Environmental Impact Assessment Report (EIAR)

Crumhach Wind Farm, Co. Sligo

Chapter 12 - Noise and Vibration

Table of Contents

GLOSSARY OF TERMS

Term	Definition
A – Weighting	The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.
Background Noise	The noise level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or nighttime periods. The $L_{A90,10min}$ is the parameter that is used to define the background noise level in this instance. L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
dB (decibel)	The unit normally employed to measure the magnitude of sound. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μpa)
dB(A)	An 'A-weighted decibel' – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A – Weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies
Hertz (Hz)	The unit of sound frequency in cycles per second
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background
L_{A90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level.
L_{den}	Refers to the L_{Aeq} noise levels over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator
Low Frequency Noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
Noise	Sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other

	facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels
Octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards
Sound Pressure Level (L_p)	The sound pressure level at a point is defined: $$L_P = 20 \log_{10}\left(\frac{P}{P_0}\right) \text{ dB}$$ where P is the sound pressure and P_0 is a reference pressure for propagation of sound in air and has a value of $2x10^{-5}$Pa
Tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'

GLOSSARY OF ACRONYMS

Acronym	Definition
EIAR	Environmental Impact Assessment Report
AACI	Association of Acoustic Consultants
AM	Amplitude Modulation
AMWG	Amplitude Modulation Working Group
BS	British Standards
CEMP	Construction and Environmental Management Plan
CNAL	Construction Noise Assessment Locations
dB	Decibel
DESNZ	Department for Energy Security and Net Zero
DoEHLG	Department of Environment Heritage and Local Government
EAM	Excess Amplitude Modulation
HDD	Horizontal Directional Drilling
HSE	Health Service Executive
Hz	Hertz
IOA	Institute of Acoustics
LA	Local Authority
LFN	Low Frequency Noise
NAL	Noise Assessment Locations
NAM	Normal Amplitude Modulation
NMLs	Noise Monitoring Locations
NSRs	Noise Sensitive Receptors
NWG	Working Group on Noise from Wind Turbines
OAM	Other Amplitude Modulation
PPV	Peak Particle Velocity
RFT	Request for Tender

TCCs	Temporary Construction Compounds
WHO	World Health Organisation

12. NOISE AND VIBRATION

12.1 Introduction

The Proposed Project has the potential to create noise and vibration during the construction, operational and decommissioning phases.

As detailed in Section 1.1.1 in Chapter 1: Introduction, for the purposes of this EIAR, the various project components are described and assessed using the following references: 'Proposed Project', 'Proposed Wind Farm', 'Proposed Grid Connection Route', 'Proposed Turbines', 'Existing Wind Farm', 'Existing Grid Connection' and 'the Site'. As identified in Section 1.1.1, the construction phase includes for the removal of the existing 23 no. turbines and the construction of the proposed 17 no. turbines and associated infrastructure on site. The operational phase includes for the operation of the proposed 17 no. turbines on site, and the decommissioning phase includes for the decommissioning of the proposed 17 no. turbines on site. The full description of the Proposed Project is detailed in Chapter 4: Description of the Proposed Project.

This chapter assesses the potential noise and vibration impacts at the nearest Noise Sensitive Receptors (NSRs), which are residential properties located within c. 2.5 km of the Proposed Turbines.

This chapter considers the likely significant noise and vibration effects associated with the construction, operation and decommissioning of the Proposed Project.

The specific objectives of the chapter are to:

- Describe the existing noise baseline
- Describe the assessment methodology and significance criteria used in completing the impact assessment;
- Describe the potential effects (including cumulative effects); and,
- Describe the mitigation measures proposed to address any likely significant effects; and assess the residual noise effects remaining, following the implementation of mitigation.

This EIAR Report is supported by the following figures and appendices:

- Figures
  - Figure 12-1: Construction Noise Assessment Locations;
  - Figure 12-2: Overview of Wind Turbine Operational Noise Assessment Locations;
  - Figure 12-3: Cumulative Wind Farm Locations.
- Appendices
  - Appendix 12-1: Construction Noise Report; and,
  - Appendix 12-2: Wind Turbine Operational Noise Report.

Figures and technical appendices are referenced in the text where relevant.

12.1.1.1 Statement of Authority

The noise and vibration assessments were carried out by TNEI Ireland Ltd. TNEI is a specialist energy consultancy with an Acoustics team that has undertaken noise assessments for over 5 GW of onshore wind farm developments. The decommissioning and construction noise assessment was undertaken by Faolán Ly (BSc), who is an Affiliate Member of the Institute of Acoustics. The operational noise assessment was undertaken by Jason Baldwin (BSc, Dip) who is a full Member of the Institute of Acoustics. The EIAR Chapter was written by Mark Tideswell (BSc, Dip), who is a full member of the

Institute of Acoustics. The decommissioning and construction assessments were reviewed and approved by Moise Coulon (BSc, Dip). The operational noise assessment and this EIAR Chapter were reviewed by Gemma Clark (BSc, MSc). Gemma is a full member of the Institute of Acoustics.

12.2 Legislation, Policy and Guidelines

As well as the guidance listed in Section 1.7 of Chapter 1 of this EIAR, this assessment adhered to the following combination of guidance and assessment methodologies:

- British Standard BS 5228: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments'[1];
- Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006[2];
- UK Government Department for Energy Security and Net Zero (DESNZ) 'Assessment and Rating of Wind Turbine Noise' (2026)[3];
- Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (2013) (IOA GPG)[4];
- ISO 9613-2: 2024 'Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors'[5];
- Association of Acoustic Consultants of Ireland 'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments'(2021) (AACI Guidelines)[6].

The above documents are discussed in detail within Section 2 of Appendices 12-1 and 12-2 where relevant, in addition to National and Local Policy.

With regards to national planning policy and guidance, it is noted that the Irish Government Wind Energy Development Guidelines for Planning Authorities (2006) (DoEHLG 2006 Guidelines) are currently under review. A set of draft updated guidelines were issued for consultation in December 2019 ('DoEHLG Draft 2019 Guidelines) but these guidelines have not, at the time of writing, been adopted.

In keeping with best international practice, the Draft DoEHLG 2019 Guidelines relied upon some elements of the former UK guidance, ETSU-R-97 *'Assessment and Rating of Noise from Wind Farms'*[7] and the Institute of Acoustics *'Good Practice Guidelines to the Application of ETSU-R-97 For the Assessment and Rating of Wind Turbine Noise'* (IOA GPG). An update which supersedes ETSU-R-97 was released on June 19th 2026 named 'Assessment and Rating of Wind Turbine Noise' (ARWTN); the assessment principles are generally the same as ETSU-R-97 and introduces new terminology and clarifications to previous. It is specified in this this update that the IOA GPG is endorsed and should continue to be used. Therefore, any text referencing the IOA GPG, which itself refers to the ETSU-R-97 guidance should be considered to relate to ARWTN.

Significant concerns were raised during the public consultation process on the Draft DoEHLG 2019 Guidelines, including those raised by acousticians[8] with significant experience in wind farm noise,

---

[1] *British Standards Institute, 2014. Code of practice for noise and vibration control on construction and open sites. Noise. UK : BSI, 2014. BS 5228:2009+A1:2014*
[2] *Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006.*
[3] *Department for Energy Security and Net Zero (DESNZ), 2026. Assessment and Rating of Wind Turbine Noise. UK Government.*
[4] *Institute of Acoustics, 2013. Good Practice Guidance on the application of ETSU-R-97 for wind turbine noise assessment.*
[5] *(ISO), International Standards Organisation. ISO9613: 2024 'Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors'. 2024.*
[6] *Association of Acoustic Consultants of Ireland, 2021. 'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments.*
[7] *ETSU for the DTI (Department of Trade and Industry), 1996 . The Working Group on Noise from Wind Turbines ETSU-R-97 The Assessment and Rating of Noise from Wind Farms'.*
[8] *Mackay, J, Singleton, J, Reid, M, Cand, M, Mahon, J, McKenzie, A, Keaney, D, Hayes, M, Bowdler, D, Kelly, D, Jiggins, M, Irvine, G & Lester, M, 2020. Public consultation on the revised wind energy development guidelines: Joint consultation response. Available at: https://www.tneigroup.com/news_event/tnei-submit-joint-consultation-response-and-meet-with-government-regarding-proposed-updates-to-the-irish-wind-farm-noise-guidelines-wedg/*

regarding the noise section of these draft guidelines and how the authors had misinterpreted existing guidance and incorporated a number of errors within the technical approaches proposed. In light of these concerns, and the fact that significant changes would need to be made before they could be adopted, an assessment using the Draft DoEHLG 2019 Guidelines is not, in our opinion, technically feasible or appropriate and therefore has not been undertaken.

At the time of writing this report, no further updates on the review process have been issued, however, on the 22 February 2023, a request for tender (RFT) was published for the review and redraft of the DoEHLG 2006 Guidelines by the Department of Environment. Timelines for the review are still unclear however, the Government of Irelands' Climate Action Plan 2024 includes a 2024 Action (EL/24/5) to 'Publish the Revised Wind Energy Development Guidelines for onshore wind.'

The DoEHLG 2006 Guidelines, therefore, remain the relevant statutory guidelines and, as a result, they have been used for this assessment, appropriately supplemented by the guidance in ARWTN and the IOA GPG, which are considered by TNEI to represent current best practice.

In 2018 the World Health Organisation (WHO) issued noise guidelines *'Environmental Noise Guidelines for the European Region'*[9] (the WHO Guidelines) that provide recommendations for protecting human health from exposure to environmental noise. The WHO Guidelines consider noise originating from various sources including wind turbine noise. The WHO Guidelines make a series of 'strong' and 'conditional' recommendations. Two conditional recommendations were made in relation to wind turbine noise. In relation to conditional recommendations the WHO Guidelines notes that:

'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 WHO Guidelines make recommendations based on noise exposure levels characterised using the L_{den} parameter. L_{den} is a weighted annual average sound pressure level over all days, evenings and nights in a year which is commonly used for transportation noise but rarely used for wind turbine noise.

In relation to wind turbine noise the WHO Guidelines state:

> *'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.'*

Notwithstanding the limitations associated with the derivation of the L_{den} threshold levels, serious concerns have been raised about the practicality of using a threshold which is based on a weighed annual average which cannot be directly measured. Given the strength of recommendation and limitations associated with the use of L_{den} it is not considered appropriate to undertake an assessment against L_{den} levels.

The Association of Acoustic Consultants of Ireland (AACI) published the AACI Guidelines in May 2021. The guidance document provides advice to local authority officers involved in the assessment of noise reports, the drafting of noise conditions for planning purposes and permitting, and enforcement

[9] *World Health Organisation, 2018. Environmental Noise Guidelines for the European Region'*

activities. Section 17 of the AACI Guidelines covers operational wind farm noise and construction noise guidance is included within Section 27. These are considered further in Section 12.4 below.

12.3 Scoping and Consultation

Section 2.7 of Chapter 2: Background to the Proposed Project of this EIAR describes the scoping and consultation exercise undertaken for the Proposed Project. Comments regarding noise and vibration were included in the Scoping Responses from three consultees, namely the response from Transport Infrastructure Ireland (September 2024), Fáilte Ireland (September 2024) and HSE Environmental Health (October 2024).

The Transport Infrastructure Ireland response states:

> *'The EIAR should have regard to TII's Environmental Assessment and Construction Guidelines, including the Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014),*
>
> *The EIAR should consider the European Communities (Environmental Noise) Regulations, 2018, (S.I. no. 549 of 2018), and how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (National Roads Authority, 2014)).'*

The '*Guidelines for the Treatment of Noise and Vibration in National Road Schemes'* states:

> *"The purpose of this document is to provide guidance on the treatment of noise and vibration during the planning and design of national road schemes."*

It is not intended for use for wind farm development or similar. Nonetheless, the document has been considered, as requested by Transport Infrastructure Ireland, to consider whether road traffic noise mitigation needs to be incorporated within the Proposed Project.

Section 2.3.1 of the document provides guidance on when road traffic noise mitigation measures are deemed necessary, however, the Proposed Project does not meet the stated criteria that would warrant the requirement for noise barriers, or any other noise mitigation measures, to be implemented.

Section 2.3.2 of the document provides some guideline noise levels that are "typically deemed acceptable," for construction noise occurring on the road network, however, it is noted that those levels are higher than the levels adopted within this EIAR in respect of the construction noise assessment. Therefore, no further cognisance has been given to these recommended levels (on the understanding that if it meets the noise thresholds adopted within the EIAR assessment it will also meet the National Roads Schemes guidance).

The *'Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (March 2014)'* relate to the good practice application of the *'Environmental Assessment and Construction Guidelines'*, therefore these have not been considered further.

The response from Fáilte Ireland referred to their *'Guidelines for the Treatment of Tourism in an EIA'*. With relation to noise this states that;

'A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however the impact upon tourism of issues of noise and vibration can be significant. Construction adjoining hotels for example should consider the sensitivity of the development and ensure mitigation is in place.

