levels derived at 9 m/s apply at higher wind speeds. However, it is expected that as wind speeds increase beyond 9 m/s, background noise levels will also rise.

Table 11-11: Proposed Noise Criteria Curves

Location	Period	Turbine Noise Limits $L_{A90, 10min}$ Levels (dB)						
		at Various Standardised 10m Height Wind Speeds)						
		3	4	5	6	7	8	≥ 9
NML 1	Day	40	40	40	45	45	45	45.6
	Night	43	43	43	43	43	43	43
NML 2	Day	40	40	40	40	45	45	45
	Night	43	43	43	43	43	43	43
NML 3	Day	40	40	45	45	45	46.6	50.8
	Night	43	43	43	43	43	45.5	45.5
NML 4	Day	40	40	40	45	45	45	45.8
	Night	43	43	43	43	43	43	43
NML 5	Day	40	40	45	45	45	48.4	52.2
	Night	43	43	43	43	43	45.4	45.4
NML 6	Day	40	40	45	45	45	46.1	51.1
	Night	43	43	43	43	43	43.2	43.2
NML 7	Day	40	40	45	45	47.2	52.6	52.6
	Night	43	43	43	43	44.3	45.3	45.3

In line with guidance discussed in Section 11.3.2.6.1 A fixed lower threshold of 45 dB L_{A90} or BG + 5 has been applied in the assessment for NSLs identified as being involved in the project.



11.6 ASSESSMENT OF EFFECTS

11.6.1 Do-Nothing Scenario / Future Baseline

If the proposed project does not proceed, the existing noise environment is expected to remain unchanged. The likely future receiving environment is anticipated to experience a gradual increase in traffic volumes on the local road network; however, this is not expected to result in a significant change to the overall ambient or background noise levels within the receiving environment.

11.6.2 Construction Phase

Construction noise prediction calculations have been conducted using the assessment methodology outlined in Section 11.4.4. The source noise levels referred to in this section are indicative of the type of plant items and activities associated with the construction of the proposed project.

The highest predicted noise levels are expected to occur for only short periods of time at a very limited number of properties. Construction noise levels will be lower than these levels for most of the time at most properties in the vicinity of the proposed wind farm site.

There are several stages and elements associated with the construction phase of the proposed project which will include but are not limited to the following:

- Construction of turbines and hardstand areas;
- Construction of internal site roads;
- Operation of borrow pits;
- Construction of substation;
- Construction of Battery Energy Storage System;
- Cabling and grid connection; and
- Horizontal Direction Drilling (HDD).

Chapter 2: (Description of the Proposed Project) has detailed information on each of these elements.

In general, the distances between the construction activities associated with the proposed project and the nearest NSLs are such that there will be no significant noise, and vibration impacts at the NSLs. The following sections present an assessment of the main stages of the construction phase that have the potential for associated noise and vibration effects, all other stages and elements are considered unlikely to have any significant noise and vibration effects namely, temporary construction compounds, permanent meteorological Mast, and Forestry Felling. This conclusion is based on a review of the expected activities, durations, and separation distances to NSLs for these elements of construction, applying the significance thresholds set out in Section 11.3.2.1 and Section 11.3.2.2. The likely construction noise levels during the proposed works will be below the applicable thresholds and therefore there will be no likely significant construction noise effects associated with these elements. Expected vibration from the activities will be below the assessment criteria in Section 11.3.2.5 and therefore there will be no likely significant vibration effects associated with these elements.

Construction activities will be carried out during normal daytime working hours (i.e. 7:00 hrs - 19:00 hrs Monday to Friday (excluding public holidays) and 07:00 hrs - 14:00 hrs on Saturdays). However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (e.g., concrete pours) or to accommodate delivery of large turbine components along public routes it could be necessary on occasion to work outside of these hours. Work on Sundays or public holidays will only be carried out under exceptional circumstances. Any such out of hours working will be agreed in advance with the Local Authority.

11.6.2.1 General Construction of Turbines and Hardstand Areas

11.6.2.1.1 Noise

Several noise sources that would be expected on a construction site of this nature have been identified and predictions of the potential noise emissions have been calculated at the nearest NSL. In this instance the closest noise sensitive receptor is Location H010, which is situated approximately 550 m from the proposed turbine T04.

Table 11-12 outlines the expected construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 11-12: Expected Wind Farm Turbine Construction Noise Emission Levels

Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,T}$) ⁷	Predicted Noise Level (dB $L_{Aeq,T}$) at distance (m)
			550 m
HGV Movement (C.2.30)	Removing spoil and transporting fill and other materials.	79	37
Tracked Excavator (C.4.64)	Removing soil and rubble in preparation for foundation.	75	33
Excavator Mounted Rock Breaker (C9.12)	Rock Breaking.	85	43
Piling Operations (C.12.14)	Piling Foundations (if required).	88	46
General Construction (Various)	All general activities plus deliveries of materials and plant	84	42
Dewatering Pumps (D.7.70)	If required.	80	38

⁷ All plant noise levels are derived from BS5228: Part 1



Item (BS 5228 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB L _{Aeq,T}) ⁷	Predicted Noise Level (dB L _{Aeq,T}) at distance (m)
			550 m
JCB (D.8.13)	For services, drainage and landscaping.	82	40
Vibrating Rollers (D.8.29)	Road surfacing.	77	35
Cumulative Construction Noise Level		--	50

At 550 m from the works the predicted noise levels from construction activities are in the range of 33 to 46 dB L_{Aeq,T} with a total ‘worst-case’ cumulative construction level of the order of 50 dB L_{Aeq,T}. In all instances the predicted noise levels at the nearest NSLs are below the adopted significance threshold outlined in Table 11-1 (Category A – 65 dB L_{Aeq,T} during daytime periods). This assessment is considered representative of worst-case construction noise levels at NSLs.

There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the thresholds outlined in Table 11-1 and this finding is valid should all items of plant operate simultaneously. No specific mitigation measures are required.

11.6.2.1.2 *Vibration*

Rock breaking activity will likely generate the highest levels of vibrations through the ground. Empirical data for this activity is not provided in BS 5228-2, however the likely level of vibration from this activity is expected to be substantially below the vibration criteria for building damage based on experience from other sites. AWN Consulting Ltd (the author of this chapter) has previously conducted vibration measurements under controlled conditions, during trial construction works on a sample site where breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- Three tonne hydraulic breaker on small CAT tracked excavator
- Six tonne hydraulic breaker on large Liebherr tracked excavator.

