

## 13 NOISE

### 13.1 INTRODUCTION

This chapter of the EIAR assesses the effects of the Project from noise impacts. The Project refers to all elements of the application for the proposed Carrigeen Renewable Energy Development (**Chapter 2: Development Description**). The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Wind Farm Site

The Project refers to all elements of the application for the construction and operation of the Wind Farm Site and the Grid Connection (**Chapter 2: Development Description**).

This chapter of the EIAR is supported by the following Appendices documents provided in **Volume IV** of this EIAR:

- **Appendix 13.1:** Noise monitor in-situ
- **Appendix 13.2:** Methodology for calculating wind shear, different hub heights and standardising hub height wind speed
- **Appendix 13.3:** Derived background noise levels, background plus 5 trendline with the predicted noise levels against a noise limit of 43dB(A) at each receptor
- **Appendix 13.4:** SoundPlan noise outputs
- **Appendix 13.5:** Calibration certificates of noise instruments
- **Appendix 13.6:** Candidate turbine manufacturer's Performance Specification
- **Appendix 13.7:** Noise Monitoring Programme

#### 13.1.1 Statement of Authority

Irwin Carr Consulting is based in County Down. The company has a proven track record in noise impact assessments throughout the UK and Ireland, with extensive knowledge of the issues in relation to noise from wind energy developments. Mark Burke and Shane Carr carried out the noise modelling in this assessment and contributed to the report. Mark is a Consultant in Irwin Carr Consulting, primarily responsible for environmental noise and noise monitoring. He has experience working in both the public and private sectors having previously obtained a BSc (Hons) Degree in Environmental Health and a Post-Graduate Diploma in Acoustics. Shane is a Director in Irwin Carr Consulting, primarily responsible for environmental noise and noise modelling. He has over 22 years' experience working in both the public and private sectors having previously obtained a BSc (Hons) Degree in

Environmental Health and a Post-Graduate Diploma in Acoustics. Shane has been responsible for undertaking and reviewing noise impact assessments on numerous large scale wind farms throughout the UK and Ireland.

Brendan O'Reilly has a Master's degree in noise and vibration from Liverpool University and has over 40 years' experience in noise and vibration control (and many years' experience in preparation of noise impact statements) and has been a member of a number of professional organisations. Brendan was a co-author and project partner (as a senior noise consultant) in 'Environmental Quality Objectives Noise in Quiet Areas' administered by the EPA. Brendan has considerable experience in the assessment of noise impact and has compiled studies for over 100 wind farm developments throughout Ireland, north and south. Brendan carried out the baseline study.

### 13.1.2 Acoustic Terminology

Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment, is transitory, fluctuates, and is normally localised. Environmental noise is normally assessed in terms of A-weighted decibels, dB (A), when the 'A weighted' filter in the measuring device elicits a response which provides a good correlation with the human ear. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general, a noise level is liable to provoke a complaint whenever its level exceeds by a certain margin, the pre-existing noise level or when it attains an absolute level. A Noise Monitoring Programme has been included in **Appendix 13.7**. A change in noise level of 3 dB (A) is 'barely perceptible', while an increase in noise level of 10 dB (A) is perceived as a twofold increase in loudness. A noise level in excess of 85 dB (A) gives a significant risk of hearing damage. Construction and industrial noise sources are normally assessed and expressed using equivalent continuous levels,  $L_{Aeq}^1$ . Wind turbine source noise is generally expressed in  $L_{eq}$  dBA and in sound power levels (LWA dB). Sound power level is a measure of the noise source while sound pressure level is a measurement taken at a distance from the noise source carried out with a noise meter.

Operational wind turbine noise is assessed using the  $LA_{90}^2$  descriptor, which allows reliable measurements to be made without corruption from relatively loud transitory noise events from

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<sup>1</sup>  $L_{Aeq}$  is defined as being the A-weighted equivalent continuous steady sound level that has the same sound energy as the real fluctuating sound during the sample period and effectively represents a type of average value.

<sup>2</sup>  $LA_{90}$ , or  $L_{90}dBA$  is defined as the noise level equaled or exceeded for 90% of the measurement interval and with wind farm noise the interval used is 10 minutes.

other sources. The LA90 should be used for assessing both the wind energy development noise and background noise as stated in the Wind Energy Development Guidelines 2006 (the Guidelines) and the Draft Revised Wind Energy Development Guidelines 2019 (DRWEDG 2019). As discussed in ETSU-R-97<sup>3</sup> the LA90 is 1.5-2.5 dBA less than the LAeq measured over the same period. In this assessment, the difference between LAeq and LA90 is given as 2 dBA which is best practice and the value most commonly applied in wind farm assessments in Ireland. Wind turbine noise levels are given as sound power levels (LWA) dB at integer wind speeds up to maximum LWA levels. **Table 13.1** gives a comparison of noise levels in our everyday environment.

**Table 13.1: Comparison of sound pressure level in our Environment<sup>4</sup>**

Source/Activity	Indicative noise level dBA
Threshold of hearing	0
Rural night-time background	20-50
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/hr at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/hr at 100m	65
Inside a typical shopping centre	70-75
Inside a modern car at around 90km/hr	75-80
Passenger cabin of jet aircraft	85
City Traffic	90
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

### 13.1.3 Assessment Structure

This Chapter contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in baseline surveys and in the assessment of the significance of effects
- Baseline Description - a description of the baseline noise of the area surrounding the Project based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment that could not be obtained
- Assessment of Potential Effects - identifying the ways in which noise receptors could be affected by the Project, including a summary of the measures taken during design of the Project to minimise noise effects

<sup>3</sup> ETSU-R-97, The Assessment & Rating of Noise from Wind Farms, June 1996

<sup>4</sup> Fact sheet published by the Australian Government (Greenhouse Office) and the Australian Wind Energy Association

- Mitigation Measures and Residual Effects - a description of measures recommended to off-set potential negative effects and a summary of the significance of the effects of the Project after mitigation measures have been implemented
- Cumulative Effects – identifying the potential for effects of the Project to combine with those from other wind farm developments
- Summary of Effects
- Statement of Significance

## **13.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA**

### **13.2.1 Assessment Methodology**

This assessment has involved the following elements, further details of which are provided in the following sections:

- Legislation and guidance review.
- Desk study, including review of available maps and published information.
- Site walkover.
- Evaluation of potential effects.
- Evaluation of the significance of these effects.
- Identification of measures to avoid and mitigate potential effects.

### **13.2.2 Description of Effects**

The significance of effects of the Project is described in accordance with the EPA guidance document '*Guidelines on the information to be contained in the Environmental Impact Assessment Reports (EIAR), EPA May 2022*'. The details of the methodology for describing the significance of effects are provided in Table 3.4: Section 3.7.3 of the aforementioned EPA 2022 document.

### **13.2.3 Relevant Legislation and Guidance**

The noise assessment is carried out in accordance with the guidance contained in the following documents:

- Wind Energy Development Guidelines (WEDG)<sup>5</sup> 2006 (the 2006 Guidelines)
- Recent 2023 An Coimisiún Pleanála Decision on Noise Limits
- WHO 2018 Environmental Noise Guidelines for European Region (WHO 2018)
- Draft Revised Wind Energy Development Guidelines December 2019 (DRWEDG 2019).

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<sup>5</sup> Department of Environment, Heritage and Local Government: Wind Energy Development Guidelines, Guidelines for Planning Authorities 2006 Energy

- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise including Supplementary Guidance Note 4: Wind Shear<sup>6</sup> (the IOA Good Practice Guide) 2013.
- ISO 1996<sup>7</sup> Acoustics-Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Assessment Procedures Third Edition (ISO 1996).
- ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation
- ETSU-R-97<sup>8</sup>: The Assessment & Rating of Noise from Wind Farms (ETSU-R-97)
- Institute of Acoustics Amplitude Modulation Working Group<sup>9</sup>, WSP Turbine AM Review<sup>10</sup> and IEC Technical Specification 61400-11-2 Wind energy generation systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics in receptor position, 2024<sup>11</sup>.
- National Roads Authority (NRA) Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004.
- Transport Infrastructure Ireland (TII) document Good Practice Guidance for the Treatment of Noise during the planning of National Road Schemes, 2014.
- BS 5228:2009-1+A1:2014, *Code of Practice for Noise and Vibration Control on Construction and Open Sites* (two parts).

### 13.2.3.1 Wind Energy Development Guidelines 2006

The following are a number of key extracts from the 2006 Guidelines in relation to noise impact:

#### General Noise Impact

*“Noise impact should be assessed by reference to the nature and character of noise sensitive locations.”*

*“Separate noise limits should apply for day-time and for night-time”*

*“Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.”*

<sup>6</sup> Institute of Acoustics (2013) A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise

<sup>7</sup> ISO 1996/1- Acoustics-Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures

<sup>8</sup> ETSU-R-97: Acoustics-The Assessment & Rating of Noise from Wind Farms: ETSU for the DTI, UK, 1996

<sup>9</sup> IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group, Final Report, A Method for Rating Amplitude Modulation in Wind Turbine Noise, August 2016

<sup>10</sup> Wind Turbine AM Review, Phase 2 Report, Department of Energy & Climate Change, WSP/Parsons Brinckerhoff, August 2016

<sup>11</sup> IEC Technical Specification 61400-11-2 Wind energy generation systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics in receptor position, 2024

### Measurement Units

*“The descriptor [LA90 10min] which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other sources, should be used for assessing both wind energy development noise and background noise.”*

### Specific Noise Limits

*“Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.”*

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

*However, in very quiet areas, the use of the margin of 5 dB(A) above the background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments. Instead in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of LA90,10min of the wind energy development noise should be limited to an absolute level within the range 35-40 dB(A)”.*

*“During the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43 dB(A) will protect sleep inside properties during the night”*

The 2006 Guidelines do not specify daytime or night-time hours. However, it is considered good practice to follow the framework given in ETSU-R-97 and IOA Good Practice Guide where daytime and night-time hours are specified. The limits are based on the prevailing background noise level for ‘quiet daytime’ periods, defined in ETSU-R-97 as:

- Quiet waking hours or quiet day-time periods are defined as:
  - All evenings from 18:00 to 23:00 hrs
  - Saturday afternoon from 13:00 to 18.00 hrs and all-day Sunday 07:00 to 18:00 hrs
- Night-time is defined as 23:00 to 07:00 hrs

### **13.2.3.2 An Coimisiún Pleanála**

#### 2022 An Coimisiún Pleanála Decision

A recent decision by ACP for a wind farm (ABP-309306-21, dated 26<sup>th</sup> September 2022) gave noise limits in accordance with the 2006 Guidelines and were as follows:

- (a) between 7am and 11pm:
  - (i) the greater of 5 dB(A) L90,10min above background noise levels, or 45 dB(A) L90,10min, at wind speeds of 5m/s or greater,

- (ii) 40 dB(A) L90, 10min, at all other wind speeds.
  - (b) 43 dB(A) L90,10min at all other times
- where wind speeds are measured at 10 metres above ground level.