Material Assets; Traffic and Transport

The different transport patterns associated with tourism activities is a key impact of tourism and should be considered especially for tourism projects. These produce temporal and seasonal changes on the norm and specialist consideration and interpretation should be given. Tourism proposals should, where possible, be well served by public transport and should be accessible by modes other than the car. The impact of traffic on tourism assets can be substantial and can vary in severity according to season, the weather, etc. The impact of construction traffic can be a particular concern in tourism sensitive areas in terms of noise pollution and visual impact. The construction programme of developments should work to avoid peak tourism periods in tourism areas and should consider planned or anticipated tourism events and festivals.'

The Proposed Wind Farm is located in a remote location and will be unlikely to impact aspects such as planned tourism events / festivals with regards to noise, but this can be kept under review as the Proposed Wind Farms timeline progresses.

The HSE Environmental Health response sets out a number of requirements for the consideration of noise, as detailed below;

'Noise and Vibration

The potential impacts for noise and vibration from the proposed development on all noise sensitive locations must be clearly identified in the EIAR. The EIAR must also consider the appropriateness and effectiveness of all proposed mitigation measures to minimise noise and vibration. A baseline noise monitoring survey should be undertaken to establish the existing background noise levels. Noise from any existing turbines in the area should not be included as part of the background levels. In addition, an assessment of the predicted noise impacts during the construction phase and the operational phase of the proposed wind farm must be undertaken which details the change in the noise environment resulting from the proposed development. Details of the location and frequency of noise monitoring for the proposed development should be included in the EIAR to be submitted as part of the Planning Application.

The Draft Revised Wind Energy Development Guidelines were published in December 2019. Whilst these have yet to be adopted, any proposed wind farm development should have consideration of the draft Guidelines.'

Each of the HSE requirements are covered within this EIAR; the baseline aspect is considered in 12.4.3.2, with the assessment of predicted noise impacts during the construction and operational phases detailed in 12.6.2 and 12.6.4 respectively. Clarification on how noise from existing turbines has been accounted for is detailed in 12.5.1. The application of the Draft WEDG 2019 guidance has been considered, however due to the significant limitations identified, its application would not be appropriate (as already explained (section 12.2)).

12.4 Assessment Methodology and Significance Criteria

12.4.1.1 Construction Noise Methodology

There is no published statutory Irish guidance that contains suggested noise limits for construction activities, other than for road construction works, however, the AACI Guidelines states:

> *"The chief guidance document applied in the assessment of construction phase noise impacts is British Standard BS 5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 1: Noise (2014)".*

The construction noise assessment has therefore been undertaken using the BS 5228 guidance. The prediction of construction noise levels was undertaken using the calculation methodology presented in ISO 9613:2024, using noise source data for appropriate construction plant from Annex C of the current version of BS 5228.

To undertake an assessment of the construction noise impact in accordance with the BS 5228 criteria, the following steps have been undertaken:

- Identify NSRs and select representative Construction Noise Assessment Locations (CNALs);
- Identify applicable threshold of significant effects;
- Predict noise levels for various construction noise activities;
- Compare predicted noise levels against the applicable thresholds;
- Where necessary, develop suitable mitigation measures to minimise any significant adverse effects during the construction phase; and (if required)
- Assess any residual adverse effects taking into account any identified mitigation measures.

Of the NSRs identified in the surroundings, a total of eight have been chosen as CNALs. All eight are residential properties. The CNALs represent the closest NSRs or clusters of NSRs to the Proposed Project construction activities. The CNAL are summarised in Table 12-1 below and are shown on Figure 12-1.

Table 12-1: Summary of Construction Noise Assessment Locations

Receptor	ITM Easting	ITM Northing
CNAL01	543341	829184
CNAL02	543819	830001
CNAL03	544723	830052
CNAL04	545239	829418
CNAL05	545914	829099
CNAL06	546618	829694
CNAL07	547834	829917
CNAL08	544758	822431

N

CNAL01
CNAL02
CNAL03
CNAL04
CNAL05
CNAL06
CNAL07
CNAL08
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16
T17

Kilometre
0
2.5
5

LEGEND

- EIAR Site Boundary
- Crumhach Wind Farm
- Construction Noise Assessment Locations (CNALs)
- Onsite 110kV Substation
- Decommissioned Turbine Laydown Area
- Temporary Construction Compounds
- Turbine Hardstands
- New Roads
- Upgrades to Existing Roads
- Upgrades to Public Roads
- Borrow Pits

Noise Sensitive Receptors (NSRs) Represented By:

- NML1
- NML2
- NML3
- NML4
- NML5
- NML6
- NML7
- NML8

Rev.	Date	Amendment Details	Drawn	Approved
2	10/06/2026	REVISION	MT	JB
1	18/03/2026	REVISION	MT	JB
0	10/03/2026	FIRST ISSUE	JCM	MT

tnei

Client: sse

Drawing Status: FOR INFORMATION

Project Title: CRUMHACH WIND FARM

Drawing Title: FIGURE 12-1: CONSTRUCTION NOISE ASSESSMENT LOCATIONS

Scale: 1:75,000 | Original Size: A3 | Spatial Reference: IRENET95 Irish Transverse Mercator

Drawing Number: IE00220-014

The construction phase of the Proposed Project will include civil engineering works, electrical works, and turbine removal and erection (please refer to Chapter 4 of this EIAR for details). During each phase the plant and equipment, and the associated traffic, would influence the noise generated. The selection of plant and equipment to be used will be determined by the main contractor when they are commissioned, therefore the assessment has been based upon a typical selection of plant for a wind farm project of this size and the indicative construction schedule (included in Chapter 4 of this EIAR). In view of this, the plant has been modelled operating at the closest points to each NSR for a given activity in each construction phase, under a precautionary scenario as it would generate the highest noise levels, whereas in reality only certain plant and equipment will be working at the closest point for short periods of time. In the case of mobile plant, this has been modelled as a point source that moves along a defined path, averaging out the sound power level across the length of the line, rather than concentrating it in a single location next to the receptor. In such cases, the predicted noise level will represent an average level expected to be received for most of the activity period, however, it should be recognised that when directly opposite a receptor, noise levels would be higher than predicted for a short period of time.

The core hours for the proposed construction works will be 07:00 to 19:00 Monday to Friday, and Saturday 07:00 to 13:00. There will be no working on Sundays and Public Holidays, however, it should be noted that out of necessity some activity outside of the core hours could arise, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair weather windows for concrete deliveries, the erection/removal of turbines and the erection and dismantling of cranes.

Chapter 4: Description of the Proposed Project outlines the tasks that will be undertaken during the construction phase, which is estimated to be 24 months. For the purposes of this assessment, noise modelling has been undertaken for months 1-21 only, as months 22-24 will be limited to electrical commissioning and site landscaping which will not result in substantial levels of noise. The modelled construction scenarios are detailed in

Table 12-2: Summary of Modelled Construction Scenarios

Months	Description
1-3 (Daytime)	The existing southerly Kingsmountain and existing Dunneill turbines near the main site entrance are decommissioned. Site establishment commences with construction of the temporary construction compounds (TCCs). The junctions at each site entrance are upgraded and access tracks upgraded for TCC's 1-4 on the main wind farm site. Forestry felling is completed at the new substation site as well as around the new proposed turbine locations.
4-6 (Daytime)	Operation at the borrow pits commences with materials transported back to the nearest TCCs. Tree felling is completed at the proposed turbine locations in Kingsmountain Wind Farm. Access tracks are upgraded for this portion of the wind farm. Access tracks to T1 and T2 are also completed. Turbine hardstandings are completed for turbines T6 to T13. Decommissioning of the rest of the Dunneill turbines is completed.
10-12 (Daytime)	Delivery of ready-mixed concrete facilitates the creation of turbine foundations at T6 to T13. Construction of the substation is completed during this period. Turbine hardstandings are created for the new proposed turbines along the L2702 (T1-T5).
13-17 (Daytime)	The final turbine hardstandings are completed for T14-T17. Turbine foundations completed for T1 to T5 as well as T14-T17. Cranes and components for turbine erection are delivered to the hardstands at T2, T4, and T6-T13. Subsequent erection of these turbines.

Months	Description
18-21 (Daytime)	Turbine erection cranes are moved from T2 to the path towards T1. Turbine T1, T3, T5 erected and cranes removed off site. Cranes also moved in the main site from T13 towards T16. The two TCCs on the west side of the development are decommissioned in M19, and the other two are removed in M21.Remaining turbines (T14-T17) are erected and the cranes are removed from site.
All (Night-time)	Generators and lights operational at all TCCs.

.

Table 12-2: Summary of Modelled Construction Scenarios

Months	Description
1-3 (Daytime)	The existing southerly Kingsmountain and existing Dunneill turbines near the main site entrance are decommissioned. Site establishment commences with construction of the temporary construction compounds (TCCs). The junctions at each site entrance are upgraded and access tracks upgraded for TCC's 1-4 on the main wind farm site. Forestry felling is completed at the new substation site as well as around the new proposed turbine locations.
4-6 (Daytime)	Operation at the borrow pits commences with materials transported back to the nearest TCCs. Tree felling is completed at the proposed turbine locations in Kingsmountain Wind Farm. Access tracks are upgraded for this portion of the wind farm. Access tracks to T1 and T2 are also completed. Turbine hardstandings are completed for turbines T6 to T13. Decommissioning of the rest of the Dunneill turbines is completed.
10-12 (Daytime)	Delivery of ready-mixed concrete facilitates the creation of turbine foundations at T6 to T13. Construction of the substation is completed during this period. Turbine hardstandings are created for the new proposed turbines along the L2702 (T1-T5).
13-17 (Daytime)	The final turbine hardstandings are completed for T14-T17. Turbine foundations completed for T1 to T5 as well as T14-T17. Cranes and components for turbine erection are delivered to the hardstands at T2, T4, and T6-T13. Subsequent erection of these turbines.
18-21 (Daytime)	Turbine erection cranes are moved from T2 to the path towards T1. Turbine T1, T3, T5 erected and cranes removed off site. Cranes also moved in the main site from T13 towards T16. The two TCCs on the west side of the development are decommissioned in M19, and the other two are removed in M21.Remaining turbines (T14-T17) are erected and the cranes are removed from site.
All (Night-time)	Generators and lights operational at all TCCs.

More detailed information on each of the construction scenarios and modelling assumptions can be found within Appendix 12-1 of this EIAR. The noise levels for all Scenarios have been calculated at the CNALs and compared to the appropriate BS 5228 thresholds (detailed in Table E.1, Annex E of BS 5228). It is worth noting that for much of the working day, the noise associated with construction activities will be less than predicted as the assessment has assumed all equipment is constantly operating at full power and is located at the closest point to each receptor, whereas in practice equipment load and precise location will vary.

Construction activities outside the Proposed Turbines, along the Proposed Grid Connection Route or the turbine delivery route distant road junctions that may need reinforcement have been assessed qualitatively. These activities will be of short duration and best practice during constructions would minimise any potential impact.

12.4.1.2 Construction Vibration

In relation to potential vibration during the construction phase of the Proposed Project, two sets of vibration limits should be considered: one in regard to potential for damage to buildings and one in regard to the vibration effects on people within buildings.

Threshold values to determine the potential for damage to buildings are detailed in BS 7385-2:1993 (which is also referred to in BS 5228). The unit of measurement used for this assessment method is the Peak Particle Velocity (PPV), which is measured in mm/s or $mm.s^{-1}$. For dwellings, the standard provides the guideline threshold levels, as set out in Table 12-3 below.

Table 12-3: Transient vibration guide values for building damage

Peak Component Particle Velocity (mm/s)	Damage Levels for residential buildings
15 mm/s PPV for a frequency of 4 Hz, rising to 50 mm/s PPV for a frequency of 40Hz and above.	Cosmetic
30 mm/s PPV for a frequency of 4 Hz, rising to 100 mm/s PPV for a frequency of 40Hz and above.	Minor Damage
60 mm/s PPV for a frequency of 4 Hz, rising to 200 mm/s PPV for a frequency of 40Hz and above.	Major Damage

Table B.1 of BS 5228-2, reproduced here as Table 12-4 provides guideline PPV levels that can be used in a construction setting. It is important to note that the levels refer to internal vibration within a building, and not external levels.

Table 12-4: BS 5228-2 Guidance on Effects of Vibration Levels

Vibration Level (A) (B) (C)	Effect
0.14 $mm.s^{-1}$	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 $mm.s^{-1}$	Vibration might be just perceptible in residential environments.
1.0 $mm.s^{-1}$	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 $mm.s^{-1}$	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.
(A) The magnitudes of the values presented apply to a measurement position that is representative of the point of entry into the recipient. (B) A transfer function (which relates an external level to an internal level) needs to be applied if only external measurements are available. (C) Single or infrequent occurrences of these levels do not necessarily correspond to the stated effect in every case. The values are provided to give an initial indication of potential effects, and where these values are	

Vibration Level (A) (B) (C)	Effect
routinely measured or expected then an assessment in accordance with BS 6472-1 or -2, and/or other available guidance, might be appropriate to determine whether the time varying exposure is likely to give rise to any degree of adverse comment.	