Vibration measurements were conducted during various staged activities and at various distances. Peak vibration levels during staged activities using the three-tonne breaker ranged from 0.48 PPV (mm/s) to 0.25 PPV (mm/s) at distances of 10 m to 50 m respectively from the breaking activities. Using a six-tonne breaker, measured vibration levels ranged between 1.49 PPV (mm/s) to 0.24 PPV (mm/s) at distances of 10 m to 50 m respectively. While these measurements relate to breaking of concrete, the range of values recorded provides some context in relation to typical ranges of vibration generated by construction-breaking activity. The levels measured at up to 50 m from the activity are significantly below the assessment threshold set out in Table 11-4.

Accounting for the distance from proposed works to the nearest NSLs, vibration effects are not likely at any NSL.



11.6.2.1.3 Description of Effects

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the likely potential worst-case associated effects at the nearest noise sensitive locations associated with construction of turbines and hardstanding areas are described as follows:

Quality	Significance	Duration
Negative	Not Significant	Short Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from the construction of turbines and hardstand areas.

11.6.2.2 Construction of Internal Site Roads

It is proposed to construct new internal roads to access the various parts of the proposed project. Review of the track layout has identified that the nearest NSL to any point along the proposed track is approximately 50 m to H192. All other locations are at greater distances with the majority at significantly greater distances. The full description of the new road is outlined in Chapter 2 (Description of the Proposed Project).

11.6.2.2.1 Noise

Table 11-13 outlines the expected construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 11-13: Predicted Noise Levels from Construction Plant at Various Distances from the New Internal Site Roads

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB LAeq,T)	Predicted Noise Level (dB LAeq,T) at distance (m)				
		50 m	75 m	100 m	125 m	250 m
HGV Movement (C.2.30)	79	60	56	53	51	45
Excavator Mounted Rock Breaker (C9.12)	85	66	62	59	57	51
Vibrating Rollers (D.8.29)	77	58	54	51	49	43
Cumulative Construction Noise Level	--	67	63	60	58	52

At 50 m from the proposed works, which is the shortest distance to any NSL, the predicted noise levels are within the linear construction noise limit of 70 dB LAeq,1hr as set out in Section 11.3.2.2.



Additionally, given the progressive nature of the construction methodology, it is anticipated that works will be in close proximity to the nearest Noise Sensitive Locations (NSLs) for a limited duration. The predicted noise levels presented in Table 11-13 are expected to occur for a period of less than 10 days. Applying the guidance outlined in Section 11.3.2.4, it is concluded that the likely noise impacts are not significant.

There are no items of plant or construction activities that are likely to give rise to noise levels that would be considered out of the ordinary or in exceedance of the thresholds outlined in Table 11-1. No specific mitigation measures are required.

11.6.2.2.2 Vibration

With reference to the discussion on vibration presented in Section 11.6.2.1 there will be no significant vibration impacts associated with the construction of internal site roads and therefore no specific mitigation measures are required.

11.6.2.2.3 Description of Effects

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with construction of internal site roads are described below.

Quality	Significance	Duration
Negative	Not Significant	Temporary

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential effect. There are no likely significant effects from the construction of internal roads.

11.6.2.3 Borrow Pits

11.6.2.3.1 Noise

- To inform this aspect of the proposal, a noise assessment has been completed based on the following expected activities at each borrow pit: 1 mobile crusher and 1 rock breaker will be used at each borrow pit location;
- The plant will operate simultaneously in the vicinity of all proposed borrow pit location indicated in Table 11-14; and
- Table 11-15 outlines the assumed noise levels for the plant items as extracted from BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.



Table 11-14: Proposed Borrow Pit Locations

Borrow Pit Ref	Co-ordinates (ITM)	
	Easting	Northing
BP-01	603,192	699,636
BP-02	603,506	699,989
BP-03	603,582	697,776

Table 11-15: Plant Noise Emissions

Item	dB(A) L _w Levels per Octave Band (Hz)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Crusher	95	98	98	106	103	100	95	86	110
HGV Movement	77	88	95	93	93	92	86	76	98
Dump Truck	87	92	99	97	102	99	94	85	105
Semi-mobile screen/stockpile r	69	82	96	99	103	101	99	88	107
Tracked Excavator (each of 3 no)	77	88	95	93	93	92	86	76	99

A noise model prediction model has been prepared to consider the expected noise emissions from the proposed construction works at borrow pits as outlined above. A percentage on-time of 66% has been used for the noise calculations.

The nearest NSL to any of the borrow pit locations is at a distance of over 590 m from any borrow pit area. Consequently, the resulting noise levels at the NSLs are well below the daytime construction noise criterion. The predicted levels at the ten NSLs with the highest predicted noise levels assuming all borrow pits operate simultaneously are presented in Table 11-16.

Table 11-16: Prediction Noise Levels from Borrow Pit Activity at Nearest NSLs

Location Ref.	dB L _{Aeq,T}
H109	46
H313	46
H250	45
H140	45
H053	45
H188	45
H202	45
H010	45



Location Ref.	dB L _{Aeq,T}
H246	44
H083	44

Review of the results contained in Table 11-16 confirms that the predicted construction noise levels are almost 20 dB below the relevant daytime construction noise criteria (65 dB L_{Aeq,T}). Construction works at the borrow pits will only occur during daytime periods only.

11.6.2.3.2 *Vibration*

With reference to the discussion on vibration presented in Section 11.6.2.1.2, there will be no significant vibration impacts associated with the construction phase of the proposed project and therefore no specific mitigation measures will be required.

11.6.2.3.3 *Description of Effects*

The predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with operation of borrow pits are described follows:

Quality	Significance	Duration
Negative	Not Significant	Short Term

There are no likely significant effects from the borrow pits.

11.6.2.4 *Substation Construction*

11.6.2.4.1 *Noise*

The nearest NSL to the proposed substation is H083, which is approximately 320 m to the closest point of the substation. As a worst-case example assuming the same construction activities as outlined in Table 11-12, it is predicted that the likely worst-case potential noise levels from construction activities associated with the substation will be in the order of 50 dB L_{Aeq,T} H083, at the nearest NSL. This level of noise is well below the significance threshold of 65 dB L_{Aeq,T}, therefore no specific mitigation measures are required.

11.6.2.4.2 *Vibration*

Which reference to the discussion on vibration presented in Section 11.6.2.1.2 there will be no significant vibration impacts associated with the construction phase of the proposed project and therefore no specific mitigation measures will be required.

11.6.2.4.3 *Description of Effects*

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the potential worst-case associated



effects at the nearest noise sensitive locations associated with construction of substation are described below.

Quality	Significance	Duration
Negative	Not Significant	Short Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential effect. There are no likely significant effects from construction of the substation.

11.6.2.5 Battery Storage Compound

The battery storage compound is to be sited at ITM coordinates 603122, 699822. The nearest NSL is H083, which is approximately 440 m to the closest point to the proposed battery storage compound.