### **13.2.3.3 World Health Guidelines (WHO) 2018**

The most recent WHO 2018 Guidelines: 'Environmental Noise Guidelines for the European Region' gives a recommendation limit of 45 dB Lden which is based on low quality evidence. This is an annual average noise level, based on wind speed and direction in the vicinity of the Wind Farm Site with no specific limits for night.

RPS<sup>12</sup> were requested by the Department of Communications, Climate Action and Environment to carry out a comparison between the WHO recommended level of 45dB Lden level in the WEDG limit level of 43dBLA90.

The limit levels in the WEDG are a worst-case limit when a turbine is operating at full power, while the WHO limits are average levels. RPS considered the percentage of times when the turbines were operating at their maximum levels, based on typical Irish wind speed measurements and concluded:

*It is reasonable to conclude from both these calculations that the annual average noise output from wind turbines in Ireland will be sufficiently lower than the maximum rated sound power to be consistent with the WHO guidelines.*

We have assumed that compliance with the limit levels in the WEDG is consistent with the recommended levels in the 2018 WHO document.

### **13.2.3.4 Draft Revised Wind Energy Development Guidelines 2019 (DRWEDG 2019)**

There have been a number of draft guidelines over the years with the latest one being in December 2019. The DRWEDG 2019 guidelines, currently in draft format are subject to significant public and stakeholder consultation and liable to change, in line with best practice. A tender has been issued by the Department of Environment, Climate and Communications to review and re-draft the Wind Energy Development Guidelines. This process has yet to be completed.

This assessment is based on the current guidance outlined in **Section 13.2.3.1**.

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<sup>12</sup> MGE0713RP0001F01, Draft Wind Energy Guidelines – Wind Turbine Analysis, RPS Nov 2018

### 13.2.4 Institute of Acoustics Statement in Respect of Wind Farm Noise

The Institute of Acoustics is the professional body in Ireland and the UK for those working in the field of acoustics. In December 2024 they issued a statement with regard to Amplitude Modulation, Infrasound, Low Frequency Noise and vibration, as presented below:

#### *Amplitude Modulation*

*'Amplitude Modulation' (AM) is a feature of the character of wind farm noise caused by the cyclical nature of the blades. An understanding of the causal mechanisms has been gained in recent years, along with control methods to help assist with sites where AM can lead to complaints. An IOA endorsed metric was published in 2016 and can be found at: [<http://ioa.org.uk/publications/wind-turbine-noise>]. A sample planning condition was proposed by IOA members which was published in the IOA bulletin (November-December 2017 issue).*

#### *Infrasound*

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

#### *Low Frequency Noise*

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

#### *Vibration*

*Vibration from operational wind turbines has been measured by extremely sensitive measurement equipment such as seismic arrays. but in terms of human perception, measured vibration levels are well below perception thresholds even on the actual wind*

*turbine sites. There is, therefore, no need to assess vibration affecting people for operational wind turbine developments.*

### 13.2.5 Desk Study

The locations for noise monitoring were selected by inspection of Site layout maps and by identifying the nearest receptors surrounding the wind turbines. The Noise Study Area has been defined such that the predicted results have been included for all residential receptors within 2km of the Wind Turbines.

The six noise monitoring locations are considered representative of the local noise environment. They were set-up in line with the Institute of Acoustics Good Practice Guide and geographically sited to obtain noise measurements all across the site. **Appendix 13.1** shows the set-up and location of each monitoring location.

### 13.2.6 Acquisition and Analysis of Background Noise Data

The 2006 Guidelines, ETSU-R-97 and the IOA Good Practice Guide recommend the measurement and use of wind speed data, against which background noise measurements are correlated. The IOA Good Practice Guide Supplementary Guidance Note 4<sup>13</sup>. (**Appendix 13.2**) gives the methodology to account for wind shear, calculation to hub height and to standardise 10m height wind speed.

A temporary Met Mast positioned within the Wind Farm Site during the noise survey was used for wind data measurements over 10-minute intervals.

The wind speed at the 103.5m hub height of the proposed wind turbines was then standardised to 10m height wind speed with the wind speed plotted against the 10-minute background noise data to derive a best fit polynomial curve.

### 13.2.7 Prediction of Wind Turbine Noise Levels

The predicted noise levels follow the methodology given in the IOA Good Practice Guide. Noise level calculations complies with ISO 9613-2<sup>14</sup> which provides a prediction of noise levels likely to occur under worst-case down-wind conditions.

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<sup>13</sup> IOA, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise- Supplementary Guidance Note 4: Wind Shear

<sup>14</sup> ISO 9613-2 Acoustics -Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation

There are numerous models for predicting noise from a point source and some of these models are specifically used for the prediction of noise from wind farms. In this noise assessment the SoundPLAN software package was used to calculate the noise level at the receptors.

The SoundPLAN propagation model calculates the predicted sound pressure levels by taking the source sound power level for each turbine in their respective octave bands and subtracting a number of attenuation factors according to the following formula:

$$\text{Predicted Octave Band Noise level} = LW + D - (A_{\text{geo}} + A_{\text{atm}} + A_{\text{gr}} + A_{\text{br}} + A_{\text{mis}})$$

The predicted octaves from each of the turbines are summed to give the predicted noise level expressed as dBA.

No allowance has been made for the character of noise emitted by the turbines, however in general the emissions from wind turbines are broadband in nature. In the unlikely event of a turbine exhibiting clearly tonal components at any receptor, the turbine would be turned down or stopped until such tonality is ameliorated. A guarantee will be required in the procurements of the turbine to be used onsite, stating that there should be no clearly tonal or impulsive components audible at any noise sensitive receptor location.

**Section 13.2.8** and **Section 13.2.9** below further address Amplitude Modulation and low frequency noise.

#### **A<sub>geo</sub> – Geometric Spreading**

Geometric (spherical) spreading from a simple free-field point source results in attenuation over distance according to:

$$L_p = L_w - (20 \log R + 11)$$

Where:

L<sub>p</sub> = sound pressure level

L<sub>w</sub> = sound power level

R = distance from the turbine to receiver

#### **D – Directivity Factor**

The directivity factor allows for adjustment where the sound radiated in the direction of the receptor is higher than that for which the sound power level is specified. In this case, the sound power levels are predicted as worst case propagation conditions, i.e. all receptors are assumed to be in downwind conditions.

**A<sub>gr</sub> - Ground Effects**

Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from the turbine to receiver. The prediction of ground effects is complex and depends on the source height, receiver height, propagation height between the source and receiver and the intervening ground conditions.

Ground conditions are described according to a variable defined as G, which varies between 0 for hard ground and 1 for soft ground. Although in reality the ground is predominately porous, it has been modelled as mixed 50% hard and 50% porous corresponding to a ground absorption coefficient of 0.5. Our predictions have been carried out using a source height corresponding to the proposed height of the turbine nacelle, a receiver height of 4m and an assumed ground factor of G=0.5 as recommended in the IOA Good Practice Guide.

**A<sub>bar</sub>- Barrier Attenuation**

The effect of a barrier (including a natural barrier) between a noise source and receptor is that noise will be reduced according to the path difference (difference between the direct distance between source to receptor and distance between source and receptor over the barrier). The reduction is relative to the frequency spectrum of the sound and may be predicted according to the method given in ISO 9613. In practice, barriers can become less effective in downwind conditions. A barrier can be very effective when it lies within a few metres of the receptor. In the prediction model, zero attenuation is given for barrier effects, which is a worst-case scenario setting.

**A<sub>atm</sub> - Atmospheric Absorption**

Sound emergence through the atmosphere is attenuated by conversion of sound energy to heat. This energy is dependent on the temperature and relative humidity of the air, but only weakly on ambient pressure through which the sound is travelling and is frequency dependent, with increasing attenuation towards higher frequencies. The attenuation by atmospheric absorption A<sub>atm</sub> in decibels during propagation through distance in metres is given by:

$$A_{\text{atm}} = d \times \alpha,$$

$\alpha$  = atmospheric absorption coefficient in dBm<sup>-1</sup>

d = distance from turbine

Values of  $\alpha$  from ISO 9613 Part 1, corresponding to a temperature of 10 °C and a relative humidity of 70 % has been used for these predictions and are given in **Table 13.2** below. These values are recommended in the IOA Good Practice Guide.

**Table 13.2: Frequency dependent atmospheric attenuation coefficients (dB/m)**

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient (dB/m)	0.0001	0.0004	0.001	0.0019	0.0037	0.0097	0.0328	0.117

**$A_{misc}$  – Miscellaneous Other Effects**

ISO 9613 includes effects of propagation through foliage, industrial plants and housing as additional attenuation effects. These have not been included here and any such effects are unlikely to significantly reduce noise levels below those predicted.

The ISO 9613-2 standard calculates under downwind propagation conditions and therefore predicts the average downwind sound pressure level at each dwelling. The model assumes that the wind is directly downwind from each turbine to each dwelling. The prediction model is calculated as a worst-case scenario.

The predicted noise levels  $L_{Aeq, 10min}$  are converted to the required  $L_{A90, 10min}$  by subtracting 2 dBA.

### 13.2.8 Aerodynamic Modulation or Aerodynamic Noise

Aerodynamic noise originates from the flow of air over, under and around the blades and is generally broadband in character. It is directly linked to the movement of the rotors through the air and will occur to varying degrees whenever the turbine blades move. Aerodynamic noise is generally both broadband i.e. it does not contain a distinguishable note or tone, and of random character, although the level is not constant and fluctuates in time with the movement of the blades. The dominant character of such aerodynamic noise is therefore normally a 'swish' type of sound, which is familiar to most people who have stood near to a large wind turbine.

The sound level of aerodynamic noise from wind turbine blades is not completely steady but is modulated (fluctuates) in a cycle of increased and then reduced level, sometimes called "*blade swish*", typically occurring in step with the angle of rotation of the blades and so being periodic at the rotor's rotational speed – for typical commercial turbines, this is at

a rate of around once or twice per second. This phenomenon is known as Amplitude Modulation of Aerodynamic Noise or more succinctly by the acronym AM. In some situations, however, the modulation characteristics can change in character to the point where it can potentially give rise to increased annoyance.

In early wind turbine designs, where the rotor was positioned downwind of the tower, a pronounced 'beat' was audible as each blade passed through the turbulent wake shed from the tower. However, this effect does not exist for the upwind rotor designs found on the majority of modern wind turbines, including the proposed site where the air flow to the blades is not interrupted by the tower structure. Instead, with modern turbines where the air flow to the blades is not interrupted by the tower structure, the primary mechanism in wind turbine AM arises from the uninterrupted flow of air over, under and around the blades.