With due regard to the above, external vibration level limits can be set at 15 mm/s PPV for frequencies between 4 Hz and 40 Hz and 50mm/s for frequencies above 40Hz.

Internal PPV limits can be set at somewhere between 1 mm/s^{-1} and 10.0 mm/s^{-1}, however, it should be noted that the measurement of vibration levels indoors is invasive and can be problematic. It should also be noted that the limits in Table 12-4 are generally considered guideline levels that should not be exceeded regularly or for long periods of time (see note (C) of Table 12-4).

Due to the separation distances between the construction activity areas (including from road junction upgrades) on the Proposed Wind Farm and the nearest receptors, no significant effects are anticipated. Where construction activities on the Proposed Grid Connection Route are close to residential receptors, some local vibration effects may be present, however, levels are expected to be low and of limited duration. Also, similarly to construction noise, good practice during construction will be implemented and will reduce vibration levels from these short-term works to minimum levels. Vibration impacts have not been considered further in the assessment.

12.4.1.3 Operational Wind Turbines Noise Methodology

The assessment has been undertaken in accordance with the DoEHLG 2006 Guidelines. The AACI Guidance states the following in relation to the DoEHLG 2006 Guidelines:

'The document includes daytime and night-time noise criteria. As criteria included in the document are evidently derived from ETSU-R-97, it is considered more robust to base noise assessments on the ETSU and IOA documents, particularly as the DOEHLG document is somewhat vague. The document has been undergoing a protracted review process for several years.'

The document also provides clarification on how the limits provided in the DoEHLG 2006 Guidelines should be interpreted:

- *'Daytime limit of 5 dB above background, subject to a lower fixed limit of 45 dB.*
- *Night-time limit of 5 dB above background, subject to a lower fixed limit of 43 dB (although the DOEHLG wording is particularly vague here).*
- *Where background noise levels are less than 30 dB, a daytime absolute limit set between 35 and 40 dB. No information is provided here with respect to a corresponding night-time limit. In addition, it is not stated if an increase of 5 dB over background is applicable with rising wind speed. This represents an example of the ambiguity of the document.'*

In 2013, the ETSU-R-97 guidance was supplemented by a document produced by the IOA (the IOA GPG), and in June 2026 the ETSU-R-97 guidance itself was refreshed with updated guidance under the title *'Assessment and Rating of Wind Turbine Noise'* (ARWTN). The ARWTN update represents more evolution than revolution, and the fundamental assessment principles remain unchanged from ETSU-R-97. The IOA published a statement highlighting that whilst ARWTN has updated terminology and clarifications, the assessment principles are generally the same as before and advises the continued use of the IOA GPG.

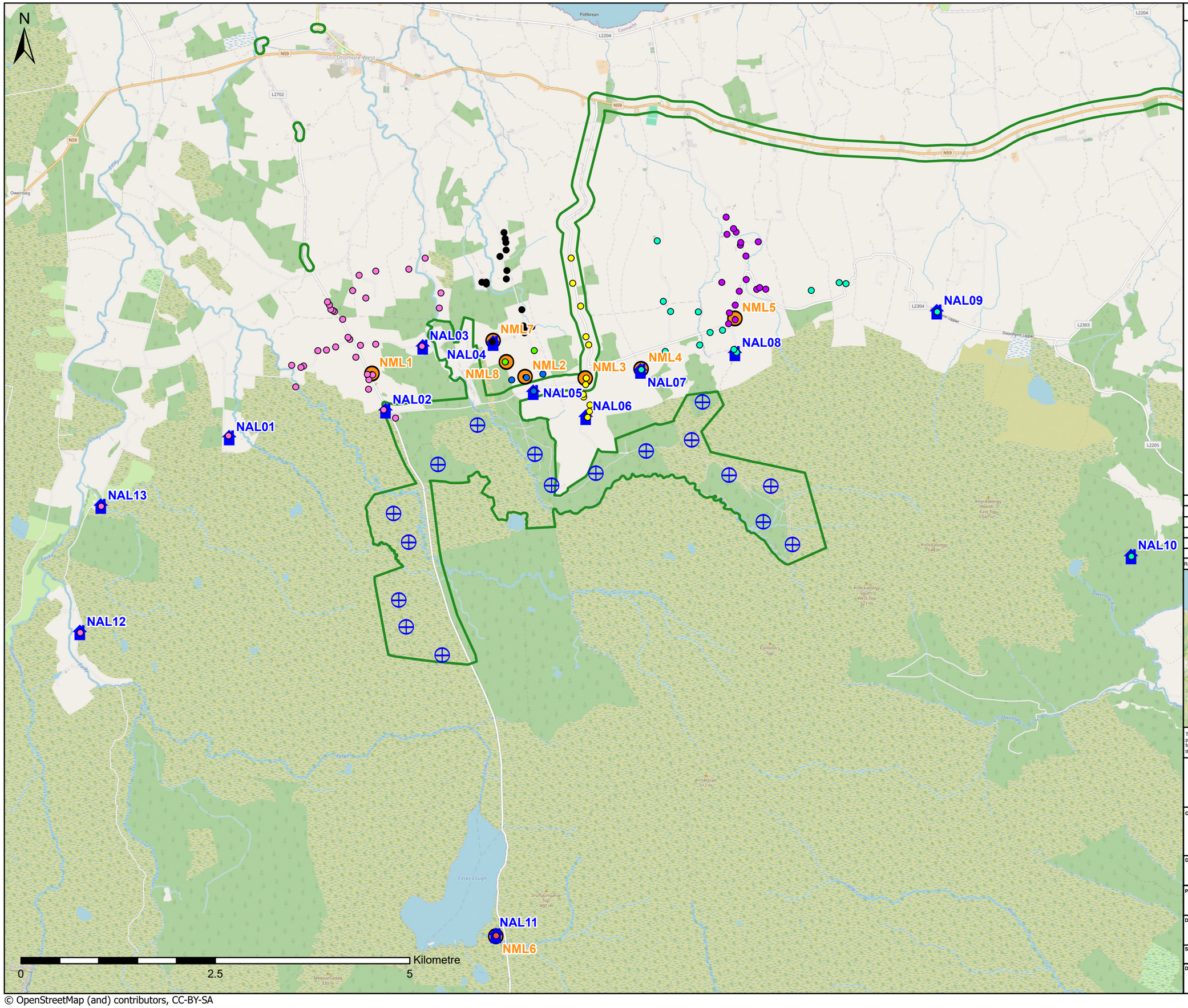
Given the lack of detail in parts of the DoEHLG 2006 Guidelines, information contained in ARWTN and the IOA GPG has been used to supplement the DoEHLG 2006 Guidelines.

The test applied to operational noise is whether or not the calculated wind farm noise levels at nearby NSRs will be below the noise limits derived in accordance with DoEHLG 2006 Guidelines for both the daytime and night-time periods.

Of the NSRs identified, 13 Noise Assessment Locations (NALs) were selected for a detailed assessment. All with the exception of location 5 (as shown on figure A1.1C of Appendix 12.2, which is Lough Easky Water Treatment Plant) are residential properties. The NALs were chosen to represent the noise sensitive receptors located closest to the Proposed Wind Farm. Predictions of wind turbine noise have been made at each of the NALs as detailed in Table 12-5 and shown on Figure 12-2. This approach ensures that the assessment considers the worst case (loudest) noise immission level expected at the NAL. All other NSRs as shown on Figure 12-2 have also been assessed separately in Appendix 12-2.

Table 12-5: Summary of Operational Noise Assessment Locations

Receptor	Easting	Northing	Elevation (m AOD)	Distance to Nearest Turbine (m)	Background Noise Data Used
NAL1 (NSR084)	541330	828834	121.57	2,347	NML1
NAL2 (NSR015)	543341	829184	141.21	994	NML1
NAL3 (NSR027)	543819	830001	117.97	1,243	NML1
NAL4 (NSR020)	544723	830052	119.55	1,090	NML7
NAL5 (NSR004)	545239	829418	155.73	815	NML2
NAL6 (NSR002)	545914	829099	189.74	728	NML3
NAL7 (NSR013)	546618	829694	178.6	890	NML4
NAL8 (NSR008)	547834	829917	186.44	772	NML4
NAL9 (NSR105)	550429	830453	143.37	3,119	NML4
NAL10 (NSR104)	552926	827309	241.52	4,377	NML4
NAL11 (NSR103)	544758	822431	194.2	3,703	NML6
NAL12 (NSR102)	539410	826328	119.99	4,138	NML1
NAL13 (NSR101)	539680	827953	101.45	3,792	NML1



LEGEND

- EIAR Site Boundary
- Crumhach Wind Farm
- Noise Assessment Locations (NALs)
- Noise Monitoring Locations (NMLs)

Noise Sensitive Receptors (NSRs) Represented By:

- NML1
- NML2
- NML3
- NML4
- NML5
- NML6
- NML7
- NML8

Rev.	Date	Amendment Details	Drawn	Approved
2	10/06/2026	REVISION	MT	JB
1	18/03/2026	REVISION	MT	JB
0	10/03/2026	FIRST ISSUE	JCM	MT

tnei

Client: sse

Drawing Status: FOR INFORMATION

Project Title: CRUMHACH WIND FARM

Drawing Title: FIGURE 12-2: OVERVIEW OF WIND TURBINE OPERATIONAL NOISE ASSESSMENT LOCATIONS

Scale:	Original Size:	Spatial Reference:
1:45,000	A3	IRENET95 Irish Transverse Mercator

Drawing Number: IE00220-015

Whilst the background noise data for NML5 has not been used as part of the NALs in Table 12.5, it has been used for other NSRs at further distances to the northeast of the Proposed Project. This is further detailed in Table A5.1 of Annex 5, Appendix 12.2.

The daytime and night-time periods are not defined within the DoEHLG 2006 Guidelines, therefore the assessment has considered these periods as detailed within ARWTN. The quiet daytime criteria are based upon background noise levels measured during 'quiet periods of the day' comprising:

- All weekday evenings from 18:00 to 23:00;
- Saturday afternoons and evenings from 13:00 to 23:00; and,
- All day Sunday 07:00 to 23:00.

It should be noted that although the daytime limits are set based upon background data collected only during the quiet daytime period, they apply to the entire daytime period (07:00 – 23:00).

Night-time periods are defined as 23:00 to 07:00, with no differentiation made between weekdays and weekends.

The DoEHLG 2006 Guidelines include guidance on how to derive limits for daytime and night-time periods.

The daytime limits take account of existing background noise levels and include a fixed limit of 45 dB or background + 5 dB, whichever is the greater, except in low background noise environments where a fixed minimum limit in the range 35-40 dB should be considered. TNEIs interpretation of these criteria, is that turbine noise should not exceed for daytime periods:

- 40 dB(A) where background noise levels are below 30 dB; and,
- 45 dB(A) or background noise plus 5 dB, whichever is the greater, where background noise levels are greater than 30.

The daytime fixed minimum limit has been chosen for the daytime period based upon the approach adopted in other recent wind farm consents.

The DoEHLG 2006 Guidelines states that a *"fixed limit of 43 dB(A) will protect sleep inside properties during the night"*, however, whilst it is not explicit within the DoEHLG 2006 Guidelines, the addition of a night-time 'background noise +5 dB' parameter is how the AACI Guidance document recommends the night-time limits are interpreted, as detailed in 12.4.1.3 above. On that basis, in line with the AACI interpretation, the night-time noise limits used in this assessment have been based on 43 dB or background noise + 5 dB, whichever is the greater.

Two sets of noise limits have been derived; the Total DoEHLG 2006 Guidelines Noise limits which apply to the cumulative noise level of all relevant wind turbine developments which are operating, permitted, and proposed in the area, including the Proposed Wind Farm; and the Site Specific Noise Limits which apply to operational noise from the Proposed Wind Farm only. The Site Specific Noise Limits are derived to take account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other wind farm developments.

The aim of the operational noise assessment is to establish the Total DoEHLG 2006 Guidelines Noise Limits, determine whether a cumulative assessment is required at the nearest NSRs, derive Site Specific Noise Limits and to establish whether the Proposed Wind Farm can operate within those limits. When considering the Total DoEHLG 2006 Guidelines Noise Limit, the aim of the assessment was to determine whether the cumulative noise predictions can operate within the Total DoEHLG 2006 Guidelines Noise Limit.

The exact model of turbine to be installed as part of the Proposed Wind Farm will be the result of a future tendering process and within the dimensions prescribed in this planning application should

planning permission be granted. Achievement of the noise limits determined by this assessment will be a key determining requirement in the final choice of turbine for the Proposed Wind Farm. Whichever turbine model is ultimately selected will need to adhere to the limits set within the consented planning conditions. This can be achieved through implementation of mitigation measures, such as low-noise modes, where required.

This noise assessment models the following candidate wind turbines:

- the Nordex N149 5.X MW with serrated trailing edge blades and a hub height of 105 m;
- the Vestas V150 6.0 MW with serrated trailing edge blades and 105 m hub; and
- the Nordex N133 4.8 MW with normal blades and 110 m hub.