11.6.2.5.1 Noise

As a worst-case, assuming the same construction activities as outlined in Table 11-12, it is predicted that the likely worst-case potential noise levels from construction activities associated with the BESS compound will be in the order of 47 dB $L_{Aeq,T}$ at the nearest NSL. This level is well below the significance threshold of 65 dB $L_{Aeq,T}$.

11.6.2.5.2 Vibration

Which reference to the discussion on vibration presented in Section 11.6.2.1.2 there will be no significant vibration impacts associated with the construction phase of the proposed project and therefore no specific mitigation measures will be required.

11.6.2.5.3 Description of Effects

The likely predicted noise and vibration effects are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with construction of the battery storage compound are described below.

Quality	Significance	Duration
Negative	Not Significant	Short Term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from construction of the Battery Storage Compound.

11.6.2.6 Grid Connection Construction

The proposed Grid Connection Route (GCR) spans approximately 12.23 km, running north from a proposed 110 kV substation to the existing Dallow 110 kV substation. The majority of the



route follows public roads, with 8.54 km located in County Tipperary and the remaining 3.66 km in County Offaly.

The associated construction works will occur for short durations at varying distances from Noise Sensitive Locations (NSLs). Review of the proposed GCR has identified that the nearest NSLs to the proposed underground cable route, along local roads, are located at approximately 10 m from the nearest point. In addition to the main construction works, the proposed GCR requires undercrossing watercourses for which Horizontal Directional Drilling (HDD) this element is assessed separately in Section 11.6.2.7.

There are 17 number joint bay pits proposed along the proposed GCR it is expected that excavations for these pits will require an element of rock breaking.

11.6.2.6.1 Noise

Table 11-17 outlines the expected construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period. Note the plant items and activities are indicative and based on conservative assumption to be representative of a reasonable worst case.

Table 11-17: Predicted Noise Levels for Expected Construction Plant at Various Distances from the Grid Connection Works

Plant Item (BS 5228 Ref.)	Plant Noise Level at 10m Distance (dB L _{Aeq,12hr}) ⁸	Calculated Construction Noise Levels dB L _{Aeq,12hr} at reference distance from works			
		10 m	15 m	25 m	50 m
Tracked Excavator (C.2.7)	70	68	64	60	54
Vibrating Rollers (C.2.40)	73	71	67	63	57
Wheeled Loader (C.2.8)	68	66	62	58	52
Cumulative Predicted Construction Noise Level (No Rock Breaking)		74	70	66	60
Excavator Mounted Rock Breaker (C9.12) ^a	85	78	74	70	64
Cumulative Predicted Construction Noise Level (with Rock Breaking) ^b		78	74	70	64

^a Assumed 20% on time for rock breaking

^b Only one tracked excavator considered in cumulative calcs. Rock breaking and Vibration rolling will occur simultaneously

⁸ All plant noise levels are derived from BS 5228: Part 1



For standard grid connection works, any NSL set back at 15 m or more from the proposed works is predicted to experience noise levels within the linear construction noise limit of 70 dB $L_{Aeq,1hr}$ as set out in Section 11.3.2.2.

NSLs located closer than 15 m to the works may experience construction noise levels slightly above 70 dB $L_{Aeq,1hr}$. However, due to the progressive nature of the construction methodology, it is anticipated that works will remain in close proximity to the nearest NSLs only for a limited duration. The predicted noise levels shown in Table 11-13 are expected to occur for less than two days in a worst-case scenario, with works typically progressing at a rate of 150 metres per day along the route.

Based on the guidance in Section 11.3.2.4, the likely noise impacts are considered not significant, and no specific mitigation measures are required.

Where rock breaking is required at joint bay pits, any NSL set back 25 metres or more from the proposed works is predicted to remain within the linear construction noise limit of 70 dB $L_{Aeq,1hr}$ as set out in Section 11.3.2.2.

There are five joint bay locations with NSLs situated within 25 m, the closest NSL being 15 m from the works. These NSLs may experience construction noise levels above 70 dB $L_{Aeq,1hr}$. Nevertheless, it is anticipated that rock breaking will only occur at each location for less than 5 days.

In line with the guidance in Section 11.3.2.4, the likely noise impacts are considered not significant, and no specific mitigation measures are required.

11.6.2.6.2 Vibration

With reference to the discussion on vibration presented in Section 11.6.2.1.2, there will be no significant vibration impacts associated with the grid connection construction phase of the proposed project and therefore no specific mitigation measures will be required.

11.6.2.6.3 Description of Effects

For NSLs within 15 m of the grid connection works and 25 m from rock breaking activities anticipated at the joint bay locations, the likely predicted noise levels will potentially exceed the construction noise criterion however once of the duration of the impacts is taking into consideration, the impacts are not significant.

With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest noise sensitive locations associated with construction of the grid connection and underground cabling are described below.

Quality	Significance	Duration
Negative	Slight	Temporary

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential effect. There are no likely significant effects from construction of the grid connection.



11.6.2.7 Horizontal Directional Drilling (HDD)

11.6.2.7.1 Noise

There are four locations where Horizontal Directional Drilling (HDD) is proposed to facilitate grid connection crossings. Refer to Chapter 2 for further detail on the construction methodologies for HDD crossings. This section assesses the likely significant noise, and vibration impacts and effects from the proposed HDD activities.

The coordinates for the four HDD locations are presented Table 11-18.

Table 11-18: Proposed HDD Locations

Details	Co-ordinates (ITM) for Drilling Rig	
	Easting	Northing
Culvert W1	604,552	703,037
Bridge 1 - Old railway	604,864	703,454
Cattle underpass	604,781	705,731
Bridge 2 - Little Brosna River	605,228	705,702

A review of the location listed in Table 11-18 has identified the nearest NSL and these have been used to assess the likely noise impacts. Table 11-19 outlines the expected construction noise levels associated with the proposed works for this element of the construction and the predicted noise levels to the nearest NSL at each location.

Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 11-19: Predicted Noise Levels for Expected HDD Activities at Various Distances

Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB _{L_{Aeq,1hr}}) ⁹	Predicted Noise Level (dB _{L_{Aeq,1hr}}) at distance to nearest NSL (m)			
		Culvert W1	Bridge 1	Cattle Underpass	Bridge 2
		50 m		300 m	75 m
Directional drill (generator) (C.4.96)	77	56		36	51
Tracked Excavator (C.4.17)	71	50		30	45

⁹ All plant noise levels are derived from BS5228: Part 1



Item (BS 5228 Ref.)	Plant Noise level at 10m Distance (dB L _{Aeq,1hr}) ⁹	Predicted Noise Level (dB L _{Aeq,1hr}) at distance to nearest NSL (m)			
		Culvert W1	Bridge 1	Cattle Underpass	Bridge 2
		50 m		300 m	75 m
Cumulative Predicted Construction Noise Level		57		37	52

At all HDD location the predicted construction noise levels at the nearest NSLs are below the adopted significance threshold outlined in Table 11-1 (Category A – 65 dB L_{Aeq,T} during daytime periods) and the likely noise impacts are not significant.