The most recent information in relation to assessing AM comes in the IEC TS 61400-11. The scope of this document includes an assessment of the sound characteristics of the noise and relies on the Institute of Acoustics Reference Method (IoA RM) to quantify the AM level along with the penalty scheme as shown in **Figure 1** below.

The introduction to the IEC states:

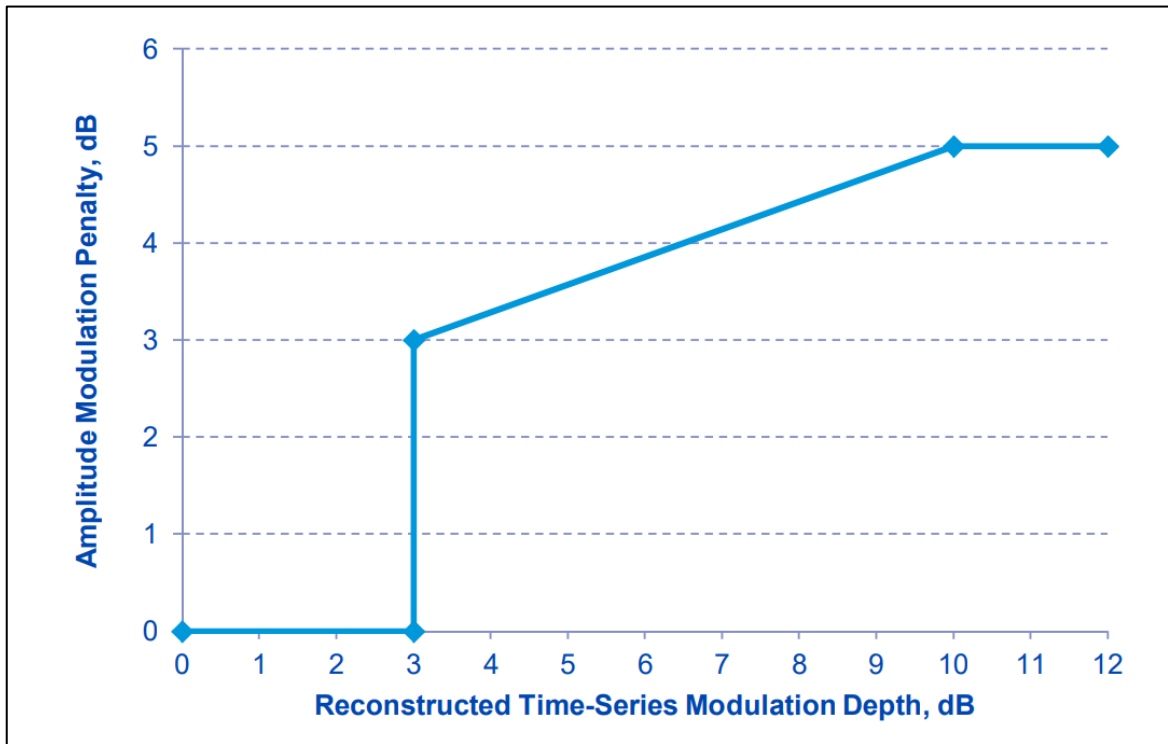
*The primary objective of this document is to establish uniform measurement and data analysis techniques to facilitate the evaluation of the A-weighted sound pressure level, or other acoustical properties, attributable to wind turbines at representative far-field locations.*

The IEC relies on the IoA RM for calculation of the reconstructed time-series. The modulation depth for the 10 s block is calculated by subtracting the 5th percentile (L95) of the reconstructed time-series from the 95th percentile (L5) in the manner of the maximum of the entire 10-second time-series minus the minimum of the same. This will tend to represent the highest typical modulation in the 10-s block.

At the time of writing, the most recent guidance document is the Assessment and Rating of Wind Turbine Noise, which is currently in Draft format, but proposes to replace the 1996 ETSU-R-97 document. In relation to AM it follows a similar approach as the IoA RM and the IEC document in terms of the quantification of AM and noise character. It describes a similar approach where:

*Noise shall be 'rated' by adding a character correction which can be applied during assessment of compliance of a particular wind farm with its site-specific noise limits.*

The rating scheme referenced is the same as **Figure 1** below:



**Figure 1: Proposed Penalty Scheme**

Current scientific knowledge is such that AM cannot be predicted at the planning stage, but can only be measured once the wind farm becomes operational.

The methodology contained within the IoA RM, IEC 61400 and Draft Assessment and Rating of Wind Turbine Noise documents all allow quantification of all aspects of AM and the penalty scheme identified above allows quantification of the mitigation required, if any. An appropriate penalty can be added onto the measured LA90 noise level, to allow direct comparison to an overall applicable noise limit.

It can also allow a quantification of the mitigation required to reduce the rated noise levels from turbines, if exceedances are identified post the wind farm becoming operational.

**13.2.9 Infrasound and Low Frequency Noise and Vibration**

There is always low frequency (or infrasound) noise present in the ambient quiet background. It is generated by natural sources such as road traffic, wind effects through air and vegetation, wave motion, water flow in streams and rivers. There are also low frequency emissions from many sources found in modern life, such as household appliances (e.g., washing machines, air conditioners, fridges, heating systems, boilers, burners, heat pumps, extraction systems,

electric or battery clocks, sky box, etc.). Other sources include water flowing through pipes within your home and in water flow from municipal water supply. Vibration of elements of structures (low frequency, less than 20 Hz) can be generated by local activity in one's home by way of normal routine activity, like climbing stairs, walking on the floor, closing doors etc. When sitting in a moving vehicle very high levels of low frequency vibration/sound is experienced.

The frequency range of audible noise is in the range of 20 to 20,000Hz and low frequency noise is generally from about 2 to 200Hz with infrasound typically of frequencies below 20Hz. There are differing views about the biological effects of low frequency noise or infrasound on human health. The balance of the evidence is there are no serious consequences to health from exposure to infrasound.

This view is endorsed by the IoA Policy statement (**Section 13.2.3.5**) which advises members that there is no need to assess either Low Frequency Noise or Infrasound as the absolute levels are well below the levels reported to trigger health effects.

A study of low frequency noise (infrasound) and vibration around a modern wind farm was carried out for ETSU and reported in ETSU W/13/00392/REP – '*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm*'<sup>15</sup>. The results showed levels of infrasound to be below accepted thresholds of perception even on the Site. Furthermore, a document prepared for the World Health Organisation, states that "*there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects*".

Significant research carried out on low frequency noise has been in the area of blasting (air overpressure) which falls into a very low frequency range (2-20Hz), although with a considerably higher magnitude.

The level of ground vibration from the operation of the wind farms is below human threshold of 0.2mm/s<sup>16</sup> at the base of a turbine, therefore it would be significantly lower at the receptor locations.

The IoA policy statement (**Section 13.2.3.5**) which advises members:

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<sup>15</sup> ETSU W/13/00392/REP – '*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm*'.

<sup>16</sup> Wiss, J. F., and Parmelee, R. A.. (1974) Human Perception of Transient Vibrations, "*Journal of Structural Division*", ASCE, Vol 100, No. S74, PP. 773-787

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

#### South Australian Environment Protection Authority (EPA) Infrasound Study

A report released in January 2013 by the South Australian EPA<sup>17</sup> found that the level of infrasound from wind turbines is insignificant and no different to any other sources of noise, and that the worst contributors to household infrasound are air-conditioners, traffic and noise generated by people. The study included several houses in rural and urban areas, houses both adjacent to a wind farm and away from turbines and measured the levels of infrasound with the wind farms operating and also switched off. There were no noticeable differences in the level of infrasound under all these different conditions. In fact, the lowest levels of infrasound were recorded at one of the houses closest to a wind farm, whereas the highest levels were found in an urban office building. The South Australian study found: *'the contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment'*.

#### Massachusetts Institute of Technology (MIT)

A report by an Independent Expert Panel prepared for Massachusetts Department of Health (2012)<sup>18</sup> consisted of a panel that included seven individuals with backgrounds in public health, epidemiology, toxicology, neurology and sleep medicine, neuroscience, and mechanical engineering, all of which were considered independent experts from academic institutions. The report found that *"there is insufficient evidence that the noise from wind turbines is directly (i.e., independent from an effect on annoyance or sleep) causing health problems or disease'* and *'available evidence shows that infrasound levels near wind turbines cannot impact the vestibular system'*.

#### Technical Research Centre of Finland

A long-term study into so-called "wind turbine syndrome"<sup>19</sup> health problems supposedly caused by low-frequency sound from spinning blades has concluded that this "infrasound" has absolutely no physical impact on the human body.

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<sup>17</sup> [http://www.epa.sa.gov.au/environmental\\_info/noise/wind\\_farms](http://www.epa.sa.gov.au/environmental_info/noise/wind_farms)

<sup>18</sup> Infrasound Does Not Explain Symptoms Related to Wind Turbines, Finnish Government, June 2020, <https://www.vttresearch.com/en/news-and-ideas/vtt-studied-health-effects-infrasound-wind-turbine-noise-multidisciplinary>

<sup>19</sup> Report by Leigh Collins, 21<sup>st</sup> April 2020 on a study commissioned by the Finnish Government into infrasound and wind turbine syndrome

The study conducted by the Technical Research Centre of Finland (VTT) and others, commissioned by the Finnish government, found that infrasound sound waves with frequencies below the range of human hearing cause no measurable changes in the human body, and cannot in any way be detected by the human ear.

Infrasound measurements were taken inside and outside local dwellings near two Finnish wind farms, as well as inside the facilities and beyond them, for 308 days.

Measurements showed that the infrasound levels in rural areas with wind farms were about the same as levels in a regular urban environment.

*"Infrasound samples representing the worst-case scenarios were picked out from the measurement data and used in the listening tests,"* said VTT.

*"The participants in the listening tests were divided into two groups based on how they reported wind turbine infrasound related symptoms: people who suffered from those and people who never had symptoms."*

*"The participants were unable to make out infrasonic frequencies in wind turbine noise, and the presence of infrasound made no difference to how annoying the participants perceived the noise, and their autonomous nervous system did not respond to it. There were no differences between the results of the two groups."*

#### **13.2.10 Field Work**

Baseline noise monitoring was undertaken during two measurement periods, firstly between 30<sup>th</sup> May and 18<sup>th</sup> July 2025 and secondly between 19<sup>th</sup> September and 31<sup>st</sup> October 2025 at the locations shown in **Appendix 13.1**. Two continuous measurement periods were undertaken in order to gather sufficient wind speed monitoring data, which was completed over the same period at the same 10-minute intervals using a temporary Met Mast located on Site. Noise data was recorded for a representative range of wind speeds during the monitoring period.