These candidate turbines fall within the range of turbine dimensions proposed as part of the application as per Chapter 1 Section 1.7.3 (i.e. tip height range of 176.6 m to 180 m, rotor diameter range of 133.2 m to 150m, and hub height range of 105 m to 110 m). The final choice of wind turbine would be subject to a competitive tendering process, but will fall within the range of parameters assessed within this EIAR.

The modelling results presented within this Chapter are based on the Nordex N149 5.X MW turbine as a comparison of predictions of all candidates at NSRs indicates it has higher levels at wind speeds greater than 6 m/s at 10 m standardised height. Prediction modelling results for the other two candidate turbines are included within Appendix 12-2.

Calculations of operational noise have been undertaken in accordance with International Standard ISO 9613-2, *'Acoustics – Attenuation of sound during propagation outdoors'* (ISO 1996). The model calculates, on an octave band basis, attenuation due to geometric spreading, atmospheric absorption and ground effects. The noise model was set up to provide realistic noise predictions, including mixed ground attenuation (G=0.5) and atmospheric attenuation relating to 70 % relative humidity and 10 °C (Section 4.3 of the IOA GPG). The receiver height modelled was 4 m.

Typically, wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so it is appropriate to consider the effect of wind direction on predicted noise levels and therefore the impact of directivity has been considered in the assessment (see Section 4.4 of Appendix 12-2).

In line with the IOA GPG, an assessment has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and the NSRs. Propagation across a valley (concave ground) increases the number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Terrain screening effects (barrier corrections) act as blocking points, subsequently reductions in sound levels at a given receptor can potentially be observed. Concave and barrier corrections were required for some turbines at several receptors as detailed in Appendix 12-2.

Other topics relating to operational wind farm noise characteristics, such as tonality, Infrasound, ground-borne vibration, Low Frequency Noise (LFN) and amplitude modulation were considered as part of this assessment. There is no evidence that LFN or infrasound[10] or ground-borne vibration has adverse impacts on the health of wind farm neighbours and has therefore been scoped out - more information on LFN is provided in Appendix 12-2. Tonality associated with wind turbines is well understood and has been considered in accordance with the guidance in ARWTN and the IOA GPG. The topic of amplitude modulation is considered in more detail below.

[10] *Institute of Acoustics, 2024. Institute of Acoustics Statement in Respect of Wind Farm Noise Assessment.*

12.4.1.4 Amplitude Modulation

In the context of wind turbine noise, Amplitude Modulation (AM) describes a variation in noise level over time; for example, observers may describe a 'whoosh whoosh' sound, which can be heard close to a wind turbine as the blades sweep past. The AM of aerodynamic noise is an inherent characteristic of wind turbine noise and was originally noted in ETSU-R-97, on page 68, which states:

> *'The modulation or rhythmic swish emitted by wind turbines has been considered by some to have a characteristic that is irregular enough to attract attention. The level and depth of modulation of the blade noise is, to a degree, turbine-dependent and is dependent upon the position of the observer. Some wind turbines emit a greater level of modulation of the blade noise than others. Therefore, although some wind turbines might be considered to have a character that may attract one's attention, others have noise characteristics which are considerably less intrusive and unlikely to attract one's attention and be subject to any penalty.*
>
> *This modulation of blade noise may result in a variation of the overall A-weighted noise level by as much as 3dBA (peak to trough) when measured close to a wind turbine. As distance from the wind turbine [or] wind farm increases, this depth of modulation would be expected to decrease as atmospheric absorption attenuates the high frequency energy radiated by the blade.'*

The Acoustics community has sought to make a distinction between the AM originally discussed within ETSU-R-97, which is expected at most wind farms and as such may be considered as 'Normal Amplitude Modulation' (NAM), compared to the unusual AM that has sometimes been heard at some wind farms, hereinafter referred to as 'Other Amplitude Modulation' (OAM). The term OAM is used to describe an unusual feature of aerodynamic noise from wind turbines, where a greater than normal degree of regular fluctuation in sound level occurs at the blade passing frequency, typically once per second. In some literature it may also be referred to as 'Excess Amplitude Modulation' (EAM). It should be noted that the noise assessment and rating procedure detailed in ARWTN fully takes into account the presence of the intrinsic level of NAM when setting acceptable noise limits for wind farms.

Persistent OAM can be a source of nuisance to wind farm neighbours. Indeed, in a recent decision of the Irish High Court on the 8th March 2024, the court found that frequent and sustained periods of OAM arising from the operational Ballyduff Wind Farm was an unreasonable interference with a neighbour's use and enjoyment of their property which was located approximately 359 m from the nearest turbine. The residents were awarded monetary damages, in addition to an order being made for one of the turbines to be shut down during certain periods of the day. As of writing, the wind farm operator is appealing this decision, alleging the High Court erred legally and factually in a range of its findings. However it is considered that for instances in which OAM arises, mitigation is possible and is the appropriate response.

The ARWTN guidelines state with relation to AM that;

> *'All wind turbines generate AM (or blade swish, to a limited extent), but the occurrence of elevated levels of AM is a complex phenomenon that is likely to be related to a combination of turbine and site characteristics; the current consensus is that AM cannot be predicted.'*

The guidance goes on to note that it is *'best controlled through enforcement of planning conditions which include the application of character corrections'.*

A significant amount of research has been undertaken in relation to OAM and a summary of the most relevant research is included in Section 3.3 of Appendix 12-2. Key outcomes of the research are that:

- It is clear that OAM, if it occurs frequently and for sustained periods, it has the potential to result in adverse impacts for wind farm neighbours.

- It is not currently possible to predict if and when OAM will occur at a proposed wind farm. On sites where OAM has been identified it occurs intermittently and varies in terms of severity.
- There are methodologies available that can be used to measure and quantify OAM, in particular the method produced by the Amplitude Modulation Working Group (AMWG), which was formed by the Institute of Acoustics. The methodology was presented in a report '*Methods for Rating Amplitude Modulation in Wind Turbine Noise'* which was published in April 2015.
- Whilst it is possible to measure and quantify OAM using the AMWG methodology (which provides an AM rating for each 10 minute period), further study is still required to help quantify what level of OAM, if any, is acceptable. This is complicated by the fact that it is unclear whether a small amount of OAM that occurs regularly is likely to be more (or less) annoying than a large amount of OAM that occurs very infrequently.
- Notwithstanding a lack of an agreed defined threshold detailing what level of OAM is acceptable, there are measures available which have been shown to mitigate OAM should it occur. Measures can include:
    - Changes to the operation of the relevant wind turbine(s) by changing parameters such as blade pitch;
    - Addition of blade furniture (such has vortex generators) to alter the flow of air over the wind turbine blades; and, in extreme cases,
    - Targeted wind turbine shutdowns in specific conditions where OAM is found to occur.

  Where mitigation is required, it needs to be designed on a site-specific basis.

To ensure that any future complaints relating to noise and OAM can be responded to appropriately, the Applicant proposes to appoint a community liaison officer who would be the first point of contact in the event that noise complaints were to occur, and the mitigation strategy set out in Section 12.7.2 below will be employed.

12.4.1.5 Cumulative Wind Turbine Operational Noise Methodology

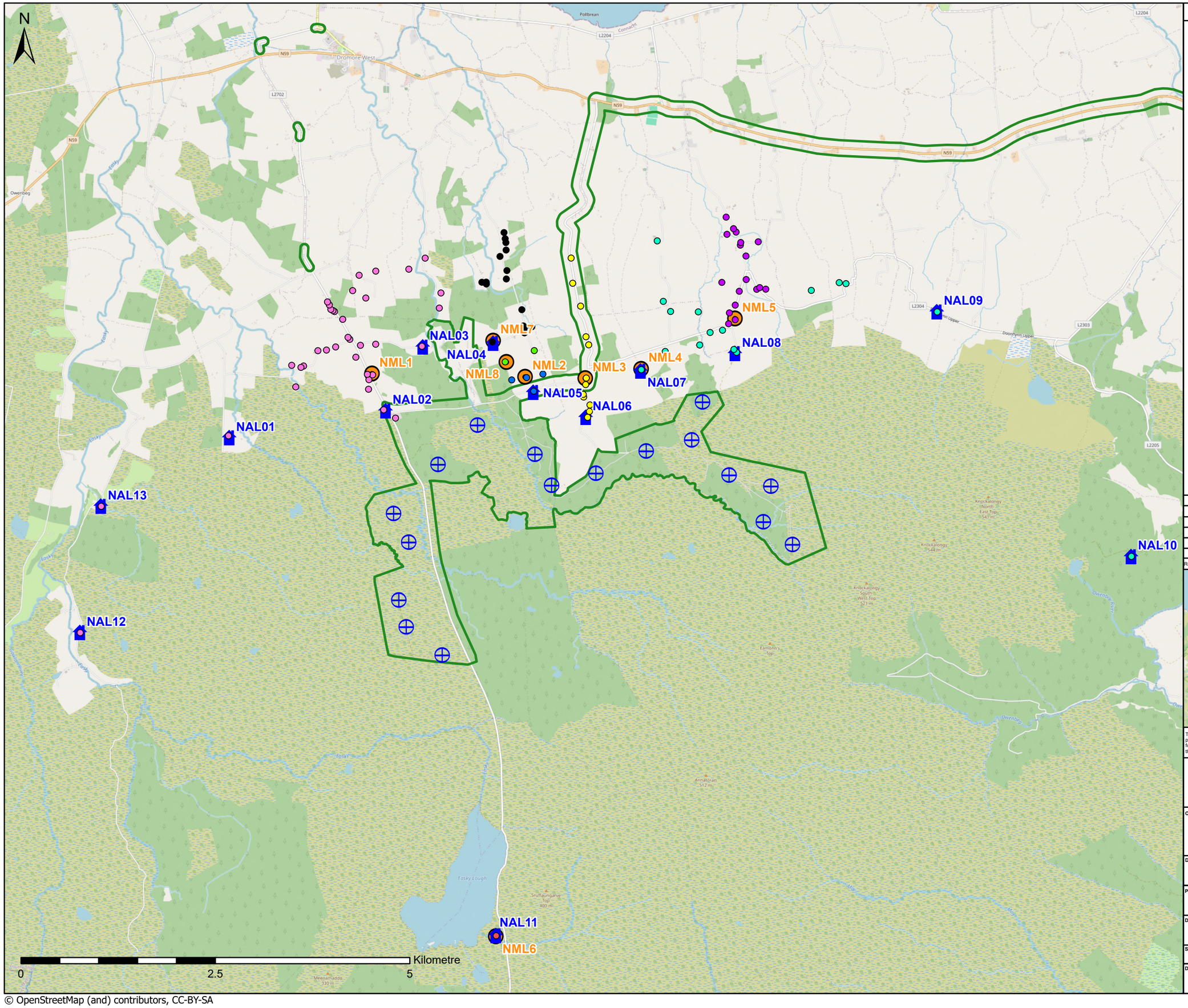
The noise assessment considers nearby wind turbine schemes that are operational, permitted and proposed (planning application submitted). The nearby schemes found to be relevant and therefore considered in the assessment are as follows:

- Black Lough Wind Farm (Existing) – 6 x Enercon E92 2.3 MW;
- Carrowleagh Wind Farm (Existing) - 13 x Enercon E70 2.3 MW;
- Cloonkeelaun Wind Farm (Existing) – 3 x Enercon E70 2.3 MW; and
- Strokane Wind Turbine (Existing) – 1 x Enercon E92 2.3 MW.

A cumulative noise assessment was undertaken in accordance with the guidance contained within the IOA GPG. The noise assessment has been undertaken in three separate stages:

- Stage 1 - Establish the 'Total DoEHLG 2006 Guidelines Noise Limits' which are applicable for all wind farm schemes in the area;
- Stage 2 – undertake a cumulative assessment, comparing Total DoEHLG 2006 Guidelines Noise Limits with cumulative noise predictions. At this stage, the predicted 'likely' cumulative wind turbine noise levels are the actual levels expected at a noise assessment location; and
- Stage 3 – establish the Proposed Wind Farms Specific Noise Limits (at levels at or below the Total DoEHLG 2006 Guidelines Noise Limits, where limit apportionment is required) and compare the noise predictions from the Proposed Wind Farm on its own against the proposed Site Specific Noise Limits.

The location of the turbines modelled, inclusive of those considered in the cumulative noise assessment (Stage 2), are shown in Figure 12-3.



LEGEND

- EIAR Site Boundary
- Crumhach Wind Farm
- Noise Assessment Locations (NALs)
- Noise Monitoring Locations (NMLs)

Noise Sensitive Receptors (NSRs) Represented By:

- NML1
- NML2
- NML3
- NML4
- NML5
- NML6
- NML7
- NML8

Rev.	Date	Amendment Details	Drawn	Approved
2	10/06/2026	REVISION	MT	JB
1	18/03/2026	REVISION	MT	JB
0	10/03/2026	FIRST ISSUE	JCM	MT

tnei

Client: sse

Drawing Status: FOR INFORMATION

Project Title: CRUMHACH WIND FARM

Drawing Title: FIGURE 12-2: OVERVIEW OF WIND TURBINE OPERATIONAL NOISE ASSESSMENT LOCATIONS

Scale:	Original Size:	Spatial Reference:
1:45,000	A3	IRENET95 Irish Transverse Mercator

Drawing Number: IE00220-015

12.4.2 Potential Effects Scoped Out

12.4.2.1 Decommissioning

Activities that occur during the decommissioning phase of the Proposed Project are unlikely to produce higher noise levels than those produced during construction and many of the activities will be similar in nature, particularly those related to the removal of the existing turbines. As such it is considered that if construction noise levels are predicted to be below the threshold levels, then decommissioning noise will also be within the threshold levels. Decommissioning of the Proposed Project is detailed in Section 4.10 of Chapter 4 of this EIAR and in the Decommissioning Plan.