There are no items of plant or construction activities that are likely to give rise to noise levels that would be considered out of the ordinary or in exceedance of the thresholds outlined in Table 11-1. No specific mitigation measures are required.

11.6.2.7.2 Vibration

Due to the distance of the proposed works from NSL and with reference to the discussion on vibration presented in Section 11.6.2.2.2, there will be no significant vibration impacts associated with HDD works and no specific mitigation measures are required.

11.6.2.7.3 Description of Effects

The likely predicted noise and vibration impacts are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the potential associated effects at the nearest NSLs associated with construction of internal site roads are described below.

<i>Quality</i>	<i>Significance</i>	<i>Duration</i>
Negative	Not Significant	Temporary

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from horizontal directional drilling.

11.6.2.8 Construction Traffic

This section has been prepared to review potential noise impacts associated with construction traffic along the local road network. The information presented in Chapter 14 (Traffic and Transportation) has been used to inform the assessment presented in this chapter.

Changes in the traffic noise levels associated with the construction traffic for ‘peak’ and ‘average’ construction have been calculated on based on information in Chapter 14 (Traffic and Transportation). Table 11-20 presents the details of the assessment and the calculated change in traffic noise levels due to the proposed project.



Table 11-20: Estimated Changes in Traffic Noise Levels

Link Label (Route ID)	Base AADT 2028 (% HGVs)	Base AADT 2028 + Construction Generated (% HGVs)	Change in Traffic Noise Level dB(A) from Construction Traffic
A (L1071)	597 (9%)	637 (8%)	0.1
B (R492)	1590 (8%)	1730 (9%)	0.6
C (N62 (N))	6878 (13%)	6951 (13%)	0.1
D (N62 (S))	5896 (14%)	5963 (14%)	<0.1

The calculated increases in the noise predicted increases in traffic noise levels due to the additional construction generated traffic will be less than 1 dB on all routes. With reference to the DMRB magnitude of impact set out in Section 11.3.2.3 the potential impacts are classified as ‘negligible’. The associated increase in traffic noise is expected to be imperceptible.

11.6.2.8.1 Description of Effects

The likely predicted effects are below the thresholds identified for a significant effect to occur. With respect to the EPA’s criteria for description of effects, the potential associated effects at the nearest NSLs associated with additional traffic generated during the construction phase are described below.

<i>Quality</i>	<i>Significance</i>	<i>Duration</i>
Negative	Imperceptible	Short Term

There are no likely significant effects from construction traffic.

11.6.3 Decommissioning Phase

In relation to the decommissioning phase, similar overall noise levels as those calculated for the construction phase are expected, as similar tools and equipment will be used. The noise and vibration impacts associated with any decommissioning of the proposed project can be considered to be comparable to those outlined in relation to the construction phase (as per Section 11.6.2) albeit less works will be required as only above-ground structures will be removed. Turbine and mast foundations would remain underground, and cable ducting will remain in situ. The underground cabling and on-site substation will remain in place. Refer to Chapter 2 (Description of Proposed Project) for full details. The predicted noise levels are expected to be below the appropriate Category A value (i.e. 65 dB L_{Aeq,T}) at all NSLs for the decommissioning phase, the impact is not significant.

11.6.3.1.1 Description of Effects

The likely predicted noise and vibration impacts are below the limits and/or thresholds identified. With respect to the EPA’s criteria for description of effects, the likely potential



associated effects at the nearest noise sensitive locations associated with decommissioning are described below.

Quality	Significance	Duration
Negative	Not Significant	Short Term

There are no likely significant effects from the decommissioning phase.

11.6.4 Operational Phase

11.6.4.1 Assessment of Wind Turbine Noise

Using the assessment methodology described in Section 11.4.5 the predicted turbine noise levels have been calculated at all NSLs within the study area of the proposed wind farm site. A worst-case omni-directional turbine noise prediction assessment has been carried out using the ISO 9613-2:2024 calculation standard and best practice guidance.

The initial noise predictions calculations are based on ‘worst-case’ conditions favourable to noise propagation, i.e., downwind propagation from source to receiver and/or downward refraction under temperature inversions.

The results of the noise prediction models have been compared against the turbine noise limits that have been assigned to each of the NSL’s as presented in Table 11-11 in Section 11.5.2 which in turn have been derived in accordance with the applicable criteria described in detail in Section 11.3.2.6.

At all NSLs the worst omni-directional cumulative turbine noise levels are below the noise criterion curves, except for at seven NSLs where the initial review has identified potential exceedances which are presented with discussion in Table 11-21.

Table 11-21: Review of Potential Exceedance in Omni-directional Noise Prediction for N163

Location Ref.	Highest magnitude of potential exceedance predicted in Omni-directional (Worst Case), dB		Review & Comment
	Day	Night	
H010	0.7	0.7	The Predicted turbine noise level is indicated a slight potential exceedance at H010 where the proposed project is the dominant source turbine noise. The next step in the assessment is to consider the effect of direction noise propagation as discussed in Section 11.4.5.4.
H060	0.3	2.5	The predicted exceedances are dominated by the



Location Ref.	Highest magnitude of potential exceedance predicted in Omni-directional (Worst Case), dB		Review & Comment
	Day	Night	
H071	--	1.0	Lacka/Skehanagh turbine; the contribution from the proposed project is greater than 10 dB below the turbine noise limit values at these NSLs. In accordance with the guidance discussion in Section 11.3.2.6.5, there is no significant contribution from the proposed project and any potential exceedances identified in this review are not relevant to the assessment of the proposed project.
H081	--	2.2	
H100	--	2.1	
H209	--	1.6	
H281	--	1.3	

Appendix 11-6 presents the predicted omni-directional turbine results at all NSLs in tabulated form and Noise contours for the omni-directional rated power wind speed (i.e., highest noise emission) are presented in Appendix 11-7.

Table 11-22 Table 11-22 presents the result of the turbine noise predictions and assessment review at location H010 for the three turbine types described in Section 11.4.5.2.1. There are no exceedances predicted when considering the predicted turbine noise levels of the Nordex N149 or the Vestas V150 at H010. The predicted turbine noise levels at H060, H071, H081, H100, H209 and H281 will remain unchanged as the contribution to turbine noise from the proposed project at these locations is insignificant as described in Table 11-21.