#### **13.2.11 Consultation**

Consultation was carried out with landowners who were familiar with the Wind Farm Site. Access to the nearest dwellings was carried out with permission from the householders / landowners.

#### **13.2.12 Noise Assessment Methodology**

In summary, the assessment process comprised:

- Identification of potential receptors, i.e., houses and other potentially noise-sensitive locations;
- Measurement of existing background noise levels at representative locations close to the Wind Farm Site;
- Prediction of the noise levels from wind turbines received at each receptor; and
- Comparison of the predicted noise levels with noise limits.

Potential receptors in the area around the Project were initially identified from Ordnance Survey maps, google maps, EPA maps and Site visits. Background measurements were carried out at the locations shown in **Appendix 13.1**.

The method of measuring background noise is described in ISO 1996 and ETSU-R-97. In practice, it means carrying out continuous monitoring of background noise levels at receptors for a period that includes a range of wind speeds which correspond to the maximum sound power of the candidate turbines being proposed. The candidate turbine assessed reaches maximum sound power level at a mean wind speed of 8m/s at 10m height and generates the highest noise level for that turbine specification.

The method of predicting noise levels of wind turbines at receptors is discussed in **Section 13.2.3.2**. This method was applied to the calculations for both contour plots and individual receptor predictions.

It is standard practice to predict noise levels for a reference wind speed and to adjust these for other wind speeds, according to the variation in sound power level with wind speed. For EIA purposes of the EIA technical assessment, one candidate turbine has been considered. The Nordex N163 5.X (generating capacity of 5.7 megawatts (MW)) operating in Mode 0, with serrated trailing edge (STE), has been selected with a hub height of 103.5m. The tip of the blades with STE lowers noise emissions without reducing energy output, and the selected turbine will have STE as standard. The worst-case sound power level at each wind speed from 4m/s to 12m/s was input into the noise model.

A copy of the manufacturers performance specification for the turbines used in the assessment when operating in Mode 0 with STE is given in the **Appendix 13.6**.

The prediction modelling is based on the turbines operating at full power and all turbines fitted with STE which reduces noise emissions of each turbine. The IOA Good Practice Guide recommends that an uncertainty value is required to be added to the turbine emission

data prior to modelling. Depending on the type of manufacturer's data, the uncertainty value will range from 0 to 2 dBA. However, as no uncertainty is given in the manufacturer's data sheet, an uncertainty value of 2 dBA is applied in line with the IOA GPG. **Table 13.3** presents the maximum sound power output at varying wind speed (presented at standardised 10m height) for the turbine type with a hub height of 103.5m. A value of 2 dBA is subtracted to account for conversion from LAeq to LA90 which is best practice.

**Table 13.3: Noise Emission Data, Nordex N163-5.X MW, STE at Maximum Sound Power (LWA dB) at Standardised 10m Height wind Speed**

Standardised 10m Height Wind Speed ms <sup>-1</sup>	4	5	6	7	8	9	10	11	12
Sound Power Level dB LWA derived from 103.5m hub height	97.7	102.4	106.7	107.2	107.2	107.2	107.2	107.2	107.2
Uncertainty added and Conversion of LAeq to LA90	97.7	102.4	106.7	107.2	107.2	107.2	107.2	107.2	107.2

The octave band values are given in **Table 13.4** for the N163–5.X MW with uncertainty values and conversion for LAeq to LA90 added as input to the prediction model.

**Table 13.4: Octave Band Spectrum of Nordex N163-5.X MW, STE at Maximum Sound Power (LWA dB) at 12m/s wind speed**

Octave Band Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	L <sub>WA</sub>
Sound Power Level, dB LWA at max sound power level	88.9	95.1	98.8	101.4	102.1	99.6	92.0	84.0	107.2
Uncertainty added to octaves and conversion of LAeq to LA90	88.9	95.1	98.8	101.4	102.1	99.6	92.0	84.0	

### 13.2.12.1 Noise Limits

The method of deriving operational noise limits, described in **Section 13.2.2.1**, is based on the Wind Energy Development Guidelines 2006 and lower limits specified in a recent An Coimisiún Pleanála decision (2022), described in **Section 13.2.3.2**. The noise limits for the Wind Farm Site are designed to meet the limits outlined by ACP (ABP-309306-21, dated 26<sup>th</sup> September 2022) in accordance with the 2006 Guidelines and were as follows:

(c) between 7am and 11pm:

- (iii) the greater of 5 dB(A) L90, 10min above background noise levels, or 45 dB(A) L90, 10min, at wind speeds of 5m/s or greater,
- (iv) 40 dB(A) L90, 10min, at all other wind speeds.

(d) 43 dB(A) L90,10min at all other times

where wind speeds are measured at 10 metres above ground level. Where properties are financially involved, a 45dB(A) L90,10min limit can be applied.

### **13.2.13 Construction Assessment Methodology**

#### **13.2.13.1 Relevant Guidance**

There is no published national guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However National Roads Authority (NRA) give limit values which are acceptable (the NRA Guidelines)<sup>20</sup>. Guidance to predict and control noise is also given in BS 5228:2009-1+A12014, *Code of Practice for Noise and Vibration Control on Construction and Open Sites* (two parts) where Part 1 deals with Noise<sup>21</sup>.

#### **13.2.13.2 NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes**

The NRA Guidelines provide noise limits which are acceptable and states, where it is deemed necessary to predict noise levels associated with construction noise, that this should be done in accordance with BS 5228.

#### **13.2.13.3 BS 5228: 2009-1A; 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites**

Part 1 of BS 5228 deals with noise prediction and control. It recommends procedures for noise control in respect of construction operations. The standard stresses the importance of community relations, and states that early establishment and maintenance of the relations throughout the carrying out of Site operations will go some way towards allaying people's concerns. Some of the more relevant factors that are likely to affect the acceptability of construction noise are:

- The attitude of local residents to the Project
- Site location relevant to noise sensitive receptors
- Duration of Site construction activities
- Hours of work
- The characteristics of the noise produced.

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<sup>20</sup> National Roads Authority, *Guidelines for Noise and Vibration in National Road Schemes*.

<sup>21</sup> BS 5228-1: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites: *Code of Practice for Basic Information and Procedures for Noise Control*.

Recommendations are made regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the activity. Measures to control noise are described including:

Control of noise at source by, e.g.

- Substitution of plant or activities for less noisy ones
- Modification of plant or equipment to less noisy ones
- Using noise control enclosures
- Siting of equipment and its method of use
- Maintenance of equipment
- Controlling the spread of noise by increasing distance between plant and receptors, or by the provision of acoustic screening

Example criteria for the assessment of the significance of noise effects are also given, although these are not mandatory.

Methods of calculating the levels of noise resulting from construction activities are provided, as are updated source levels for various plant, equipment and construction activities.

#### 13.2.13.4 Construction and Decommissioning Noise Assessment Methodology

The NRA guidelines for construction noise which are considered acceptable are given in **Table 13.5**.

**Table 13.5: Noise levels that are considered acceptable based on the NRA guidelines**

Day / Times	Guideline Limits
Monday to Friday 07:00 – 19:00hrs 19:00 – 22:00hrs	70dB LAeq, (1h) and LAmax 80dB *60dB LAeq, (1h) and LAmax 65dB*
Saturday 08:00 – 16:30hrs	65dB LAeq, 1h and LAmax 75dB
Sunday and Bank Holidays 08:00 – 16:00hrs	*60dB LAeq, 1h and LAmax 65dB*

\*Construction at these times, other than required by an emergency works, will normally require explicit permission from the relevant local authority, in this case Roscommon County Council.

#### Construction Times for the Project

The construction times for this Project are:

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Monday to Saturday: 07.00 to 19.00hrs with no work on Sunday, or Bank Holidays.

Part 1 of BS 5228 provides several example criteria for the assessment of the significance of noise effects from construction activities. Noise levels generated by construction activities are considered significant if:

- The LAeq, period level of construction noise exceeds lower threshold values of 65 dB during daytime, 55 dB during evenings and weekends or 45 dB at night.
- The total noise level (pre-construction ambient noise plus construction noise) exceeds the pre-construction noise level by 5 dB or more for a period of one month or more.

Construction noise from the construction, or decommissioning of the Wind Farm Site is not considered an intensive activity. The main noise sources will be associated with the construction of the Turbine Foundations and Turbine Hardstands. Lesser noise source activity will be construction of Site Access Tracks, Temporary Construction Compounds, turbine erection and the construction of the Onsite Substation.

Decommissioning will likely involve the remediation of Turbine Hardstand Areas and Turbine Foundations, where they will be covered in topsoil and allowed to revegetate. Site Access Tracks will likely be left in-situ for use by the landowners. Underground Internal Wind Farm Cables will be removed, and the ducting left in-situ. Therefore, the decommissioning phase of the Wind Farm Site is likely to be shorter and less intrusive than the construction phase with the resultant effects being less.

All workers associated with the Project will be subject to the Health and Safety Authority Guidance<sup>22</sup> which states that for noise exposure noise levels likely to exceed 80 dBA (expressed as Lep,d 8 hour dBA) there is the potential of risk of damage to hearing. All workers onsite will be given guidance on how to comply with the 'First Action Level'.

#### 13.2.14 Evaluation of Potential Effects

The potential impacts of construction are evaluated by comparing the predicted noise levels against the guideline limits given in **Table 13.5**: Noise levels that are considered acceptable based on the NRA guidelines, and sample criteria in Part 1 of BS 5228 in **Section 13.2.13.1.2**.

The potential operational impacts are evaluated by comparing the predicted noise levels against the day and night-time noise limits given in **Section 13.3.6**. The predicted noise

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<sup>22</sup> Noise - Frequently Asked Questions - Health and Safety Authority (hsa.ie)

levels are calculated according to the IOA Good Practice Guide as detailed in **Section 13.2.7** and potential impacts are assessed against the noise limits at the nearest receptors.

#### **13.2.14.1 Sensitivity**

The sensitivity of the Project during construction is based on the guideline values in **Table 13.5**: Noise levels that are considered acceptable based on the NRA guidelines, and sample criteria in Part 1 of BS 5228. The sensitivity of the Project during operation is based on the values in **Section 13.3.4** and **Section 13.4.2**.

#### **13.2.14.2 Magnitude**

The magnitude of potential impacts of construction is based on the values in **Table 13.10**. The magnitude of the Project during operation is based on the values in **Table 13.13**.

#### **13.2.14.3 Significance Criteria**

The significance of construction is based on the potential impacts based on the predicted values and compliance with the guideline limits in **Table 13.5** and sample criteria in Part 1 of BS 5228.

The significance of the potential impacts of the Project have been assessed by taking into account the noise limits at receptors and the degree to which compliance has been met.