12.4.3 Method of Baseline Characterisation

12.4.3.1 Extent of the Study Area

Prior to the commencement of the operational noise assessment, initial desktop noise modelling was undertaken in order to identify all NSRs and to select potential Noise Monitoring Locations (NMLs). A total of 105 NSRs were identified within a search area of approximately 2.5 km from the Proposed Wind Farm, of which 17 no. NSRs are located within 1 km of the Proposed Wind Farms turbines. Eight NMLs were selected to represent background noise levels at all NSRs. The NSRs and NMLs are all shown on Figure 12-2 and coordinates of the NMLs are also included below in Table 12-6. More information can be found in Appendix 12-2.

Construction works along the Proposed Grid Connection Route and road and TDR junction improvements would be extremely limited in duration, and noise from these works is therefore assessed qualitatively, rather than through the prediction of noise at specific receptors.

12.4.3.2 Field Survey

The noise survey to determine the existing background noise environment at NSRs neighbouring the Proposed Wind Farm was undertaken in accordance with the guidance contained within ARWTN and current good practice (IOA GPG).

Background noise monitoring was undertaken at eight NMLs (as shown on Figure 12-2) over the periods:

- 14th June 2024 – 26th September 2024 at NMLs 1 - 3, 5[11] and 7;
- 17th June 2024 – 26th September 2024 at NMLs 4 and 8; and
- 17th July 2024 – 26th September 2024 at NML 6[12].

The data was collected over two periods of grid outage, where Dunneill and Kingsmountain Wind Farms (operating in the near vicinity) were both shut down. These periods were used in the analysis to obtain clean baseline noise datasets in the absence of wind farm noise to inform the Total WEDG Noise Limits.

The NMLs were installed, where possible within, or in proximity to, the amenity area at the residential dwellings. The noise monitoring equipment was sited with due consideration of local noise sources such

[11] *The equipment located at NML5 suffered a fault following a maintenance visit, therefore valid data only exists for this location over the period 14th June 2024 – 25th August 2024.*
[12] *At NML6 (an isolated dwelling to the south of the Proposed Wind Farm), the noise monitoring equipment was sited to minimise the possible influence of the stream leading to Easky Lough that encircles the property. However, the data collected was clearly affected by the watercourse, and has therefore not been used within the noise assessment. Data has been included within the sections below for information purposes.*

as boiler flues, watercourses, and vegetation. Further details on the NMLs can be found within Appendix 12-2.

Table 12-6: Summary of Noise Monitoring Locations

Receptor	ITM Easting	ITM Northing
NML1	543163	829657
NML2	545131	829617
NML3	545905	829597
NML4	546623	829719
NML5	547829	830365
NML6	544754	822419
NML7	544720	830081
NML8	544890	829807

Simultaneous wind speed/direction data were recorded within the Proposed Wind Farm at various heights using a LiDAR device located at ITM coordinates 545983, 828334. The wind speed data collected at 105 m and 120 m was used to calculate wind speed at 110 m (proposed maximum hub height) which was then standardised to 10 m height in accordance with good practice.

Wind speed/direction and rainfall data were collected over the same time scale and averaged over the same ten-minute periods as the noise data to allow analysis of the measured background noise as a function of wind speed and wind direction. All data analysis was undertaken in accordance with ARWTN and the IOA GPG.

12.4.4 Criteria for the Assessment of Effects

The Environmental Protection Agency document *'Guidelines on the information to be contained in Environmental Impact Assessment Reports'* [13] has been adhered to for the assessment of potential effects as summarised below.

12.4.4.1 Criteria for Assessing Significance – Construction Noise

The significance criteria adopted for this assessment are based on Appendix E part E.3.2 of BS 5228-1:2009+A1:2014 and detailed in Table 12-7 below.

Table 12-7: Construction Noise Significance Criteria

Significance of Effect	Significance Level	
	Not Significant	Potentially Significant
Category A	≤65dB $L_{Aeq, T}$	>65dB $L_{Aeq, T}$

[13] *The Environmental Protection Agency, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports*

Significance of Effect	Significance Level	
	Not Significant	Potentially Significant
Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)		
Category A Evenings and Weekends (19:00 – 23:00)	<55dB $L_{Aeq, T}$	>55dB $L_{Aeq, T}$
Category A Night-time (23:00 – 07:00)	<45dB $L_{Aeq, T}$	>45dB $L_{Aeq, T}$
Note: The L_{Aeq} is the A-weighted, equivalent continuous sound level in decibels measured over a stated period of time, ($L_{Aeq,T}$) where T is the length of the assessment period (Time).		

It should be noted that exceedance of the limit does not in itself indicate a significant effect, rather, the standard states: '*If the site noise level exceeds the appropriate category value, 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.*'

12.4.4.2 Criteria for Assessing Significance – Wind Turbine Operational Noise

The DoEHLG 2006 Guidelines and ARWTN do not define significance criteria but describe a framework for the measurement of wind farm noise and give indicative noise levels considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development. Achievement of the DoEHLG 2006 Guidelines derived noise limits ensures that noise from the Proposed Wind Farm will comply with current Government guidance.

In terms of the EIA Regulations, in this noise and vibration assessment the use of the term "significance" refers to compliance or non-compliance with the DoEHLG 2006 Guidelines derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in DoEHLG 2006 Guidelines, then the noise effects are deemed not significant. Any breach of the derived Total DoEHLG 2006 Guidelines or Site Specific Noise Limits due to the Proposed Wind Farm has the potential to result in a significant effect.

It is not possible to predict if OAM will occur at any given site and if it does, how frequent and sustained it might be. The significance of AM will depend on its intensity, frequency of occurrence and duration, however it has the potential to be significant if it occurs at any wind farm. As it cannot be predicted or assessed in advance, mitigation measures can be adopted. A brief outline of the proposed approach following receipt of AM reported to the Local Authority has been provided in Section 12.7.2.

12.4.4.3 Limitations and Assumptions

The noise data collected during the background noise survey are representative of the typical background noise levels at the nearest NSRs[14] (accounting for operational noise from Dunneill and

[14] *Whilst the sound environment currently comprises the operational Dunneill and Kingsmountain wind farms, it is considered that noise for the Proposed Project should be assessed in its own terms and not relative to the wind farms it is replacing. No consideration of the current environment, including the operational wind farms, has been made in this assessment.*

Kingsmountain Wind Farms). The guidance in the DoEHLG 2006 Guidelines supplemented by ARWTN and the IOA GPG has been followed by suitably experienced Acoustic Consultants to ensure that the data collected is as representative as possible.

For the assessment locations where no background noise measurements were undertaken, noise data collected at proxy locations deemed representative of the background noise environment was used to assess the noise impacts at those receptors.

For construction noise, predictions have been undertaken based on an indicative construction programme and typical activities expected.

As detailed in Section 1.7.3 in Chapter 1: Introduction of this EIAR, various types and sizes of wind turbines, within the proposed ranges, have been selected and considered in the relevant sections of the EIAR. For the noise and vibration assessment, four candidate wind turbine models have been used for predictions of operational noise from the Proposed Wind Farm, whilst the final model of wind turbine to be used may differ from that presented in this assessment, operational noise levels would have to comply with the noise limits imposed by the Local Authority, derived in this noise assessment.

No other assumptions or data gaps have been identified.

12.5 Baseline Conditions

12.5.1 Current Baseline

The Proposed Wind Farm is located within a rural location where existing background noise levels at the NSRs are generally considered to be low (<30 dB at low wind speeds as defined in the DoEHLG 2006 Guidelines[15]). The predominant sound sources in the area include operational wind farm noise from both Dunneill and Kingsmountain Wind Farms, wind induced noise (wind passing through vegetation and around buildings) and birdsong, with cars on local roads also audible on occasions.

Table 12-8 and Table 12-9 provide a summary of the background noise levels measured during the monitoring period during the quiet daytime and night-time periods. As stated in 12.4.3.2, the data was collected over two periods of grid outage, where Dunneill and Kingsmountain Wind Farms (operating in the near vicinity) were both shut down such that no operational wind turbine noise was present in the measurements (further detail is provided in Section 5.5 of Appendix 12-2). Additionally, background noise data recorded during periods of rainfall (including the preceding 10-minute period in line with IOA GPG) have been excluded from the dataset, as well as other atypical data in accordance with best practice. Further information of the data recorded during the noise survey can be found in Appendix 12-2.

Table 12-8: Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	23.6	24.3	26	28.4	31.3	34.4	37.4	40.1	42.3	43.6	43.9	43.9
NML2	24.7	26.0	27.3	28.7	30.1	31.7	33.4	35.3	37.5	39.8	42.5	42.5
NML3	22.1	22.3	23.5	25.4	28.0	30.9	34.1	37.2	40.1	42.5	44.4	44.4

[15] *Section 5.4 of the DoEHLG 2006 Guidelines refers to ' low noise environments where background noise is less than 30 dB(A)'*

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML4	21.2	21.9	23.1	24.9	27.0	29.6	32.4	35.4	38.5	41.7	44.8	44.8
NML5	29.2	29.7	30.6	32	33.7	35.9	38.3	41.1	44.1	47.3	50.8	50.8
NML6	38.4	37.7	37.5	37.7	38.3	39.3	40.5	42.0	43.6	45.3	47.1	48.8
NML7	27.8	28.7	30.0	31.6	33.5	35.6	37.7	39.9	42.1	44.1	46.0	46.0
NML8	28.8	29.0	29.9	31.4	33.3	35.4	37.5	39.4	40.9	41.8	42.0	42.0

Table 12-9: Summary of Prevailing Background Noise Levels during Night-time Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	21.2*	21.2	22.2	24.1	26.7	29.7	33.0	36.4	39.6	42.4	44.7	46.1
NML2	24.8	24.9	25.3	25.9	26.9	28.2	29.9	32.1	34.8	38.0	41.7	46.1
NML3	19.8*	19.8	20.3	21.9	24.3	27.3	30.7	34.2	37.8	41.1	44.0	46.3
NML4	19.9*	19.9	20.4	21.8	23.9	26.7	29.9	33.4	37.1	40.7	44.3	47.5
NML5	27.0	27.2	27.8	28.9	30.4	32.3	34.7	37.4	40.4	43.9	47.6	51.7
NML6	35.9	36.9	37.6	38.1	38.5	38.9	39.4	40.1	41.1	42.5	44.5	47.1
NML7	27.0*	27.0	27.4	28.5	30.2	32.4	34.9	37.6	40.3	43.1	45.6	47.9
NML8	27.3*	27.3	27.6	28.6	30.3	32.3	34.6	36.9	39.0	40.8	42.0	42.5

** Flatlined where derived minimum occurs at lower wind speeds, see Section 5.8 of Appendix 12.2: Operational Noise Report.*

12.5.2 Future Baseline

Based on available information, the baseline environment is not expected to change significantly over the operational life of the Proposed Project as there are no known plans to introduce significant sources of noise which could influence background noise levels, such as major road schemes for example.

12.5.3 Summary of Sensitive Receptors

12.5.3.1 Scoped Out Receptors

All of the buildings within c. 2.5 km of the Proposed Turbines have been identified. All locations have been considered to be NSRs for the purposes of this assessment. The locations of the NSRs are presented in Figure 12-2.

12.5.3.2 Scoped In Receptors

Of all the NSRs identified within the 2.5 km search area (see Figure 12-2) around the Proposed Wind Farm, a sample of the nearest and likely to be most sensitive to noise were selected as Construction Noise Assessment Locations (CNALs) and Noise Assessment Locations (NALs). These were chosen to represent the noise sensitive receptors located closest to the Proposed Project during either the construction or operational phase.

The onsite 110kV substation and associated temporary construction compound are located within the Proposed Wind Farm and as such are addressed above. For the Proposed Grid Connection Route, rather than identifying individual NSRs on the Proposed Grid Connection Route and road and TDR junction improvements, the construction noise assessment considers the typical noise levels that are likely to occur along the length of the route.

The assessment results for the CNALs and NALs have been presented within the main body of this report, whilst noise predictions for all other NSRs have been included for completeness within Annex D of Appendix 12-1, and Annex 5 of Appendix 12-2.

For the assessment locations where no background noise measurements were undertaken, noise data collected at proxy locations deemed representative of the background noise environment was used to assess the noise impacts at those receptors.