Table 11-22: Review of Predicted Turbine Noise Levels (omni-directional) against Relevant Criteria

NSL	Details	Derived L _{A90, 10-min} Levels (dB) at Various Standardised 10m Height Wind Speeds							
		3	4	5	6	7	8	9	10
H010	Predicted - N163	35.6	35.6	39.9	44.3	45.7	45.7	45.7	45.7
	Daytime Criterion	45	45	45	45	45	45	45.6	45.6
	Daytime Excess	--	--	--	--	0.7	0.7	0.1	0.1
	Night-time Criterion	45	45	45	45	45	45	45	45
	Night-time Excess	--	--	--	--	0.7	0.7	0.7	0.7



NSL	Details	Derived L _{A90, 10-min} Levels (dB) at Various Standardised 10m Height Wind Speeds							
		3	4	5	6	7	8	9	10
H010	Predicted - N149	34.6	34.6	38.7	43.1	44.6	44.7	44.8	44.8
	Daytime Criterion	45	45	45	45	45	45	45.6	45.6
	Daytime Excess	--	--	--	--	--	--	--	--
	Night-time Criterion	45	45	45	45	45	45	45	45
	Night-time Excess	--	--	--	--	--	--	--	--
H010	Predicted - V150	36.0	36.0	40.3	42.9	43.8	43.8	43.7	43.7
	Daytime Criterion	45	45	45	45	45	45	45.6	45.6
	Daytime Excess	--	--	--	--	--	--	--	--
	Night-time Criterion	45	45	45	45	45	45	45	45
	Night-time Excess	--	--	--	--	--	--	--	--

The next stage in the assessment is to consider the effects of wind direction adopting the methodology described in Section 11.4.5.4 to assess the potential slight exceedance that has been identified at Location H010. Directional noise prediction models have been developed to identify the number and magnitude of exceedances of the noise criteria at H010 considering the N163 turbine. Table 11-23 reviews the predicted noise levels against the noise criteria across the various wind speeds and direction sectors.

Table 11-23: Review of Predicted Turbine Noise Exceedances Considering Wind Direction

NSL	Description	Wind Speed	Predicted Exceedance in L _{A90, 10-min} Levels (dB) in Wind Direction Sector							
			N	NE	E	SE	S	SW	S	NW
H010	Turbine noise Criteria Day	≤8	45	45	45	45	45	45	45	45
		9	45.6	45.6	45.6	45.6	45.6	45.6	45.6	45.6
	Turbine noise Criteria Night	≤8	45	45	45	45	45	45	45	45
		9	45	45	45	45	45	45	45	45



NSL	Description	Wind Speed	Predicted Exceedance in L _{A90, 10-min} Levels (dB) in Wind Direction Sector							
			N	NE	E	SE	S	SW	S	NW
	Predicted Turbine Noise	6	42.6	43.8	43.4	42.5	42.2	40.0	41.0	42.0
		7 - 9	44.0	45.2	44.8	43.9	43.6	41.4	42.4	43.4
	Predicted Exceedance Day	6	--	--	--	--	--	--	--	--
		7 - 8	--	0.2	--	--	--	--	--	--
		9	--	--	--	--	--	--	--	--
	Predicted Exceedance Night	6	--	--	--	--	--	--	--	--
		7 - 8	--	0.2	--	--	--	--	--	--
		9	--	0.2	--	--	--	--	--	--

The assessment of directional cumulative turbine noise at H010 confirms that the predicted turbine noise levels are below the assessment noise criteria noise which the exception of a potential exceedance of up to 0.2 dB in north east wind directions at wind speeds of 7 m/s and above in night time periods and at 7 and 8 m/s during the daytime.

It is reiterated that the noise prediction calculations have been made using the ISO 9613-2:2024 standard and relate to conditions favourable to noise propagation (typically downwind propagation from source to receiver and/or downward refraction under temperature inversions). A +2 dB uncertainty has been applied to turbine emissions in line with the IOA GPG.

The magnitude of the predicted potential exceedances for the N163 turbine are considered negligible in the context of this assessment. A change of this magnitude (± 0.2 dB) would not be perceptible to the human ear and falls within the typical range of measurement uncertainty and the calculation uncertainty of + 2 dB (see Section 11.4.5.2).

As the turbine noise is predicted to exceed the noise criterion, albeit by a very small margin, it is determined that, in the absence of mitigation, the N163 turbine under the worst-case scenario has the potential for significant effects at Location H010. The noise emissions from the turbine can be reduced through the curtailment applied to the turbine via embedded controls. This mitigation can ensure that the residual turbine noise levels at Location H010 will be within the applicable noise limits Mitigation in the form of an outline turbine curtailment is addressed in Section 11.7.2.1. Therefore, no likely significant effects are expected at Location H010 with mitigation applied

11.6.4.1.1 Description of Effects

11.6.4.1.1.1 N163 Turbine

With the exception of location H010, when considering the turbine with the highest noise emissions, there are no significant effects associated with the operation of the proposed wind farm, since the predicted cumulative turbine noise levels associated with the wind farm are within the turbine noise criteria, and/or the contribution from the proposed wind farm is negligible.



While noise levels at low wind speeds will increase due to the development and specifically the operation of the turbines, the predicted levels will remain low, albeit new sources of noise will be introduced to the soundscape. At some other locations, there is currently noise from existing turbines at neighbouring wind farms. This assessment has considered the cumulative contribution from all turbines in the area with the potential cumulative noise effects.

With respect to the EPA’s criteria for description of effects, the likely noise effects for the N163 turbine in the absence of mitigation are described below.

At location H010 a potential exceedance of 0.2 dB of the criterion is predicted at ≥ 7 m/s for the N163 turbine in northeasterly wind directions. While the magnitude of the predicted exceedances is considered imperceptible in the context of environmental noise, they are slightly above the applicable wind turbine noise criteria and on that basis alone can be defined as having a significant effect in accordance with the appraisal methodology described in Section 11.3.2.8.1. With respect to the EPA criteria for description of effects, the predicted effects at H010 before mitigation can be described as follows:

Quality	Significance	Duration
Negative	Significant	Long-term

The above effect should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact.

At all other NSLs, the effect associated with operation of the wind turbine of the development are described as follows:

Quality	Significance	Duration
Negative	Not significant	Long-term

11.6.4.1.1.2 N149 and V150 Turbines

There are no significant effects associated with the operation of proposed project, as the predicted cumulative turbine noise levels are within the turbine noise criteria, or the contribution from the proposed wind farm is negligible.

While noise levels at low wind speeds will increase due to the development, specifically the operation of the turbines, the predicted levels will remain low, albeit a new source of noise will be introduced into the soundscape. At some other locations, there is currently noise from existing turbines at neighbouring wind farms. This assessment has considered the cumulative contribution from all turbines in the area with the potential cumulative noise effects.