### **13.3 BASELINE DESCRIPTION**

#### **13.3.1 Identification of Potential Receptors**

A number of predictions were prepared for the layout of the Wind Farm Site. Based on the initial layout, potential noise-sensitive receptors, including occupied and un-occupied dwellings, were identified from maps. Receptor locations were verified through visits to the area surrounding the Project.

#### **13.3.2 Selection of Baseline Noise Survey Locations**

Six baseline noise survey locations were selected on the basis of their locations relative to the turbine layout.

#### **13.3.3 Baseline Noise Survey**

Baseline noise monitoring was undertaken during two measurement periods, firstly between 30th May and 18th July 2025 and secondly between 19th September and 31st October 2025 at the at the receptor locations given in **Table 13.6** (Photos of monitors in-situ in **Appendix 13.1**).

**Table 13.6: Baseline Noise Survey**

Location	ITM Reference	Description of Location
NML 1 (H048)	574222, 789442	Main noise sources include local agricultural activity and wind effects on vegetation. Road noise was also identified from the N5 in the vicinity.
NML 2 (H023)	575080, 789037	Main noise sources include local agricultural activity and wind effects on vegetation. Low road noise was also identified from the N5.
NML 3 (H003)	577081, 788430	Main noise sources include local agricultural activity and wind effects on vegetation.
NML 4 (H015)	578641, 790334	Main noise sources include local agricultural activity and wind effects on vegetation.
NML 5 (H042)	580724, 789157	Main noise sources include local agricultural activity and wind effects on vegetation.
NML 6 (H035)	581288, 791234	Main noise sources include local agricultural activity and wind effects on vegetation.

The survey was carried out in accordance with ISO 1996, ETSU-R-97 and the IOA Good Practice Guide with the following implemented:

- Measurement of background noise levels at 10-minute intervals was undertaken using Type 1 instruments.
- Concurrent measurements of noise and mean wind were made at 10-minute intervals with the mean wind speed recorded from a temporary Met Mast on the Wind Farm Site. The methodology is given in **Section 13.2.6**.
- The background noise measurement which was recorded continuously included 10-minute intervals, as LA90, 10min along with a series of other parameters including LAeq,10min.
- Noise measurements were recorded at a height of 1.2-1.5m above ground level and more than 5m from any reflective surface, other than the porous ground.
- An electronic rain gauge was installed onsite at NML 4 – H015 to monitor rainfall at 10-minute intervals over the duration of the noise survey. Rain data which impacted on noise levels were removed from the noise data set prior to analysis.
- The standardised 10m wind speed was plotted against the time synchronised background noise levels using a best-fit polynomial line.

### 13.3.3.1 Instrumentation Used

The following instrumentation was used in the baseline survey measurements:

- Larson Davis Precision Integrating Sound Level Analyser/Data logger with 1/2" Condenser Microphones. Microphone was fitted with double skin windscreens based on that specified in W/31/00386/REP 'Noise Measurements in Windy Conditions'<sup>23</sup>.
- Calibration Type: Larson Davis Precision Acoustic Calibrator.
- Rain Gauge Type: TR-525met tipping bucket rain gauge, 0.2mm pulse with LOGBOX datalogger

All acoustic instrumentation was calibrated before and after the survey and the drift of calibration was less than 0.3 dB, which is within accepted guidelines. Calibration certificates of the acoustic instruments are included in **Appendix 13.5**.

#### 13.3.4 Prevailing Background Noise Levels

**Table 13.7** gives the background noise levels obtained from quiet daytime and night-time measurement periods at the baseline measurement locations. The main noise sources are road traffic noise from the N5, and some low intensity agriculture activity in the surrounding farms. The area is not defined as a low noise environment as the background is above 30 dB LA90 for most locations at all wind speeds, with the exception of some levels below 30 dB at low wind speeds.

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<sup>23</sup> W/31/00386/REP 'Noise Measurements in Windy Conditions'.

**Table 13.7: Prevailing Background Noise Level**

Monitoring Location	Prevailing Background (B/G) noise levels LA90dB, 10min									
	Standardised Mean 10m Height Wind Speed, (m/s)									
	4	5	6	7	8	9	10	11	12	
NML 1	Day	40.1	39.9	39.4	38.6	37.5	-	-	-	-
	B/G+5	45.1	44.9	44.4	43.6	42.5	-	-	-	-
NML 1	Night	29.4	29.6	29.5	29.3	28.9	28.3	27.5	-	-
	B/G+5	34.4	34.6	34.5	34.3	33.9	33.3	32.5	-	-
NML 2	Day	37.9	38.6	39.0	39.1	38.9	-	-	-	-
	B/G+5	42.9	43.6	44.0	44.1	43.9	-	-	-	-
NML 2	Night	33.1	34.5	35.8	36.9	38.0	38.9	39.7	-	-
	B/G+5	38.1	39.5	40.8	41.9	43.0	43.9	44.7	-	-
NML 3	Day	29.6	30.3	30.8	31.0	30.8	-	-	-	-
	B/G+5	34.6	35.3	35.8	36.0	35.8	-	-	-	-
NML 3	Night	27.7	29.1	30.4	31.5	32.6	33.6	34.4	-	-
	B/G+5	32.7	34.1	35.4	36.5	37.6	38.6	39.4	-	-
NML 4	Day	30.6	31.5	32.2	32.7	32.9	-	-	-	-
	B/G+5	35.6	36.5	37.2	37.7	37.9	-	-	-	-
NML 4	Night	28.6	30.2	31.6	32.8	33.9	34.7	35.3	-	-
	B/G+5	33.6	35.2	36.6	37.8	38.9	39.7	40.3	-	-
NML 5	Day	26.6	27.5	28.2	28.7	28.9	-	-	-	-
	B/G+5	31.6	32.5	33.2	33.7	33.9	-	-	-	-
NML 5	Night	23.9	25.4	26.5	27.3	27.7	27.8	27.5	-	-
	B/G+5	28.9	30.4	31.5	32.3	32.7	32.8	32.5	-	-
NML 6	Day	29.6	30.2	30.8	31.6	32.5	-	-	-	-
	B/G+5	34.6	35.2	35.8	36.6	37.5	-	-	-	-
NML 6	Night	27.6	28.1	28.6	29.0	29.4	29.8	27.6	-	-
	B/G+5	32.6	33.1	33.6	34.0	34.4	34.8	32.6	-	-

**Appendix 13.3** of this chapter plots the derived background noise levels, background plus 5 trendline with the predicted noise levels against a noise limit of 45dB(A) at each receptor.

### 13.3.5 Noise Assessment Locations

The monitoring locations were chosen so that the distance was sufficient to ensure no noise contribution from any other operating wind turbines.

Should the predicted operational noise levels from the Project comply with the requirements of the 2006 Guidelines at the closest receptors, it may be assumed that the predicted noise levels at receptors further away from the Project will also comply, due to the attenuation of turbine noise levels with distance. The predicted noise levels are given in **Table 13.13**.

### 13.3.6 Noise Limits

The noise limits for the Project are based on the limits contained within the 2006 Guidelines and on the background levels obtained in **Table 13.7**. A lower fixed limit of 45 dBA for daytime has been applied, whilst also considering the lowest background noise levels obtained at the location of NML 5 used as the basis for the assessment at all receptors with a limit of 43 dBA being applied for the night-time period (**Table 13.8**). Where receptors are financially involved, a 45 dBA limit can be applied.

**Table 13.8: Derived Background Day and Night Noise Levels used in Assessment**

Monitoring Location	Prevailing Background (B/G) noise levels LA90dB, 10min							
	Standardised Mean 10m Height Wind Speed, (m/s)							
	4	5	6	7	8	9	10	
NML 5	Day	26.6	27.5	28.2	28.7	28.9	-	-
	B/G+5	31.6	32.5	33.2	33.7	33.9	-	-
Noise Limit		45	45	45	45	45	45	45
NML 5	Night	23.9	25.4	26.5	27.3	27.7	27.8	27.5
	B/G+5	28.9	30.4	31.5	32.3	32.7	32.8	32.5
Noise Limit		43	43	43	43	43	43	43

### 13.3.7 Development Design Mitigation

The candidate turbine model, the N163 will be fitted with STE as standard which is best practice. A serrated extension of the trailing edge to the rotor blades mitigates noise emissions by effectively breaking up the turbulence on the tooth flanks into smaller eddies. The intensity of the pressure fluctuations is reduced which mitigates the noise emissions. Since the intensity of the noise emissions is largely dependent on the flow speed, STE are only installed on the outer rotor blade area where the rotary speed is the highest. For the candidate turbine selected for the EIA technical assessment, the Nordex N163, STE reduces the noise level by 2 dBA.

## 13.4 ASSESSMENT OF POTENTIAL EFFECTS

### 13.4.1 Construction Noise

#### 13.4.1.1 Construction and Decommissioning Noise Levels

As has been previously stated, the construction process associated with wind farms is not considered intensive and is temporary works most of which is carried out a considerable distance from receptors. The main noise sources will be associated with the construction of the Turbine Foundations, Turbine Hardstands, Grid Connection and temporary construction compounds, with lesser sources being the construction of the Onsite Substation. The main construction traffic to the Wind Farm Site will be during a very short period where ready-mix trucks deliver concrete for the turbine foundations. While delivery of material from local quarries for upgrade of Site Access Tracks, Turbine Hardstands, Temporary Storage Compounds and Onsite Substation will be for longer periods but will be of less intensity, generating lower levels of noise along the routes. During delivery of materials, trucks will access the Wind Farm Site from a different route than leaving the Wind Farm Site, thereby reducing traffic noise at receptors along the local road network. The delivery of turbines by large trucks travelling at very low speed will generate very low levels of noise at receptors along the Turbine Delivery Route.

It is not possible to specify the precise noise levels of emissions from the construction equipment until such time as a contractor is chosen and construction plant has been selected. However, **Table 13.9** indicates typical construction range of noise levels for this type of activity (levels from author's database and BS 5228). Predictions are made for receptors nearest to the turbine foundations / hardstands activity, temporary construction compound development and for receptors at varying distance from the Grid Connection.

**Table 13.9: Typical Noise Levels from Construction Works**

Activity	L <sub>Aeq</sub> at 10m
General Construction (pile driving, ready-mix trucks pouring concrete)	70-84 dBA
Tracked excavator removing topsoil, subsoil for foundation	80- 87 dBA
Rock breaker and excavator loading	82-89 dBA
Vibrating rollers including tipping material	76-86 dBA
Grid Connection: Trenching Tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor	71-74 dBA
Excavator loading / tipping, excavator and Vibratory roller	80- 87 dBA

The difference in noise levels between two locations can be calculated as:

$$\begin{aligned} L_{p2} - L_{p1} &= 10 \log (R_2 / R_1)^2 - (A_{atm} + A_{gr} + A_{br} + A_{mis}) \\ &= 20 \log (R_2 / R_1) - (A_{atm} + A_{gr} + A_{br} + A_{mis}) \end{aligned}$$

**where:**

$L_{p1}$  = sound pressure level at location 1

$L_{p2}$  = sound pressure level at location 2

$R_1$  = distance from source to location 1

$R_2$  = distance from source to location 2

and where:

$A_{atm}$  = Attenuation due to air absorption

$A_{gr}$  = Attenuation due to ground absorption

$A_{br}$  = Attenuation provided by a barrier

$A_{mis}$  = Attenuation provided by miscellaneous other effects

In the calculations attenuation by  $A_{atm}$ ,  $A_{gr}$  and  $A_{mis}$  is taken as 3 dBA where distances are more than 200m from a source and as zero within 200m - amelioration by barriers is not accounted for.