12.6 Assessment of Likely Effects

12.6.1 'Do-Nothing' Scenario

An alternative land use option to repowering the Existing Wind Farm as part of the Proposed Project would be to leave the Existing Wind Farm as it is, with no changes made to the existing operation 23 no. wind turbines within the Existing Wind Farm. In doing so, environmental effects in terms of emissions are likely to be neutral for the short term, however 13 no. of the existing turbines (existing Dunneil Wind Farm) are due to be decommissioned in accordance with their planning permissions in 2039. Once the 13 no. turbines are decommissioned, there will be a negative effect on greenhouse gas emissions. The 10 no. turbines which were commissioned in 2003 will be left in situ (existing Kingsmountain Wind Farm). However, these machines are aging and are not as efficient as the newer machines. Although these turbines do not have a decommissioning date, they will eventually break down and have to be decommissioned. The opportunity to continue capturing the available renewable energy resource with the Existing Wind Farms would be lost.

An alternative land use option to developing a renewable energy project in the greenfield sections of the Proposed Wind Farm site (i.e areas of the Proposed Wind Farm site located outside the footprint of the Existing Wind Farm) would be to leave the area as it is with no changes made to the current land use practices of commercial forestry, turf cutting, and public road corridor.

In implementing the 'Do-Nothing' alternative, however, the opportunity to capture a significant part of Co. Sligo's renewable energy resource would be missed, as would the opportunity to contribute to meeting Government and EU 2030 targets for the production and consumption of electricity from renewable resources and the reduction of greenhouse gas emissions. In addition, the opportunity to meet the obligations as laid out in the Climate Action and Low Carbon Development Act 2021 will be lost. The opportunity to generate local employment, development contributions, and rates would also be forgone. Furthermore, the opportunity to implement the measures outlined in the Biodiversity Management and Enhancement Plan (BMEP) as outlined in Appendix 6-4 would also be lost.

In this scenario, there would be a reduction in noise levels following Dunneill Wind Farm's eventual decommissioning in 2039, though clearly as a result of this there would also be a reduction in

renewable energy. Over time, the Kingsmountain wind turbines would likely become less efficient (depending on levels of maintenance), and as a result will potentially lead to a deterioration in noise emissions as well. In time the machines will break down, resulting in further reduction in noise levels, but at the expense of renewable energy generation (which will have subsequent knock on effects on meeting the Government and EU 2030 targets).

12.6.2 Potential Construction Noise Effects

Table 12-10 presents the thresholds from BS 5228 Category A (lowest thresholds in the ABC method) and the calculated noise emission levels at each CNAL for all modelled scenarios. Full details of the modelling and assessment can be found in Appendix 12-1.

Table 12-10: Predicted Precautionary Scenario Construction Noise Imission Levels

CNAL	Category A Threshold dB $L_{Aeq, t}$			Immission Level, dB $L_{Aeq, t}$ for each Month																					
	Daytime (07:00 – 19:00) and Saturdays (07:00 - 13:00)	Evenings (19:00-23:00 weekdays.) Weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)	Night-Time (23:00 – 07:00)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Night
CNAL01	65	55	45	56	56	53	40	40	40	41	38	51	55	56	56	59	58	51	59	55	60	57	51	52	38
CNAL02	65	55	45	42	40	39	42	45	45	50	39	41	42	43	44	44	42	40	43	41	43	40	37	34	24
CNAL03	65	55	45	44	41	41	46	49	50	48	43	44	44	44	44	45	44	43	44	43	43	40	39	35	24
CNAL04	65	55	45	55	54	53	57	57	57	57	57	57	58	59	58	57	57	57	57	56	58	53	53	45	34
CNAL05	65	55	45	45	44	45	48	48	49	49	49	49	50	49	49	48	48	46	45	44	45	43	43	42	30
CNAL06	65	55	45	40	40	42	43	43	45	45	46	44	45	46	44	45	46	46	41	41	42	40	39	35	23
CNAL07	65	55	45	34	35	36	37	37	40	38	42	37	38	42	37	38	42	42	35	35	36	34	34	30	18
CNAL08	65	55	45	24	27	26	26	26	26	27	27	27	27	28	29	29	30	27	26	29	28	26	25	18	11

The Proposed Wind Farm construction noise assessment results show that the predicted construction noise levels are below the 65 dB(A) threshold Level at all CNALs for all assessment scenarios (months 1-21).

At CNAL 01 and 04, noise levels will be above the evening and weekend 55 dBA threshold levels. Whilst this is unlikely to result in a significant impact, as duration of exposure will be limited, it is recommended that construction activities are not undertaken in proximity to these properties outwith normal daytime working hours (Mon-Fri 07:00 to 19:00 and Saturday 07:00 to 13:00).

No construction activities are proposed during the night-time, however, a night-time scenario is included in the assessment in case of generator usage at night, for infrastructure such as welfare facilities and lighting only. It should be noted that out of necessity some activity outside of the core hours could arise, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair-weather windows for concrete deliveries, the erection of turbine blades and the erection and dismantling of cranes. No working would usually be undertaken outside core hours without prior agreement with the relevant Local Authority (LA). The predicted noise levels for this scenario are below the night-time 45 dBA threshold level.

Accordingly, the impact is deemed **not significant for construction noise effects**.

For the Proposed Grid Connection Route, the amount of required plant is relatively small, typically being based around an excavator for trenching and backfill activities. As such, construction activities in any one location will be limited in duration and adverse noise effects are anticipated to be negligible. Chapter 4 of the EIAR describes the construction of the Proposed Grid Connection Route underground electrical cable trench in more detail.

Where construction activities occur besides an NSR, the noise levels at that location are likely to be in the region of 75 – 80 dB(A) for a short period of time. It should be noted, however, that this would only occur where construction activities are close to an NSR. To put this into context, trenching and backfill activities are anticipated to move along the Proposed Grid Connection Route at approximately 150 m to 300 m a day, therefore, the length of time when construction activities will be occurring adjacent to any given receptor is only likely to be for a few hours. For the majority of the time, plant and equipment will be located at greater distances and noise levels will be lower.

It is possible that noise levels from directional drilling activities may occasionally exceed the BS 5228 threshold if within 20 m of a dwelling, however this would only occur for a short period of time at any one location. Whilst there are some NSRs that are close to being within 20 m, none fall into this range, and accordingly the impact is not deemed significant.

At some watercourse, culvert and drain crossings there may be a requirement for Horizontal Directional Drilling (HDD). Specifically, this could be required for some small bridge or water crossings. HDD for large crossings would require the use of multiple items of plant including pumps, mud recyclers, drilling rigs and generators, however, typical plant for these small crossings include the small Vermeer D36 x 50 Directional Drill. Calculations of the Vermeer DD rig, assuming a source noise level of 94 dB(A) at 1m, indicates that noise levels would be below the 65dB(A) threshold from a distance of approximately 30m. For small crossings, the work would likely be completed within 1 and 2 weeks so it will be short term only. Where activities involving the small HDD drilling rig are within 30m of a dwelling then noise mitigation measures will be implemented. This includes the erection of temporary boarding alongside the drilling rig or use of 'acoustic blanket panels' to hang from heras fencing or similar. This should be installed as close to the drilling rig as is practicable and fitted to interrupt any direct line of site between the drilling rig and the closest residential receptors. Examples of appropriate products include Echo Noise Defender and Soundex DeciBloc.

Construction works related to distant road junction improvements may also occur outwith the CNALs considered above, in close proximity to some residential receptors. It is possible that noise from these

activities may at times exceed the guideline levels, however it should be noted that this will be a short-term, temporary impact. Good practice during construction is recommended and will reduce noise levels from these short-term works to minimum levels. Further detail is provided in Appendix 12-1.

Accordingly, the impact is deemed **not significant for construction activities associated with Proposed Grid Connection Route cable trenching, bridge crossings and road junction upgrades along the turbine delivery route**.

12.6.3 Potential Construction Vibration Effects

As detailed in 12.4.1.2, due to the separation distances between the construction activity areas on the Proposed Wind Farm and the nearest receptors (which is in excess of 400 m for the closest NSR), construction vibration effects are deemed **not significant.**

For the Proposed Grid Connection Route, there is the potential for higher levels of construction related vibration where construction activities occur beside an NSR. This is as a result of the likely requirement for vibratory rollers for these sections. As previous it should be noted that this would only occur where construction activities are close to an NSR. To put this into context, trenching and backfill activities are anticipated to move along the Proposed Grid Connection Route at approximately 150 m to 300 m a day, therefore, the length of time when construction activities will be occurring adjacent to any given receptor is only likely to be for a few hours. For the majority of the time, plant and equipment will be located at greater distances and vibration levels will be lower. Construction vibration effects from the Proposed Grid Connection Route are deemed **not significant.**

12.6.4 Potential Operational Noise Effects

12.6.4.1 Setting the Total DoEHLG 2006 Guidelines Noise Limits (Stage 1)

Based on the prevailing background noise levels, the Total DoEHLG 2006 Guidelines Noise Limits have been established for each of the NALs as detailed in Table 12-11 and Table 12-12 below.

Table 12-11: Total DoEHLG 2006 Guidelines Noise Limit - Daytime

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
NAL2	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
NAL3	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
NAL4	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.1	49.1	51.0	51.0
NAL5	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5
NAL6	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.5	49.4	49.4
NAL7	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
NAL8	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
NAL9	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
NAL10	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
NAL11	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.5	48.2	50.1

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL12	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
NAL13	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9

Table 12-12: Total DoEHLG 2006 Guidelines Noise Limit – Night-time

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
NAL2	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
NAL3	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
NAL4	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.3	48.1	50.6	52.9
NAL5	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.7	51.1
NAL6	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.1	49.0	51.3
NAL7	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
NAL8	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
NAL9	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
NAL10	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
NAL11	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.2	44.9	47.0	49.8	53.1
NAL12	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
NAL13	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1

12.6.4.2 Predicting the Likely Effects and the Requirement for a Cumulative Noise Assessment (Stage 2)

A likely cumulative noise assessment was undertaken at the NALs and the results of the cumulative assessment are shown in Table 12-13 and Table 12-14 below. The Tables detail the Total DoEHLG 2006 Guidelines Noise Limits and predicted likely cumulative Proposed Wind Farm noise levels for daytime hours and night-time hours, when using the Nordex N149 5.x MW with Serrated Blades on a 105 m hub, as the precautionary scenario candidate wind turbine for the Proposed Wind Farm.

The result of the likely cumulative noise assessment show that the Proposed Wind Farm can operate concurrently with the other operational and permitted wind farms in the area, whilst still meeting the Total DoEHLG 2006 Guidelines Noise limits at all NALs and as such there would be **no significant effects** at those receptors. To note, there is an exceedance of the Night-time noise limit at NAL12, however this at this location the Proposed Wind Farm does not contribute to the predicted exceedance which is a result of the cumulative wind farms.

It is not possible to predict if OAM will occur at the NALs surrounding this Proposed Project and if it does, how frequent and sustained it might be. The significance of AM will depend on its intensity, frequency of occurrence and duration, however it has the potential to be significant if it occurs at any wind farm. As it cannot be predicted or assessed in advance, mitigation measures can be adopted, a brief outline of which are presented in Section 12.7.

To note, as a result of noise data being unavailable at the lower wind speeds for some of the other developments, the cumulative noise predictions have only been calculated for windspeeds more than or equal to 6m/s. The only locations where other developments contribute to the overall predicted cumulative noise level is at NAL1, 10, 11 and 13. At these locations there is over 10 dB headroom between the cumulative noise predictions and the Total Noise Limits at 6 m/s; given the predicted cumulative noise level will continue to decrease at wind speeds less than 6 m/s, there will continue to be over 10 dB headroom for predicted cumulative noise at the lower wind speeds and therefore have a negligible impact.