With respect to the EPA’s criteria for description of effects, the likely noise effects for the SG6.6 turbine are described below.

Quality	Significance	Duration
Negative	Not significant	Long-term



11.6.4.2 Fixed Plant Noise

11.6.4.2.1 Noise Limits for Fixed Plant

Based on a review of the measured noise from the background noise survey described in Section 11.4.2, in scenarios where the wind speeds are very low, the NSLs in the vicinity of the site can be defined as areas of low background noise. As the proposed substation and battery energy storage system (BESS) will operate at a consistent noise output on a 24-hour basis, the potential impact during night-time periods is the primary consideration in this assessment. The following criteria is proposed at NSLs:

An absolute threshold of 35 dB L_{Aeq} for fixed plant. During the procurement phase, acoustic features such as tonality, impulsivity and intermittency, will be considered in the context of the character assessment framework contained in BS 4142. Where these acoustic features are present, the Rating Level will be controlled to avoid negative impacts at NSLs in accordance with BS 4142. Where background noise levels are elevated at specific NSLs, i.e. greater than 30 dB L_{A90} , a higher absolute threshold, of up to 5 dB above the background level, may be acceptable.

With respect to the guidance from the BS4142 standard, as discussed in Section 11.3.2.7.2, it is considered that the proposed criteria are robust and are expected to prevent negative impacts at NSLs.

11.6.4.2.2 Substation

Details of the proposed 110kV substation are described in Chapter 2 (Description of the Proposed Project). The substation is likely to be operating continuously, and the noise impact at the nearest NSL has been assessed to identify the potential greatest impact associated with the operation of the substation at the nearest NSL.

The noise emission level associated with a typical substation that would support a development of this nature is the order of 90 dB(A) L_w .

Noise prediction model calculations for the operation of the substation have been undertaken in accordance with ISO 9613:2024. The predicted noise level from the operation of the substation at the nearest NSL (H083 at approximately 300 m to the nearest point of the substation compound) is 23 dB $L_{Aeq,T}$. This level of noise is low, and it is concluded that there will be no significant noise from the operation of the substation at any NSL. Furthermore, the predicted noise level is well below the criterion for fixed mechanical plant outlined in Section 11.3.2.7 and unlikely to result in any negative impacts at NSLs.

11.6.4.2.3 Battery Energy Storage System

The assessment is based on the proposal for 90 No. BESS units and 15 number Inverter units operating simultaneously. Details of the proposed substation options are described in Chapter 2 of the EIAR (Description of the Proposed Project). The battery energy storage system is likely to operating continuously, and the noise impact at the nearest NSL (H083 at approximately 440m to the nearest boundary position of the battery storage compound) has been assessed to identify the potential greatest impact associated with the operation of the battery energy storage system (BESS) plant.



Typically noise emission levels associated with the operation of the type of containerised battery storage and inverter units proposed are presented in Table 11-24.

Table 11-24: Battery Storage Unit Sound Power Levels Used in Noise Assessment

Item	dB(z) L _w Levels per Octave Band (Hz)								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Battery Storage Unit	82	82	78	76	75	72	67	60	80
Inverter Unit	91	89	92	85	83	81	84	79	90

Noise prediction calculations have been undertaken in accordance with ISO 9613-2:2024. The predicted noise levels from the operation of the proposed battery energy storage system have been calculated using the noise emission data in Table 11-24. The predicted noise level at the nearest NSL (H083 – involved landowner - at approximately 440 m) is 35 dB L_{Aeq,T}.

The predicted noise level from the battery energy storage system, assessed using the most current and reliable noise emission information available for the proposed plant items, complies with the fixed mechanical plant criterion for outlined in Section 11.6.4.2.1. During the procurement phase, careful consideration will be given to the selection of mechanical and electrical plant to ensure that noise emissions comply with the proposed criteria and that any character corrections are appropriately addressed in accordance with the requirements outlined in Section 11.6.4.2.14.

11.6.4.2.4 Total Noise from Fixed Plant

The cumulative noise level at the nearest NSL from the operation of the substation and the battery energy storage system is 35 dB L_{Aeq,T} at the nearest noise sensitive location. The predicted cumulative noise level complies with the recommendations contained in best practice discussed in Section 11.3.2.7, the proposed criteria in Section 11.6.4.2.1, and no negative impacts are expected.

11.6.4.2.5 Description of Effects

With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest NSLs associated with the operation of the fixed mechanical and electrical plant at the proposed substation and battery energy storage system is described below.

Quality	Significance	Duration
Negative	Not Significant	Long-term

There are no likely significant effects from the operation of fixed plant items (BESS and substation).



11.7 MITIGATION MEASURES

Regarding construction activities, reference will be made to BS 5228-1 and BS5228-2 which offers detailed guidance on the control of noise & vibration from demolition and construction activities.

11.7.1 Construction Phase Mitigation

The assessment of potential impacts presented in Section 11.6.2 has demonstrated that the proposed project is expected to comply with the noise and vibration criteria during the construction phase and therefore no specific mitigation measures are required. However, as a matter of best practice, the following mitigation measures will be implemented

The contract documents will specify that the Contractor undertaking the construction works will be obliged to adopt best practice noise abatement measures contained in British Standard BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise* and BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Vibration*.

To ameliorate any potential noise impacts that may present during the construction phase, a schedule of noise control measures has been formulated in accordance with best practice guidance, and the contract documents will require the Contractor to implement these measures. These are outlined in the Construction and Environmental Management Plan (CEMP) that has been prepared for the proposed project (see Appendix 2-3).

11.7.2 Operational Phase

11.7.2.1 Wind Turbine Noise

An assessment of the operational turbine noise levels has been undertaken in accordance with best practice guidelines and procedures as outlined in Section 11.3.2.6 of this chapter.

The findings of the assessment, presented in Section 11.6.4.1 confirmed that the predicted operational noise levels will be within the relevant best practice noise criteria curves at all locations with the exception of Location H010 (Involved Landowner) where a potential exceedance of 0.2 dB at wind speeds of ≥ 7 m/s during day and night time periods in north easterly wind direction. These slight exceedances present for just one of the three turbine types considered the assessment, the Nordex N163. There are no exceedances predicted for the V150 or N149 turbines.

Modern wind turbines can be programmed to run in reduced modes of operation (or low noise modes) to achieve the required attenuation in specific wind conditions (i.e., wind speed and direction).