**Table 13.10** gives the noise levels predicted from construction activity at varying distances. The main noise sources are assumed to be the construction of the Turbine Foundations, Turbine Hardstands and Grid connection.

Road traffic is dealt with under a sub-heading '**Traffic and Transport**' in **Chapter 16**.

The maximum construction noise levels associated with the Project and Grid Connection are listed in **Table 13.10**. At receptor locations further away, noise levels will be less than that predicted. Works associated with Decommissioning of the Wind Farm Site will be no more than the levels predicted in **Table 13.10**.

**Table 13.10: Predicted Construction Noise Levels**

Activity taken as 100% per hour	Distance of Activity (m)	LAeq dB 1hr range
General Construction (pile driving, ready-mix trucks pouring concrete)	505m to H002	33-47 dBA
Tracked excavator removing topsoil, subsoil for foundation	505m to H002	43-50 dBA
Rock breaker and excavator loading at nearest turbine T2	505m to H002	45-52 dBA
Vibrating rollers including tipping material set down area close to T2	505m to H002	39-49 dBA
Grid Connection: Trenching Tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor	At varying distances along route: 15m 20m 40m 80m	64.5-67.5 dBA 62-65 dBA 56-59 dBA 49.9-52.9 dBA
Construction of compound (loading / tipping, excavator and Vibratory roller)	505m to H002	43-50 dBA

### Construction Traffic

The delivery of turbines to the Wind Farm Site will generate low level traffic noise as the vehicles carrying the turbines will move slowly along the local roads where impact is expected to be greatest. The main construction noise generated by traffic to and from the Wind Farm Site will be due to ready-mix trucks delivering concrete. The concrete pour for each individual turbine will be required to be completed in a short a period as possible (usually within 10 hours).

Concrete pours for individual Turbine Foundations will generate 120 HGV arrivals (240 HGV movements). For delivery of concrete the timeframe envisaged for each turbine concrete pour is taken as 10 hrs. This equates to an average of 24 deliveries per hour.

The general expression for predicting the 1 hr LAeq alongside a haul road used by single engine items of mobile plant is:

$$L_{Aeq} = L_{WA} - 33 + 10\log_{10}Q - 10\log_{10}V - 10\log_{10}d$$

**where:**

$L_{WA}$  = the sound power level of the truck, in decibels (dB);

$Q$  = 24, the number of vehicles per hour;

$V$  = 60, the average vehicle speed, in kilometres per hour (km/h);

$d$  = the distance of receiving position from the centre of haul road, in metres (m).

$$LA_{eq} = 105 - 33 + 10 \log 24 - 10 \log 60 - 10 \log 20 = 55 \text{ LA}_{eq} \text{ 1hr.}$$

At 10m from the roadside the noise levels equate to 55 LA<sub>eq</sub> 1hr. The delivery of concrete will extend for a total of 11 days (1 day for each turbine). In practice the levels generated by truck movement should be lower than predicted due to the smooth surface on the local roads.

#### Grid Connection – Cable laying along road by trenching

Cable laying and trenching will occur for the Grid Connection from the Onsite Substation to the existing Flagford 220 kV Substation. The proposed works will be transient in nature along the public road network in which the underground cabling route is proposed with approximately 150m completed per day. Maximum levels will pertain no more than 0.5 days equivalent (4 hours) at any single receptor.

Construction noise levels are based on continuous operation. In practice, most plant will operate at a maximum level for short intervals.

#### **13.4.1.2 Assessment of Construction Noise**

The higher levels predicted are from the Grid Connection and delivery of concrete for Turbine Foundations. These maximum noise levels will persist for no more than 4 hours at any receptor. All predicted noise levels are well within NRA guidelines given as acceptable and effects are considered slight. Construction noise is a short-term activity.

All activity is predicted without additional mufflers, or without topographic screening. The maximum road traffic noise which is generated by ready-mix trucks delivering concrete for Turbine Foundations will be short term and of 11 days' duration. The predicted noise levels are well within the NRA guidelines given as acceptable and are therefore considered as not significant.

Ground vibration from rock breaking will be below the threshold of sensitivity to humans of 0.2mm/s peak particle velocity at all receptors<sup>24</sup>. The effects of noise and vibration from construction activities are therefore considered not significant.

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<sup>24</sup> Wiss, J. F., and Parmelee, R. A. (1974) Human Perception of Transient Vibrations, "Journal of Structural Division", ASCE, Vol 100, No. S74, PP. 773-787

### 13.4.1.3 Description of Effects - Construction

The criteria for description of effects for all construction noise activity and the potential worst-case effects, at the nearest receptors is given in **Table 13.11** below.

**Table 13.11: Description of Effects - Construction**

Quality	Significance	Duration
Negative	Not Significant	Short-term

### 13.4.1.4 Decommissioning

Noise effects during the Decommissioning phase of the Wind Farm Site are likely to be of a similar nature to that during construction but of shorter duration. It is likely that Site Access Tracks and Turbine Foundations (excluding plinths) will be left in place and covered over with topsoil unless there are environmental reasons to remove. Any legislation, guidance, or best practice relevant at the time of decommissioning will be complied with.

### 13.4.1.5 Description of Effects - Decommissioning

The criteria for description of effects for all decommissioning noise activity and the potential worst-case effects, at the nearest receptors is given in **Table 13.12** below.

**Table 13.12: Description of Effects - Decommissioning**

Quality	Significance	Duration
Negative	Not Significant	Short - term

## 13.4.2 Predicted Operational Noise Levels

**Table 13.13** gives the predicted noise levels at the nearest receptors to the Project at varying wind speeds for each receptor location. A noise contour map of the 11 no. turbine Project at maximum sound power output at a wind speed of 12ms<sup>-1</sup> at 10m height is presented in **Appendix 13.4**. The contour map in **Appendix 13.4** assumes that all turbines are simultaneously downwind to each location all of the time (continuously) which results in an overprediction of the noise levels.

**Table 13.13: Predicted Noise Levels as LA90 at Varying Wind Speeds from the Project**

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H1**	580789	790181	41	45.7	50	50.5	50.5	50.5
H2*	581390	790585	33.2	37.9	42.2	42.7	42.7	42.7
H3*	577081	788430	33.6	38.3	42.6	43.1	43.1	43.1
H4**	578745	790321	27.2	31.9	36.2	36.7	36.7	36.7
H5**	578683	790413	27	31.7	36	36.5	36.5	36.5
H6	579527	791732	26.9	31.6	35.9	36.4	36.4	36.4
H7	575204	789190	32.5	37.2	41.5	42	42	42
H8	576938	788257	31.8	36.5	40.8	41.3	41.3	41.3
H9*	577329	788268	30.6	35.3	39.6	40.1	40.1	40.1
H10	579831	791411	30.8	35.5	39.8	40.3	40.3	40.3
H11	581475	789829	30.1	34.8	39.1	39.6	39.6	39.6
H12	577359	789698	31.6	36.3	40.6	41.1	41.1	41.1
H13**	579616	791664	27.7	32.4	36.7	37.2	37.2	37.2
H14	575185	789166	32.3	37	41.3	41.8	41.8	41.8
H15*	578641	790334	26.7	31.4	35.7	36.2	36.2	36.2
H16*	576727	790172	32.4	37.1	41.4	41.9	41.9	41.9
H17	578189	791974	21.9	26.6	30.9	31.4	31.4	31.4
H18	580249	789333	30	34.7	39	39.5	39.5	39.5
H19*	577194	788164	30.1	34.8	39.1	39.6	39.6	39.6
H20	580201	789297	29.5	34.2	38.5	39	39	39
H21	579730	791677	27.9	32.6	36.9	37.4	37.4	37.4
H22**	580133	791471	30.4	35.1	39.4	39.9	39.9	39.9
H23	575080	789037	30.9	35.6	39.9	40.4	40.4	40.4
H24**	580303	789219	28.9	33.6	37.9	38.4	38.4	38.4
H25	575035	789036	30.7	35.4	39.7	40.2	40.2	40.2
H26	577873	791258	23.8	28.5	32.8	33.3	33.3	33.3
H27	577645	788259	28.6	33.3	37.6	38.1	38.1	38.1
H28**	579790	791684	28	32.7	37	37.5	37.5	37.5
H29	575178	789011	31.1	35.8	40.1	40.6	40.6	40.6

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H30	577980	788684	28.3	33	37.3	37.8	37.8	37.8
H31	574231	789656	29.3	34	38.3	38.8	38.8	38.8
H32	575109	788998	30.7	35.4	39.7	40.2	40.2	40.2
H33	574894	789011	29.9	34.6	38.9	39.4	39.4	39.4
H34*	577186	788041	29	33.7	38	38.5	38.5	38.5
H35	581288	791234	28.7	33.4	37.7	38.2	38.2	38.2
H36	574858	789015	29.8	34.5	38.8	39.3	39.3	39.3
H37	578453	790291	26.2	30.9	35.2	35.7	35.7	35.7
H38	578431	790315	26.1	30.8	35.1	35.6	35.6	35.6
H39	575107	788949	30.4	35.1	39.4	39.9	39.9	39.9
H40	574780	789003	29.3	34	38.3	38.8	38.8	38.8
H41	577369	789939	30	34.7	39	39.5	39.5	39.5
H42*	580724	789157	28.2	32.9	37.2	37.7	37.7	37.7
H43	581408	791228	28	32.7	37	37.5	37.5	37.5
H44	574754	788997	29.2	33.9	38.2	38.7	38.7	38.7
H45	580309	791616	28.9	33.6	37.9	38.4	38.4	38.4
H46**	574684	790678	30.8	35.5	39.8	40.3	40.3	40.3
H47	574299	789325	28.5	33.2	37.5	38	38	38
H48*	574222	789442	28.4	33.1	37.4	37.9	37.9	37.9
H49	580641	791582	28.5	33.2	37.5	38	38	38
H50**	579419	789670	28.9	33.6	37.9	38.4	38.4	38.4
H51*	577944	792090	21.4	26.1	30.4	30.9	30.9	30.9
H52	578121	788772	27.4	32.1	36.4	36.9	36.9	36.9
H53	581297	791327	27.9	32.6	36.9	37.4	37.4	37.4
H54**	579122	789675	27.4	32.1	36.4	36.9	36.9	36.9
H55	575293	788892	30.8	35.5	39.8	40.3	40.3	40.3
H56	574345	789211	28.2	32.9	37.2	37.7	37.7	37.7
H57	577900	792083	21.4	26.1	30.4	30.9	30.9	30.9
H58	580214	791675	28.4	33.1	37.4	37.9	37.9	37.9
H59**	578168	789100	27.5	32.2	36.5	37	37	37