Table 12-13: Compliance Table – Comparison of predicted likely cumulative noise levels (all schemes) against the Total DoEHLG 2006 Guidelines Noise Limit at each receptor – Daytime

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	28.7	30.2	30.4	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-	-	-	-16.3	-14.8	-14.7	-16.7	-18.0	-18.3	-18.3
NAL2	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	36.1	37.5	37.5	37.5	37.5	37.5	37.5
	Exceedance Level	-	-	-	-	-	-8.9	-7.5	-7.6	-9.8	-11.1	-11.4	-11.4
NAL3	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	33.5	34.9	34.9	34.9	34.9	34.9	34.9
	Exceedance Level	-	-	-	-	-	-11.5	-10.1	-10.2	-12.4	-13.7	-14.0	-14.0
NAL4	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.1	49.1	51.0	51.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	34.6	36.0	36.0	36.0	36.1	36.1	36.1
	Exceedance Level	-	-	-	-	-	-10.4	-9.0	-9.0	-11.1	-13.0	-14.9	-14.9
NAL5	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	38.7	40.1	40.1	40.1	40.1	40.1	40.1
	Exceedance Level	-	-	-	-	-	-6.3	-4.9	-4.9	-4.9	-4.9	-7.4	-7.4
NAL6	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.5	49.4	49.4
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	40.1	41.5	41.5	41.5	41.5	41.5	41.5
	Exceedance Level	-	-	-	-	-	-4.9	-3.5	-3.5	-3.6	-6.0	-7.9	-7.9
NAL7	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.8	39.2	39.2	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-	-	-	-2.2	-5.8	-5.8	-5.8	-7.5	-10.6	-10.6

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL8	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	36.9	38.3	38.3	38.4	38.4	38.4	38.4
	Exceedance Level	-	-	-	-	-	-3.1	-6.7	-6.7	-6.6	-8.3	-11.4	-11.4
NAL9	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	23.7	25.2	25.2	25.3	25.3	25.3	25.3
	Exceedance Level	-	-	-	-	-	-16.3	-19.8	-19.8	-19.7	-21.4	-24.5	-24.5
NAL10	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	19.2	20.7	20.7	20.9	20.9	20.9	20.9
	Exceedance Level	-	-	-	-	-	-20.8	-24.3	-24.3	-24.1	-25.8	-28.9	-28.9
NAL11	Total DoEHLG 2006 Guidelines Noise Limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	46.5	48.2	50.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	23.3	24.9	25.3	25.8	25.8	25.8	25.8
	Exceedance Level	-	-	-	-	-	-21.7	-20.1	-19.7	-19.2	-20.7	-22.4	-24.3
NAL12	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	40.9	42.3	43.2	44.0	44.1	44.1	44.1
	Exceedance Level	-	-	-	-	-	-4.1	-2.7	-1.9	-3.3	-4.5	-4.8	-4.8
NAL13	Total DoEHLG 2006 Guidelines Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	27.9	29.4	30.1	30.7	30.8	30.8	30.8
	Exceedance Level	-	-	-	-	-	-17.1	-15.6	-15.0	-16.6	-17.8	-18.1	-18.1

Table 12-14: Compliance Table – Comparison of predicted likely cumulative noise levels (all schemes) against the Total DoEHLG 2006 Guidelines Noise Limit at each receptor – Night-time

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	28.7	30.2	30.4	30.6	30.6	30.6	30.6
	Exceedance Level	-	-	-	-	-	-14.3	-12.8	-12.6	-14.0	-16.8	-19.1	-20.5
NAL2	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	36.1	37.5	37.5	37.5	37.5	37.5	37.5
	Exceedance Level	-	-	-	-	-	-6.9	-5.5	-5.5	-7.1	-9.9	-12.2	-13.6
NAL3	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	33.5	34.9	34.9	34.9	34.9	34.9	34.9
	Exceedance Level	-	-	-	-	-	-9.5	-8.1	-8.1	-9.7	-12.5	-14.8	-16.2
NAL4	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.3	48.1	50.6	52.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	34.6	36.0	36.0	36.0	36.1	36.1	36.1
	Exceedance Level	-	-	-	-	-	-8.4	-7.0	-7.0	-9.3	-12.0	-14.5	-16.8
NAL5	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.7	51.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	38.7	40.1	40.1	40.1	40.1	40.1	40.1
	Exceedance Level	-	-	-	-	-	-4.3	-2.9	-2.9	-2.9	-2.9	-6.6	-11.0
NAL6	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.1	49.0	51.3
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	40.1	41.5	41.5	41.5	41.5	41.5	41.5
	Exceedance Level	-	-	-	-	-	-2.9	-1.5	-1.5	-1.5	-4.6	-7.5	-9.8
NAL7	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.8	39.2	39.2	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-	-	-	-5.2	-3.8	-3.8	-3.8	-6.5	-10.1	-13.3

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL8	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	36.9	38.3	38.3	38.4	38.4	38.4	38.4
	Exceedance Level	-	-	-	-	-	-6.1	-4.7	-4.7	-4.6	-7.3	-10.9	-14.1
NAL9	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	23.7	25.2	25.2	25.3	25.3	25.3	25.3
	Exceedance Level	-	-	-	-	-	-19.3	-17.8	-17.8	-17.7	-20.4	-24.0	-27.2
NAL10	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	19.2	20.7	20.7	20.9	20.9	20.9	20.9
	Exceedance Level	-	-	-	-	-	-23.8	-22.3	-22.3	-22.1	-24.8	-28.4	-31.6
NAL11	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.2	44.9	47.0	49.8	53.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	23.3	24.9	25.3	25.8	25.8	25.8	25.8
	Exceedance Level	-	-	-	-	-	-19.7	-18.1	-17.9	-19.1	-21.2	-24.0	-27.3
NAL12	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	40.9	42.3	43.2	44.0	44.1	44.1	44.1
	Exceedance Level	-	-	-	-	-	-2.1	-0.7	0.2	-0.6	-3.3	-5.6	-7.0
NAL13	Total DoEHLG 2006 Guidelines Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	27.9	29.4	30.1	30.7	30.8	30.8	30.8
	Exceedance Level	-	-	-	-	-	-15.1	-13.6	-12.9	-13.9	-16.6	-18.9	-20.3

12.6.4.3 Operational Phase - Derivation of Site-Specific Noise Limits for the Proposed Wind Farm (Stage 3)

It is demonstrated in the Stage 2 assessment above that cumulatively, all wind farms (including the Proposed Wind Farm) are predicted to operate within the Total DoEHLG 2006 Guidelines Noise Limits.

The IOA GPG then recommends that;

'Whenever a cumulative situation is encountered, the noise limits for an individual wind farm should be determined in such a way that no cumulative excess of the total ETSU-R-97 noise limit would occur.'

To ensure that no cumulative excess of the total WEDG2006 limits would occur, a set of Site Specific Noise limits for the Proposed Wind Farm are required. The Site Specific Noise Limits have been derived to take account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other wind farm developments in proximity to the Proposed Wind Farm. Table 12-15 summarises the approach adopted at each NAL to derive the Site-Specific Noise Limits.

Table 12-15: Limit Derivation Strategy

NAL	Limit Derivation Strategy
1, 9-13	The likely noise predictions from the Proposed Wind Farm are significantly below the Total WEDG Noise Limits (at minimum >13 dB below), and therefore these NALs can be scoped out of the need to be assessed.
2-8	The likely noise predictions from the other schemes were found to be more than 10 dB below the Total WEDG Noise Limits during the daytime and night-time and as such the other schemes do not require a share of the noise budget and the entire noise limits have been allocated to the Proposed Wind Farm.

The Site Specific Noise Limits were compared to the predictions of the Proposed Wind Farm operating on its own, and the results, based on the precautionary scenario candidate turbine for the Proposed Wind Farm (Nordex N149), are summarised below in Table 12-16 for the daytime and Table 12-17for the night-time. More details on the calculation of the Site Specific Noise Limits and predictions for the other three candidate wind turbines are provided in Appendix 12-2 and show similar predictions and outcomes when compared to the N149.

The Stage 3 assessment shows that the predicted wind turbine noise levels from the Proposed Wind Farm on its own meet the Site Specific Noise Limits at all NALs for both daytime and night time periods, there would be **no significant effects** at those receptors.

Table 12-16: Compliance Table – Comparison of predicted noise levels from the Proposed Wind Farm against the Site Specific Noise Limits at each receptor – Daytime

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL2	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	25.9	27.1	31.7	36.1	37.5	37.5	37.5	37.5	37.5	37.5
	Exceedance Level	-	-	-14.1	-12.9	-13.3	-8.9	-7.5	-7.6	-9.8	-11.1	-11.4	-11.4
NAL3	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.3	48.6	48.9	48.9
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	23.2	24.4	29.0	33.4	34.8	34.8	34.8	34.8	34.8	34.8
	Exceedance Level	-	-	-16.8	-15.6	-16.0	-11.6	-10.2	-10.3	-12.5	-13.8	-14.1	-14.1
NAL4	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.1	49.1	51.0	51.0
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	24.4	25.6	30.2	34.6	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-	-	-15.6	-19.4	-14.8	-10.4	-9.0	-9.0	-11.1	-13.1	-15.0	-15.0
NAL5	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	45.0	47.5	47.5
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	28.5	29.7	34.3	38.7	40.1	40.1	40.1	40.1	40.1	40.1
	Exceedance Level	-	-	-11.5	-10.3	-10.7	-6.3	-4.9	-4.9	-4.9	-4.9	-7.4	-7.4
NAL6	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.1	47.5	49.4	49.4
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	29.9	31.1	35.7	40.1	41.5	41.5	41.5	41.5	41.5	41.5
	Exceedance Level	-	-	-10.1	-8.9	-4.3	-4.9	-3.5	-3.5	-3.6	-6.0	-7.9	-7.9
NAL7	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	27.6	28.8	33.4	37.8	39.2	39.2	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-12.4	-11.2	-6.6	-2.2	-5.8	-5.8	-5.8	-7.5	-10.6	-10.6
NAL8	Site Specific Noise Limit, L_{A90}	40.0	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	46.7	49.8	49.8
	Proposed Wind Farm Turbine Noise L_{A90}	-	-	26.7	27.9	32.5	36.9	38.3	38.3	38.3	38.3	38.3	38.3
	Exceedance Level	-	-	-13.3	-12.1	-7.5	-3.1	-6.7	-6.7	-6.7	-8.4	-11.5	-11.5

Table 12-17: Compliance Table – Comparison of predicted noise levels from the Proposed Wind Farm against the Site Specific Noise Limits at each receptor - Night-time

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL2	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Wind Turbine Noise L_{A90}	-	-	25.9	27.1	31.7	36.1	37.5	37.5	37.5	37.5	37.5	37.5
	Exceedance Level	-	-	-17.1	-15.9	-11.3	-6.9	-5.5	-5.5	-7.1	-9.9	-12.2	-13.6
NAL3	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.6	47.4	49.7	51.1
	Predicted Wind Turbine Noise L_{A90}	-	-	23.2	24.4	29.0	33.4	34.8	34.8	34.8	34.8	34.8	34.8
	Exceedance Level	-	-	-19.8	-18.6	-14.0	-9.6	-8.2	-8.2	-9.8	-12.6	-14.9	-16.3
NAL4	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.3	48.1	50.6	52.9
	Predicted Wind Turbine Noise L_{A90}	-	-	24.4	25.6	30.2	34.6	36.0	36.0	36.0	36.0	36.0	36.0
	Exceedance Level	-	-	-18.6	-17.4	-12.8	-8.4	-7.0	-7.0	-9.3	-12.1	-14.6	-16.9
NAL5	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.7	51.1
	Predicted Wind Turbine Noise L_{A90}	-	-	28.5	29.7	34.3	38.7	40.1	40.1	40.1	40.1	40.1	40.1
	Exceedance Level	-	-	-14.5	-13.3	-8.7	-4.3	-2.9	-2.9	-2.9	-2.9	-6.6	-11.0
NAL6	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.1	49.0	51.3
	Predicted Wind Turbine Noise L_{A90}	-	-	29.9	31.1	35.7	40.1	41.5	41.5	41.5	41.5	41.5	41.5
	Exceedance Level	-	-	-13.1	-11.9	-7.3	-2.9	-1.5	-1.5	-1.5	-4.6	-7.5	-9.8
NAL7	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
	Predicted Wind Turbine Noise L_{A90}	-	-	27.6	28.8	33.4	37.8	39.2	39.2	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-15.4	-14.2	-9.6	-5.2	-3.8	-3.8	-3.8	-6.5	-10.1	-13.3
NAL8	Site Specific Noise Limit L_{A90}	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.7	49.3	52.5
	Predicted Wind Turbine Noise L_{A90}	-	-	26.7	27.9	32.5	36.9	38.3	38.3	38.3	38.3	38.3	38.3
	Exceedance Level	-	-	-16.3	-15.1	-10.5	-6.1	-4.7	-4.7	-4.7	-7.4	-11.0	-14.2

12.6.4.4 On-site Substation Operation

The 110 kV onsite substation will be installed in the western side of the Proposed Wind Farm. The closest receptor to the centre of the substation is NSR15, which is at a distance of approximately 360 m.

'EirGrid Evidence Based Environmental Studies Study 8: Noise'[20] presents measured noise levels for a similar 110 kV substation (Dunfirth Substation). Sound pressure level measurements are provided at four different locations around the substation at distances of 5 m and 10 m, which vary between 37 dB $L_{Aeq(T)}$ and 39 dB $L_{Aeq(T)}$. The document provides commentary on the measurements, stating, "The measured noise levels at the boundary of this substation are below the daytime WHO threshold limits for serious annoyance (55 dB L_{Aeq}) and moderate annoyance (50 dB L_{Aeq}) for outdoor living areas. They are also below the night-time free-field threshold limit of 42 dB (L_{Aeq}) for preventing negative effects on sleep."

Given the Eirgrid report presents results 5/10 m from the boundary, the proposed substation has been represented as a point source located at the approximate centre of the substation compound.

The distance from the assumed source location to the nearest noise-sensitive receptor, NSR15, is approximately 360 m. Using the highest measured noise level reported in the EirGrid study (39 dB LAeq at 10 m) and applying geometric divergence from the assumed source location, the predicted level of distance attenuation will be approximately 31 dB. Accordingly, the noise level from the substation at the receptor will be negligible.