For any turbine curtailment strategy that is developed, consideration must be given to the practical benefits. In this instance the magnitude of the predicted exceedance is considered insignificant, curtailment would yield an imperceptible and unmeasurable change in the total wind turbine noise level at a given NSL. Such curtailment may unnecessarily reduce the electrical power generating capacity of a wind farm, for an imperceptible change to the overall turbine noise levels. When curtailing for exceedance, consideration should be given to the



background noise at the specific NSL to avoid unnecessarily curtailing turbine noise when the result would yield an imperceptible change to the overall turbine noise levels.

For the Nordex N163 turbine adopted for this assessment the potential exceedance, if realised, can be mitigated through curtailment of the specific turbine for the relevant wind speed bins and period. The N163 turbines have been modelled with all turbines operating in normal mode ('Mode 0') with STE blades. The N163 turbines can be configured for up to 18 no. operating modes. Full details of the wind turbine noise prediction assessment are presented in Section 11.4.5 and Appendix 11-4.

The following outline curtailment strategy applied to this assessment will ensure that the proposed wind farm can operate within the relevant best practice noise criteria.

- Turbines T04 and T05 operating in Mode 1 in the northeasterly wind direction sector at wind speeds ≥ 7 m/s.

If required for the installed turbines, the curtailment strategy would have to be verified by the manufacturer based on the control and physical limitation of the turbine.

11.7.2.2 In the event of a complaint

In the event of a complaint associated with the proposed project, the operator will fully investigate the complaint in collaboration with the turbine manufacturer, through review of the meteorological periods and conditions. A noise monitoring protocol will be agreed with the local authority, specifying monitoring locations and analysis methods for the sound pressure levels and any character (refer to Section 11.7.3).

If the complaints suggest the potential occurrence of clearly audible tonality in the wind turbine noise, the audibility of the tones will be investigated from measured data with a robust, objective method such as that included in ISO 1996-2:2017 with modifications in IEC 61400-11-2. If the rated level of the wind farm is above the limit, then the operator will liaise with the turbine manufacturer to investigate and implement measures to reduce the rated level to below the limit. The appropriate mitigation measures will depend on the cause or source of the tonal noise. This may involve engineering modifications to mechanical or electrical components, or the implementation of software-based operational controls via the turbine control system, such as adjustments to the turbine operating mode, rotor speed and/or blade pitch. These capabilities are embedded within the control systems of modern wind turbines (see Appendix 11.9).

11.7.2.3 Fixed Plant

The assessment of noise from the operation of fixed plant at the substation and battery energy storage system is predicted to comply with the recommendations contained in best practice discussed in Section 11.3.2.7 and the proposed criteria in Section 11.6.4.2.1, and that no negative impacts or likely significant effects are expected. The Applicant confirms its commitment to selecting and specifying mechanical and electrical plant such that operational noise emissions remain within the proposed criteria, including the appropriate consideration of any character corrections in accordance with Section 11.6.4.2.1. On this basis and given the demonstrated compliance of the scheme using robust, representative source data, no additional specific noise mitigation measures are required to achieve the proposed noise criteria.



11.7.3 Monitoring

Prior to the commissioning of the project, the developer will submit a Noise Compliance Monitoring Programme (NCMP) to the planning authority for written agreement. The NCMP will include a detailed methodology for noise measurements, the frequency of monitoring, procedures for recording results and a protocol for managing complaints. A Draft Protocol for Managing Complaints is presented in Appendix 11-9. A final version of the Protocol will be contained within the NCMP to be submitted and agreed with the Local Authority prior to the operation of the project.

11.7.3.1 Wind Turbine Noise

Compliance noise surveys will be undertaken to ensure compliance with any noise conditions applied to the development. It is common practice to commence surveys within six months of a wind farm being commissioned.

In the unlikely event that an exceedance of the noise criteria is identified as part of the compliance assessment, the guidance outlined in the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) will be followed, and relevant corrective actions taken to ensure residual compliance with the turbine noise criteria. For example, implementation of noise reduced operational modes resulting in curtailment of turbine operation can be implemented for specific turbines in specific wind conditions to ensure turbine noise levels are within the relevant noise criterion curves/planning conditions limits. Such curtailment can be applied using the wind farm control system with reduction of the wind turbine energy generation.

11.8 RESIDUAL EFFECTS

This section summarises the likely residual noise and vibration effects associated with the proposed project following the implementation of mitigation measures. The effects described consider the locations of the greatest potential impact unless otherwise stated.

11.8.1 Construction Phase

During the construction phase of the project, there will be some impacts on nearby NSLs due to noise emissions from site traffic and other construction activities. However, given the distances between the main construction works and the NSLs, the short-term duration of the construction phase, and the assessment's findings that the expected noise and vibration emissions will be below the identified threshold and limit values, the impacts will not be significant.

With respect to the EPA's criteria for description of effects, in terms of these construction activities, the potential worst-case associated effects at the nearest NSLs associated with the various elements of the construction phase are described below.

Table 11-25: Residual effects of the construction phase

Construction Element	Quality	Significance	Duration
Turbines and Hardstand Areas	Negative	Not Significant	Short Term



Construction Element	Quality	Significance	Duration
Internal Site Roads	Negative	Not Significant	Temporary
Borrow Pits	Negative	Not Significant	Short Term
Substation	Negative	Not Significant	Short Term
BESS	Negative	Not Significant	Short Term
Grid Connection and underground cabling	Negative	Slight	Temporary
Horizontal Directional Drilling (HDD)	Negative	Not Significant	Short Term
Construction Traffic	Negative	Imperceptible	Short Term

The likely predicted noise and vibration levels are below the limits and/or thresholds identified. The described effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact. There are no likely significant effects from the construction phase of the proposed project.

11.8.2 Operational Phase

11.8.2.1 Wind Turbine Noise

The residual turbine noise levels associated with the proposed project will be within best practice noise criteria curves recommended in line with Irish guidance ‘Wind Energy Development Guidelines for Planning Authorities’, it is not considered that a significant effect is associated with the project.

While noise levels at low wind speeds will increase due to the development and specifically the operation of the turbines, the predicted levels will remain low, albeit new sources of noise will be introduced into the soundscape.

With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest NSLs associated with operational turbine noise are summarised as follows.

Quality	Significance	Duration
Negative	Not Significant	Long-term

There are no likely significant effects from the operation of the wind turbines of the proposed project.



11.8.2.2 Fixed Plant

The noise from fixed plant items is predicted to comply with the recommendations contained in best practice discussed in Section 11.3.2.7 and with the proposed criteria in Section 11.6.4.2.1, and that no negative impacts are expected. Therefore, no significant effects are expected.

With respect to the EPA’s criteria for description of effects, the potential worst-case associated effects at the nearest NSLs associated with operational turbine noise are summarised in Table 11-26.

Table 11-26: Residual effects from fixed plant – operational phase

Fixed Plant Feature	Quality	Significance	Duration
Substation	Negative	Not Significant	Long-term
BESS	Negative	Not Significant	Long-term

There are no likely significant effects from the operation of the fixed plant items of the proposed project.