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H60	574251	789308	28	32.7	37	37.5	37.5	37.5
H61**	580699	791604	28.2	32.9	37.2	37.7	37.7	37.7
H62	574274	789274	28	32.7	37	37.5	37.5	37.5
H63	578242	790463	25.7	30.4	34.7	35.2	35.2	35.2
H64	580503	791665	28.1	32.8	37.1	37.6	37.6	37.6
H65	574105	789577	27.9	32.6	36.9	37.4	37.4	37.4
H66	578262	790401	25.8	30.5	34.8	35.3	35.3	35.3
H67	575080	788834	29.5	34.2	38.5	39	39	39
H68*	577895	788194	26.7	31.4	35.7	36.2	36.2	36.2
H69	577829	790790	25.1	29.8	34.1	34.6	34.6	34.6
H70**	574487	790963	27.5	32.2	36.5	37	37	37
H71	574111	789384	27.2	31.9	36.2	36.7	36.7	36.7
H72	573979	789757	27.1	31.8	36.1	36.6	36.6	36.6
H73**	573981	789674	27	31.7	36	36.5	36.5	36.5
H74*	579571	789300	27.4	32.1	36.4	36.9	36.9	36.9
H75*	579562	789305	27.4	32.1	36.4	36.9	36.9	36.9
H76	575108	788747	29.1	33.8	38.1	38.6	38.6	38.6
H77	575142	788747	29.3	34	38.3	38.8	38.8	38.8
H78	578462	789878	26.2	30.9	35.2	35.7	35.7	35.7
H79	573944	789778	26.8	31.5	35.8	36.3	36.3	36.3
H80**	578086	790459	25.7	30.4	34.7	35.2	35.2	35.2
H81	580831	791693	27.1	31.8	36.1	36.6	36.6	36.6
H82	577723	792087	21.3	26	30.3	30.8	30.8	30.8
H83	578010	788170	26	30.7	35	35.5	35.5	35.5
H84	581772	791238	25.6	30.3	34.6	35.1	35.1	35.1
H85	576405	791229	27.3	32	36.3	36.8	36.8	36.8
H86	582149	790105	24.9	29.6	33.9	34.4	34.4	34.4
H87	575168	788691	29	33.7	38	38.5	38.5	38.5
H88**	579369	792536	21.7	26.4	30.7	31.2	31.2	31.2
H89	576255	787731	26.6	31.3	35.6	36.1	36.1	36.1

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H90*	578052	788124	25.6	30.3	34.6	35.1	35.1	35.1
H91	576332	787706	26.6	31.3	35.6	36.1	36.1	36.1
H92	579245	792624	21.1	25.8	30.1	30.6	30.6	30.6
H93	575167	788598	28.5	33.2	37.5	38	38	38
H94	581583	789236	25.4	30.1	34.4	34.9	34.9	34.9
H95	574258	790891	26.5	31.2	35.5	36	36	36
H96	576524	791190	27.1	31.8	36.1	36.6	36.6	36.6
H97*	574426	788836	26.6	31.3	35.6	36.1	36.1	36.1
H98	573960	790550	25.9	30.6	34.9	35.4	35.4	35.4
H99*	574065	790731	26	30.7	35	35.5	35.5	35.5
H100	582072	791047	24.4	29.1	33.4	33.9	33.9	33.9
H101	581635	789213	25	29.7	34	34.5	34.5	34.5
H102	576223	787673	26.2	30.9	35.2	35.7	35.7	35.7
H103	576377	791424	26.2	30.9	35.2	35.7	35.7	35.7
H104	573778	789924	25.5	30.2	34.5	35	35	35
H105**	580135	791968	26	30.7	35	35.5	35.5	35.5
H106	574375	788805	26.1	30.8	35.1	35.6	35.6	35.6
H107	573775	790044	25.5	30.2	34.5	35	35	35
H108	573872	789358	25.4	30.1	34.4	34.9	34.9	34.9
H109**	578863	792814	19.9	24.6	28.9	29.4	29.4	29.4
H110*	581834	789296	24.4	29.1	33.4	33.9	33.9	33.9
H111	581238	788967	25.2	29.9	34.2	34.7	34.7	34.7
H112	576252	787605	25.7	30.4	34.7	35.2	35.2	35.2
H113	574255	791111	25.4	30.1	34.4	34.9	34.9	34.9
H114	578254	788161	24.8	29.5	33.8	34.3	34.3	34.3
H115	573709	790073	24.9	29.6	33.9	34.4	34.4	34.4
H116	573701	789762	24.9	29.6	33.9	34.4	34.4	34.4
H117	582142	791162	23.6	28.3	32.6	33.1	33.1	33.1
H118	582175	791120	23.5	28.2	32.5	33	33	33
H119	581101	791829	25.2	29.9	34.2	34.7	34.7	34.7

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H120	573670	790116	24.6	29.3	33.6	34.1	34.1	34.1
H122	579464	792738	20.8	25.5	29.8	30.3	30.3	30.3
H123	578571	789420	25.9	30.6	34.9	35.4	35.4	35.4
H124	581131	791834	25.1	29.8	34.1	34.6	34.6	34.6
H125*	578555	789301	25.9	30.6	34.9	35.4	35.4	35.4
H126	581390	788941	24.5	29.2	33.5	34	34	34
H127	579559	792691	21.2	25.9	30.2	30.7	30.7	30.7
H128	581429	788941	24.3	29	33.3	33.8	33.8	33.8
H129	582357	790827	23	27.7	32	32.5	32.5	32.5
H130	578600	789118	25.6	30.3	34.6	35.1	35.1	35.1
H131	581345	791802	24.5	29.2	33.5	34	34	34
H132	576088	787540	25.1	29.8	34.1	34.6	34.6	34.6
H133	576525	791517	25.3	30	34.3	34.8	34.8	34.8
H134	577447	792218	21	25.7	30	30.5	30.5	30.5
H135	580831	792068	24.3	29	33.3	33.8	33.8	33.8
H136	574166	788703	24.7	29.4	33.7	34.2	34.2	34.2
H137*	575978	787531	24.8	29.5	33.8	34.3	34.3	34.3
H138	575347	787982	25.8	30.5	34.8	35.3	35.3	35.3
H139	573573	790098	24	28.7	33	33.5	33.5	33.5
H140	574110	791177	24.3	29	33.3	33.8	33.8	33.8
H141*	576056	787492	24.7	29.4	33.7	34.2	34.2	34.2
H142	582096	791405	23	27.7	32	32.5	32.5	32.5
H143	581382	791862	24	28.7	33	33.5	33.5	33.5
H144	573630	790453	23.9	28.6	32.9	33.4	33.4	33.4
H145	581531	791829	23.6	28.3	32.6	33.1	33.1	33.1
H146	582452	790855	22.4	27.1	31.4	31.9	31.9	31.9
H147	573530	790061	23.7	28.4	32.7	33.2	33.2	33.2
H148**	581005	792045	24.1	28.8	33.1	33.6	33.6	33.6
H149	578706	788900	25	29.7	34	34.5	34.5	34.5
H150	579539	792838	20.4	25.1	29.4	29.9	29.9	29.9

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H151	582347	791161	22.3	27	31.3	31.8	31.8	31.8
H152	581965	791612	22.8	27.5	31.8	32.3	32.3	32.3
H153**	573614	790539	23.6	28.3	32.6	33.1	33.1	33.1
H154**	575862	787492	24.3	29	33.3	33.8	33.8	33.8
H155	575892	787468	24.3	29	33.3	33.8	33.8	33.8
H156*	573611	790654	23.3	28	32.3	32.8	32.8	32.8
H157	573450	789791	23.2	27.9	32.2	32.7	32.7	32.7
H158	573584	790617	23.3	28	32.3	32.8	32.8	32.8
H159	574239	788490	24.1	28.8	33.1	33.6	33.6	33.6
H160	582624	790445	21.7	26.4	30.7	31.2	31.2	31.2
H161	573440	790099	23.1	27.8	32.1	32.6	32.6	32.6
H162	578764	788621	24.2	28.9	33.2	33.7	33.7	33.7
H163	575797	787449	24	28.7	33	33.5	33.5	33.5
H164	575776	787432	23.8	28.5	32.8	33.3	33.3	33.3
H165	573397	790172	22.8	27.5	31.8	32.3	32.3	32.3
H166	579833	788466	23.3	28	32.3	32.8	32.8	32.8
H167	579134	788925	24.7	29.4	33.7	34.2	34.2	34.2
H168	573907	791216	23.2	27.9	32.2	32.7	32.7	32.7
H169	581853	791862	22.2	26.9	31.2	31.7	31.7	31.7
H170	575722	787417	23.6	28.3	32.6	33.1	33.1	33.1
H171	578619	788034	23	27.7	32	32.5	32.5	32.5
H172*	582726	790363	21.1	25.8	30.1	30.6	30.6	30.6
H173	582265	791557	21.5	26.2	30.5	31	31	31
H174	581814	791931	22	26.7	31	31.5	31.5	31.5
H175	573896	791311	22.7	27.4	31.7	32.2	32.2	32.2
H176*	582760	790336	20.9	25.6	29.9	30.4	30.4	30.4
H177*	577104	787131	22.8	27.5	31.8	32.3	32.3	32.3
H178	581962	788805	21.5	26.2	30.5	31	31	31
H179	581421	788524	22	26.7	31	31.5	31.5	31.5
H180	580060	792788	20.5	25.2	29.5	30	30	30