12.6.5 Potential Cumulative Effects

Potential cumulative effects from noise between the Proposed Project and other permitted or proposed projects and plans in the area, (wind energy or otherwise), as set out in Section 2.7 in Chapter 2: Background to the Proposed Project of this EIAR, are set out below.

12.6.5.1 Construction Phase

No cumulative noise effects are anticipated in relation to the construction of the Proposed Wind Farm and other permitted or proposed projects and plans in the area, as set out in Section 2.7 in Chapter 2 of this EIAR. At the vast majority of CNALs, the maximum predicted noise levels as presented in

Table 12-10 12-10 are >10 dB below the threshold values. This means that even if other construction activities were taking place concurrently, the levels will be such that the addition of the construction noise associated with the Proposed Wind Farm will not result in an exceedance of the threshold values[16]. There are two CNALs (CNAL 01 and 04) where construction noise levels are within 10 dB of the threshold values, however as this would only occur for a short duration, no cumulative impacts are anticipated for any of the NSRs located in proximity to these CNALs.

No cumulative noise effects are anticipated in relation to construction of the Proposed Grid Connection Route and other permitted or proposed projects and plans in the area, as set out in Section 2.7 in Chapter 2 of this EIAR, as construction activities will be transient in nature along the route and will not be in any one location long enough for a significant impact to occur.

12.6.5.2 Operational Phase

The Proposed Wind Farm operational noise assessment has already taken cumulative impacts with other permitted nearby wind farms into consideration, as described in the above assessment. The likely

[16] *For example - 40 dB + 30 dB = 40.4 dB and this is considered to be a negligible change.*

cumulative operational noise assessment show that the Proposed Wind Farm can operate concurrently with the operational and permitted wind farms and there would therefore be **no significant cumulative wind turbines operational noise effects** at all NALs.

The on-site operational substation is located adjacent to Easky Water Treatment Plant and both are located some 360 m from NSR15. Given that the level of attenuation due to distance is expected to be in the region of 31 dB for the substation, any cumulative effect will be very minimal at NSR15, and below WHO threshold limits for serious annoyance (55 dB L_{Aeq}) and moderate annoyance (50 dB L_{Aeq}) for outdoor living areas. They will also be below the night-time free-field threshold limit of 42 dB (L_{Aeq}) for preventing negative effects on sleep.". There would therefore be **no significant cumulative substation operational noise effects** at all NALs.

12.7 Mitigation

12.7.1 Mitigation during Construction

No significant effects resulting from construction noise are predicted. Nevertheless, good practice measures to reduce and control noise during construction activities is recommended and will be detailed in a Construction Environmental Management Plan (CEMP) (Appendix 4-5) to minimise any potential impacts.

The core hours for the proposed works will be 07:00 to 19:00 Monday to Saturday. There will be no working on Sundays and Public Holidays, however, it should be noted that out of necessity some activity outside of the core hours could arise, from delivery and unloading of abnormal loads or health and safety requirements, or to ensure optimal use is made of fair weather windows for concrete deliveries, the erection of turbine blades and the erection and dismantling of cranes. If occasional work is undertaken outside of core hours, especially during construction of access tracks at the site entrance, this should be agreed in advance with the Local Authorities.

Additionally, construction activities close to residential dwellings will not be undertaken outside of the BS 5228 daytime hours (07:00 to 19:00 Monday to Friday and 07:00 to 13:00 on Saturdays).

Good onsite practices, both for construction of the Proposed Wind Farm and the Proposed Grid Connection Route will be implemented to minimise the likely effects. Particular care will be taken at watercourse crossings along the Proposed Grid Connection Route. Section 8 of BS 5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that will be employed onsite:

- Keep local residents informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Select inherently quiet plant where appropriate - all major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use;
- All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines will be shut down between work periods (or when not in use) or throttled down to a minimum;
- Regularly maintain all equipment used onsite, including maintenance related to noise emissions;
- Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and

- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures will be provided.
- At any location within 20m of a residential receptor, where directional drilling activities are required for the Proposed Grid Connection Route, the installation of temporary boarding alongside the drilling rig or 'acoustic blanket panels' hanging from Heras fencing (or similar) may be used to mitigate noise emissions.

12.7.2 Mitigation during Operation

The exact make and model of wind turbine to be used at the Proposed Wind Farm would be the result of a future tendering process. Achievement of the noise limits determined by this assessment would be a key determining factor in the final choice of the Proposed Wind Farm turbines. The noise modelling results presented within this EIAR Chapter are based on the Nordex N149 5.X MW turbine, which results in the highest predicted noise levels at the key wind speed range and is the precautionary scenario Proposed Wind Farm turbine. Predicted operational noise levels for three other candidate turbines are also included within Appendix 12-2.

The assessment for the Nordex N149 5.X MW turbine shows the predicted wind turbine noise emission levels meet the Site Specific Noise Limits under all conditions and at all locations for both daytime and night time periods. The assessment presented for the other three candidate turbines also demonstrate that the noise limits can be adhered to.

Whilst it is not possible to predict if OAM will occur, in the event that complaints are received regarding OAM, mitigation measures are available. The design of such mitigation measures can only be determined once the wind farm is operational if OAM is found to occur frequently and at sustained levels. For this Proposed Project, the developer is committed to investigating noise complaints, inclusive of any complaint which may relate to OAM (i.e. beyond overall noise levels found in planning conditions). To deal with the eventuality of a complaint, the developer proposes the following:

- A community liaison officer will be appointed prior to first generation of electricity and contact details made publicly available;
- Any complaint relating to noise can be reported to the community liaison officer, who will undertake an initial screening of the complaint (review of logs submitted, review of wind conditions and turbine data etc.) and speak to the complainant in person, with an eventual visit to the complainant location if possible;
- Following initial screening, the community liaison officer will be responsible for commissioning a detailed noise complaint investigation. This will include appointing a qualified acoustic consultant to undertake noise measurements at the complaint location and quantify the occurrence and depth (in dB) of OAM for every 10 minute of the measurement campaign. The measured 10 minute noise levels and OAM depth would also be correlated with 10 minute wind conditions and operational data to find patterns; and,
- If frequent and sustained OAM is found, then appropriate mitigation would be designed and implemented and the complainant informed by the community liaison officer. Mitigation measures considered would include: changes to the operation of the relevant wind turbine(s) by changing software parameters such as blade pitch for specific wind conditions and time periods, addition of blade furniture (such as vortex generators) to alter the flow of air over the wind turbine blades; and, in extreme cases, targeted wind turbine shutdowns in specific conditions.

12.8 Assessment of Residual Effects

12.8.1 Residual Construction Effects

Predicted construction noise and vibration levels are below the assessment criteria at all receptors, for all phases of construction. Due to the low background noise levels at some locations, elements of construction noise could be audible at the closest residential receptor for certain periods during the construction phases. However, with or without the good practice construction mitigation measures outlined above there would be **no significant residual effects**.

For the Proposed Grid Connection Route, accounting for the measures highlighted in BS 5228 at watercourse crossings, in addition to accounting for the short term nature of the works, it is considered that there would be **no significant residual effects**.

12.8.2 Residual Operational Effects

The predicted Proposed Wind Farm operational noise levels at all NALs lie below the daytime and night time Site-Specific Noise Limits. In addition, the cumulative noise predictions from the Proposed Wind Farm and other operational and consented wind farms lie below the Total DoEHLG 2006 Guidelines Noise Limits. Whilst it is not possible to predict if OAM will occur, potential mitigation measures to reduce OAM have been identified in Section 12.7.2 above. The detail of the appropriate mitigation to be adopted will be determined once the wind farm is operational if and when OAM were to occur, following on-site noise measurements and assessments triggered by a complaint investigation. There would be **no significant residual effects.**

At some locations, under some wind conditions, and for a certain proportion of the time, operational noise from the Proposed Wind Farm would be audible; however, it would be at an acceptable level in relation to the DoEHLG 2006 Guidelines and as such, regardless of which turbine dimensions are selected within the proposed range, there would be **no significant residual effects from operational wind turbine noise**.

The predicted level of noise from the centre of the on-site substation to the nearest NSR (NSR15, with separation distance of 360m) will be negligible as the level of expected attenuation from distance will be approximately 31 dB. Accordingly, the noise level from the substation at the NSR will be negligible. **There would be no significant residual effects from the operation of the substation**.

12.8.3 Residual Cumulative Effects

It was found that without mitigation there would be no significant cumulative construction noise and vibration effects. As such there would be **no residual cumulative effects during the construction phase**.

Predicted operational noise levels owing to the Proposed Wind Farm at all the NALs lie below the Total DoEHLG 2006 Guidelines Noise Limits during the daytime and night-time periods. There would be **no residual cumulative effects during the operational phase**.

12.9 Summary

Predicted construction noise levels compared with the Category A criteria outlined in Section E.3 of BS 5228: Part 1 2009+A1:2014 indicate that construction noise levels are below the guidelines considered acceptable at all receptors and that predicted levels would be short term. Construction vibration would also likely be at low levels and would be short term. Activities related to decommissioning of the Proposed Wind Farm would use similar plant to that used for construction activities (including decommissioning of the existing turbines) and would occur at the same locations, as such noise level

output during the decommissioning phase is expected to be no higher than the construction phase. Therefore, **no significant noise and vibration effects are anticipated for the construction and decommissioning phases.** Good practice during construction and decommissioning is recommended to minimise any potential noise impacts.

During the construction of the Proposed Grid Connection Route there will be short periods of time where noise levels may exceed the BS 5228 threshold levels, however, this will only occur when associated activities occur directly adjacent to a residential property. The duration of such activities at any given receptor is anticipated to be short, therefore no significant impacts are anticipated. Where Horizontal Directional Drilling (HDD) activities are required for watercourse crossings, temporary noise barriers, or similar, should be installed to reduce noise levels at the nearest dwellings and best practice mitigation measures should be employed in line with recommendations made in BS 5228

The guidance contained within the DoEHLG 2006 Guidelines was used to assess the likely operational noise impact of the Proposed Wind Farm. Predicted levels and measured background noise levels indicate that for dwellings neighbouring the Proposed Wind Farm, wind turbine noise would meet the noise criteria established in accordance with the DoEHLG 2006 Guidelines, therefore **no significant effects are anticipated for the wind turbine operational noise.** There is a slight exceedance at NAL12 during the Night-time period, however predicted noise from the Proposed Wind Farm is not contributing to this exceedance and is a result of the other cumulative wind farms. Wind turbine noise would also meet the Site-Specific Noise Limits at all NALs for all wind speeds and directions.

There are a range of wind turbine models that would be appropriate for the Proposed Wind Farm. The candidate wind turbines used for this assessment were chosen in order to allow a representative assessment of the noise impacts. Should the Proposed Project receive consent, the final choice of wind turbine would be subject to a competitive tendering process but will fall within the range of parameters assessed within this EIAR. The final choice of wind turbine will, however, have to meet the noise limits determined and contained within any condition imposed.

Whilst it is not possible to predict if OAM will occur, potential mitigation measures to reduce OAM have been identified and the developer is proposing to appoint a community liaison officer with a commitment to investigate complaints which may relate to OAM. However, the detail of appropriate mitigation to be adopted can only be determined once the wind farm is operational, following on-site noise measurements and assessments triggered by a complaint investigation. In the event that frequent and sustained OAM is identified, suitable mitigation will be implemented and therefore no significant effects are likely as a result of OAM.

Consideration has been made to operational noise from the proposed substation. The assessment referenced a document prepared by Eirgrid which presents measured noise levels for a 110 kV substation. Measured levels were reported to be between 37 dB LAeq(t) and 39 LAeq(t) at distances of ~5-10 m. A calculation was therefore undertaken using these measured levels at the nearest NSR to the substation (located some 360 m from the centre of the substation), and it was found that the level of distance attenuation will be approximately 31 dB. Accordingly, the noise level from the substation at the receptor is considered **not significant**.

12.10 EIA Classification Summary Table

Please see the below table for a summary of all identified impacts for the Proposed Project relating to noise and vibration.

Table 12-18 Impact Assessment Classification Summary

Topic	Pre-Mitigation Effect	Mitigation Section Reference	Residual Effect	Significance
Construction Phase				
Decommissioning and removal of Kingsmountain and Dunneill Turbines	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Temporary Construction Compounds (TCCs)	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Road junction and access track upgrades	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Forestry Felling (around substation and turbines)	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Borrow Pit Operation	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Turbine Hardstands	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Substation and Ancillary Construction Works	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant

Topic	Pre-Mitigation Effect	Mitigation Section Reference	Residual Effect	Significance
Wind Turbine Erection	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Proposed Grid Connection	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Turbine Delivery Route	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) Section 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant
Operational Phase				
Assessment of Wind Turbine Noise	Long-Term, Not Significant, Negative	Section 12.7.2	Long-Term, Not Significant, Negative	Not Significant
Assessment of Substation Noise	Long-Term, Not Significant, Negative	Section 12.7.2	Long-Term, Not Significant, Negative	Not Significant
Decommissioning Phase				
Removal of wind turbines	Short-Term, Not Significant, Negative	12.7.1 (Chapter 12) 5 (TA 12.1)	Short-Term, Not Significant, Negative	Not Significant