11.9 CUMULATIVE EFFECTS

A review of the planning applications submitted in the area in proximity to the site (as detailed in Chapter 1 - Introduction) has been undertaken and these projects have been considered in the noise and vibration cumulative assessments

11.9.1 Wind Turbine Noise

Existing permitted and proposed wind farm developments with the potential for cumulative impacts have been considered as part of the turbine noise impact assessment. A review of existing, proposed and permitted wind turbine developments in the wider study has been undertaken in accordance with the guidance contained in the IOA GPG. As outlined in Section 11.4.5.3, the cumulative turbine noise from the existing operational Lacka and Skehanagh Wind Farms and permitted Carrig Renewables (AIR) Wind Farm have been included in the assessment. It is confirmed that Section 11.6.4.1 provides a full cumulative noise assessment in accordance with the IOA GPG.

The effect on the noise environment associated with the proposed project in combination with other wind farm developments is not significant.

11.9.2 Noise from Fixed Plant Operation

There are no other industrial noise sources of fixed mechanical and electrical plant in the vicinity of the nearest NSLs to the proposed substation and battery energy storage system that are expected to any cumulative noise impacts at NSLs. The background noise survey (refer to Section 11.4.2 and 11.5 that was undertaken in the vicinity of the windfarm site did not identify any steady industrial plant noise sources in the receiving environment. Therefore, there is no potential for any likely significant cumulative noise effects.



11.9.3 Construction and Decommissioning

It is not anticipated that there will be any other construction activities that would give rise to significant cumulative impacts during the construction phase. The predicted noise and vibration for the proposed project are not of enough magnitude to cause an increase in the cumulative construction noise emissions that would exceed the threshold for significant impacts at any NSL.

In order for cumulative noise levels to increase, the contribution of noise from the proposed project must be within 10 dB of the other source of noise. The predicted noise levels from construction activity would therefore need to be well in excess of 55 dB $L_{Aeq,T}$ at an NSL in order for a potential cumulative construction noise increase to exceed the noise thresholds outlined in Sections 11.3.2.1 and 11.3.2.2. The assessment in Section 11.6.2 and 11.6.3 confirms that the predicted noise levels from construction and decommissioning activities at any NSL are ≤ 55 dB $L_{Aeq,T}$ and therefore the potential for any cumulative noise effects from all of the proposed activities occurring simultaneously or with construction activities from other developments is unlikely and not significant.

For grid connection and underground cabling construction work the likelihood of any significant cumulative effects are considered low. In the unlikely event that the works associated with the proposed project occurred in proximity to construction and or decommission works at another development any cumulative effects would be expected to be of brief duration and not significant.

The potential for any cumulative noise effect from all of the proposed activities occurring simultaneously or with construction activities from other developments is unlikely and not significant.

11.9.3.1 Proposed GCR

It is not considered that any significant cumulative operational noise or vibration effects are in relation to the proposed GCR. The electrical cabling will not generate any noise during the operational phase.

11.10 DIFFICULTIES ENCOUNTERED DURING PREPARATION OF THIS CHAPTER

There were no difficulties or limitations encountered when undertaking this assessment.

11.11 SUMMARY

When considering a development of this nature, the potential noise and vibration effects on the surroundings must be considered for three stages: the short-term construction phase and decommissioning phases, and the long-term operational phase.

The assessment of construction noise and vibration and has been conducted in accordance with best practice guidance contained in BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise and BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration.



Residual noise associated with the construction and decommissioned phases have been predicted to be below the proposed threshold values. Therefore, there are no likely significant effects from construction and decommissioning phases associated with the proposed project.

Based on the proposed site layout and the details of turbine noise emissions, hub height, and tip height for the range of turbine types considered in the assessment, turbine noise levels have been predicted at NSLs across a range of operational wind speeds.

The assessment found that the N163 turbine, which produces the highest noise levels among the options considered, has the potential to marginally exceed the turbine noise criteria at one location. However, the assessment has demonstrated that turbine noise emissions can be reduced through curtailment measures applied via embedded controls within the turbines. The application of mitigation in the form of turbine curtailment can ensure that residual noise levels associated with the proposed project remain within the best practice noise limits recommended in WEDG06 guidelines. Therefore, it is considered that there are no likely significant effects from wind turbine noise associated with the proposed project.

A commitment has been provided that prior to the commissioning of the wind farm; the developer will submit a Noise Compliance Monitoring Programme (NCMP) to the planning authority for written agreement. The NCMP will include a detailed methodology for all noise measurements, the frequency of monitoring, procedures for recording results and a protocol for managing complaints.

Operational noise from the proposed substation and battery energy storage system has been assessed and found to be within the proposed criteria based on review of the most appropriate guidelines and standards.

There are no likely significant effects in terms of noise and vibration from the proposed project.

11.12 REFERENCES

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022)
- BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise. (BS5228-1)
- Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) document Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2004)
- Design Manual for Roads and Bridges, Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (National England (now National Highways) 2020) (DMRB)
- BS 7385 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (1993) (BS77385)
- BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. (BS5528-2)
- Department of the Environment, Heritage and Local Government Wind Energy Development Guidelines 2006 (WEDGs)
- Department of Trade & Industry (UK) Energy Technology Support Unit (ETSU) publication The Assessment and Rating of Noise from Wind Farms (1996) (ETSU-R-97)
- Institute of Acoustics (IOA) document A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (2013) including six Supplementary Guidance Notes (IOA GPG)
- World Health Organisation (WHO) Environmental Noise Guidelines for the European Region (2018)
- ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation (1996)
- EPA Guidance Note for Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3) (2011)
- EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), 2016 (NG4)
- Draft Revised Wind Energy Development Guidelines 2019 Department of Housing, Local Government and Heritage (2019 draft WEDGs)
- World Health Organisation (WHO) document Community Noise (WHO, 1995)
- South Australian Environment Protection Authority namely, Infrasound levels near windfarms and in other environments (EPA, 2013)
- State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg Low Frequency Noise incl. Infrasound from Wind Turbines and Other Sources (2016)
- IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) document A Method for Rating Amplitude Modulation in Wind Turbine Noise (IOA, 2016)
- RenewableUK AM project (RenewableUK 2013)
- Department of Environment Food and Rural Affairs (DEFRA), the Department of Business, Enterprise and Regulatory Reform (BERR) and the Department of Communities and Local Government (CLG) Research into Aerodynamic Modulation of Wind Turbine Noise (2007)
- Wind turbine AM review: Phase 2 report. 3514482A Issue 3. Department for Business, Energy & Industrial Strategy (2016)
- ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise.