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H181	574930	787930	24.2	28.9	33.2	33.7	33.7	33.7
H182**	573507	790887	22.2	26.9	31.2	31.7	31.7	31.7
H183	577360	792710	19.5	24.2	28.5	29	29	29
H184	573814	791313	22.4	27.1	31.4	31.9	31.9	31.9
H185	573950	788440	22.7	27.4	31.7	32.2	32.2	32.2
H186	573795	791321	22.2	26.9	31.2	31.7	31.7	31.7
H187	573787	791327	22.2	26.9	31.2	31.7	31.7	31.7
H188	575706	787261	22.8	27.5	31.8	32.3	32.3	32.3
H189	582696	789585	20.4	25.1	29.4	29.9	29.9	29.9
H190	581621	792153	21.6	26.3	30.6	31.1	31.1	31.1
H191	582851	790127	20.3	25	29.3	29.8	29.8	29.8
H192	577352	792783	19.3	24	28.3	28.8	28.8	28.8
H193*	577234	787044	22.3	27	31.3	31.8	31.8	31.8
H194	581925	792029	21.1	25.8	30.1	30.6	30.6	30.6
H195	581448	788441	21.5	26.2	30.5	31	31	31
H196	573749	791340	22	26.7	31	31.5	31.5	31.5
H197*	573814	788467	22.2	26.9	31.2	31.7	31.7	31.7
H198	577301	792783	19.3	24	28.3	28.8	28.8	28.8
H199	573727	791349	21.8	26.5	30.8	31.3	31.3	31.3
H200	573161	790216	21.4	26.1	30.4	30.9	30.9	30.9
H201	573465	791017	21.6	26.3	30.6	31.1	31.1	31.1
H202	580263	792756	20.7	25.4	29.7	30.2	30.2	30.2
H203**	577375	787010	21.9	26.6	30.9	31.4	31.4	31.4
H204**	573728	791388	21.7	26.4	30.7	31.2	31.2	31.2
H205	575504	787289	22.5	27.2	31.5	32	32	32
H206	579241	788497	23.3	28	32.3	32.8	32.8	32.8
H207	581172	792413	21.5	26.2	30.5	31	31	31
H208	582138	788751	20.4	25.1	29.4	29.9	29.9	29.9
H209	578974	793434	17.5	22.2	26.5	27	27	27

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H210	574858	787816	23.4	28.1	32.4	32.9	32.9	32.9
H211**	580306	792746	20.7	25.4	29.7	30.2	30.2	30.2
H212	573694	791359	21.7	26.4	30.7	31.2	31.2	31.2
H213	573709	791400	21.6	26.3	30.6	31.1	31.1	31.1
H214	577284	792838	19.1	23.8	28.1	28.6	28.6	28.6
H215	573431	791052	21.4	26.1	30.4	30.9	30.9	30.9
H216	573406	791023	21.3	26	30.3	30.8	30.8	30.8
H217	573668	791368	21.5	26.2	30.5	31	31	31
H218	573681	791412	21.4	26.1	30.4	30.9	30.9	30.9
H219	573419	791072	21.3	26	30.3	30.8	30.8	30.8
H220	574770	787815	23.1	27.8	32.1	32.6	32.6	32.6
H221	573655	791422	21.3	26	30.3	30.8	30.8	30.8
H222	581116	792532	21	25.7	30	30.5	30.5	30.5
H223	574710	787840	23	27.7	32	32.5	32.5	32.5
H224	574792	787749	22.9	27.6	31.9	32.4	32.4	32.4
H225	573637	791449	21.1	25.8	30.1	30.6	30.6	30.6
H226	574711	787812	22.9	27.6	31.9	32.4	32.4	32.4
H227	573621	791456	21	25.7	30	30.5	30.5	30.5
H228**	574727	787768	22.8	27.5	31.8	32.3	32.3	32.3
H229	581269	792518	20.7	25.4	29.7	30.2	30.2	30.2
H230	581315	792498	20.7	25.4	29.7	30.2	30.2	30.2
H231	581336	792571	20.3	25	29.3	29.8	29.8	29.8
H232	581210	792659	20.1	24.8	29.1	29.6	29.6	29.6
H233	581614	792586	19.6	24.3	28.6	29.1	29.1	29.1
H234	581624	792634	19.3	24	28.3	28.8	28.8	28.8
H235*	573483	790037	23.4	28.1	32.4	32.9	32.9	32.9

\*(FI) – Financially Involved

\*\* (DP) – Derelict Property

### 13.4.3 Operational Noise Assessment

The assessment was made of the predicted operational noise levels from the Project based on the limits described in **Section 13.2.3.1** in the 2006 Guidelines and taking into consideration the recent 2022 An Coimisiún Pleanála decision described in **Section 13.2.3.2**.

As can be seen from **Table 13.13** that the predicted noise levels exceed the daytime noise limit of 45 dB at one receptor, H1 at certain wind speeds.

However, it has been confirmed by the applicant that H1 is a derelict building and shall not be occupied for the duration of the operational phase of the Wind Farm Site.

The predicted noise levels are higher than the night-time noise limit of 43 dB at one additional receptor at various wind speeds – H3.

It has been confirmed by the applicant that this receptor is financially involved with the Project, to which a 45 dB limit may be applied. Therefore, there are no exceedances of the 43 dB night-time noise limit.

The predicted noise levels are lower than the noise limits at the remaining receptors, at all wind speeds, and are therefore compliant with the noise limits and are not significant in terms of EIA (**Table 13.14**).

The predicted noise levels assume that all turbines are directly down-wind to nearest receptors.

**Table 13.14: Margin between Predicted Noise Levels and 45 dBA Noise Limit**

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H1**	580789	790181	-2	2.7	7	7.5	7.5	7.5
H2*	581390	790585	-9.8	-5.1	-0.8	-0.3	-0.3	-0.3
H3*	577081	788430	-9.4	-4.7	-0.4	0.1	0.1	0.1
H4**	578745	790321	-15.8	-11.1	-6.8	-6.3	-6.3	-6.3
H5**	578683	790413	-16	-11.3	-7	-6.5	-6.5	-6.5
H6	579527	791732	-16.1	-11.4	-7.1	-6.6	-6.6	-6.6
H7	575204	789190	-10.5	-5.8	-1.5	-1	-1	-1
H8	576938	788257	-11.2	-6.5	-2.2	-1.7	-1.7	-1.7
H9*	577329	788268	-12.4	-7.7	-3.4	-2.9	-2.9	-2.9
H10	579831	791411	-12.2	-7.5	-3.2	-2.7	-2.7	-2.7
H11	581475	789829	-12.9	-8.2	-3.9	-3.4	-3.4	-3.4
H12	577359	789698	-11.4	-6.7	-2.4	-1.9	-1.9	-1.9
H13**	579616	791664	-15.3	-10.6	-6.3	-5.8	-5.8	-5.8
H14	575185	789166	-10.7	-6	-1.7	-1.2	-1.2	-1.2
H15*	578641	790334	-16.3	-11.6	-7.3	-6.8	-6.8	-6.8
H16*	576727	790172	-10.6	-5.9	-1.6	-1.1	-1.1	-1.1
H17	578189	791974	-21.1	-16.4	-12.1	-11.6	-11.6	-11.6
H18	580249	789333	-13	-8.3	-4	-3.5	-3.5	-3.5
H19*	577194	788164	-12.9	-8.2	-3.9	-3.4	-3.4	-3.4
H20	580201	789297	-13.5	-8.8	-4.5	-4	-4	-4
H21	579730	791677	-15.1	-10.4	-6.1	-5.6	-5.6	-5.6
H22**	580133	791471	-12.6	-7.9	-3.6	-3.1	-3.1	-3.1
H23	575080	789037	-12.1	-7.4	-3.1	-2.6	-2.6	-2.6
H24**	580303	789219	-14.1	-9.4	-5.1	-4.6	-4.6	-4.6
H25	575035	789036	-12.3	-7.6	-3.3	-2.8	-2.8	-2.8
H26	577873	791258	-19.2	-14.5	-10.2	-9.7	-9.7	-9.7
H27	577645	788259	-14.4	-9.7	-5.4	-4.9	-4.9	-4.9
H28**	579790	791684	-15	-10.3	-6	-5.5	-5.5	-5.5
H29	575178	789011	-11.9	-7.2	-2.9	-2.4	-2.4	-2.4

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H30	577980	788684	-14.7	-10	-5.7	-5.2	-5.2	-5.2
H31	574231	789656	-13.7	-9	-4.7	-4.2	-4.2	-4.2
H32	575109	788998	-12.3	-7.6	-3.3	-2.8	-2.8	-2.8
H33	574894	789011	-13.1	-8.4	-4.1	-3.6	-3.6	-3.6
H34*	577186	788041	-14	-9.3	-5	-4.5	-4.5	-4.5
H35	581288	791234	-14.3	-9.6	-5.3	-4.8	-4.8	-4.8
H36	574858	789015	-13.2	-8.5	-4.2	-3.7	-3.7	-3.7
H37	578453	790291	-16.8	-12.1	-7.8	-7.3	-7.3	-7.3
H38	578431	790315	-16.9	-12.2	-7.9	-7.4	-7.4	-7.4
H39	575107	788949	-12.6	-7.9	-3.6	-3.1	-3.1	-3.1
H40	574780	789003	-13.7	-9	-4.7	-4.2	-4.2	-4.2
H41	577369	789939	-13	-8.3	-4	-3.5	-3.5	-3.5
H42*	580724	789157	-14.8	-10.1	-5.8	-5.3	-5.3	-5.3
H43	581408	791228	-15	-10.3	-6	-5.5	-5.5	-5.5
H44	574754	788997	-13.8	-9.1	-4.8	-4.3	-4.3	-4.3
H45	580309	791616	-14.1	-9.4	-5.1	-4.6	-4.6	-4.6
H46**	574684	790678	-12.2	-7.5	-3.2	-2.7	-2.7	-2.7
H47	574299	789325	-14.5	-9.8	-5.5	-5	-5	-5
H48*	574222	789442	-14.6	-9.9	-5.6	-5.1	-5.1	-5.1
H49	580641	791582	-14.5	-9.8	-5.5	-5	-5	-5
H50**	579419	789670	-14.1	-9.4	-5.1	-4.6	-4.6	-4.6
H51*	577944	792090	-21.6	-16.9	-12.6	-12.1	-12.1	-12.1
H52	578121	788772	-15.6	-10.9	-6.6	-6.1	-6.1	-6.1
H53	581297	791327	-15.1	-10.4	-6.1	-5.6	-5.6	-5.6
H54**	579122	789675	-15.6	-10.9	-6.6	-6.1	-6.1	-6.1
H55	575293	788892	-12.2	-7.5	-3.2	-2.7	-2.7	-2.7
H56	574345	789211	-14.8	-10.1	-5.8	-5.3	-5.3	-5.3
H57	577900	792083	-21.6	-16.9	-12.6	-12.1	-12.1	-12.1
H58	580214	791675	-14.6	-9.9	-5.6	-5.1	-5.1	-5.1
H59**	578168	789100	-15.5	-10.8	-6.5	-6	-6	-6

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H60	574251	789308	-15	-10.3	-6	-5.5	-5.5	-5.5
H61**	580699	791604	-14.8	-10.1	-5.8	-5.3	-5.3	-5.3
H62	574274	789274	-15	-10.3	-6	-5.5	-5.5	-5.5
H63	578242	790463	-17.3	-12.6	-8.3	-7.8	-7.8	-7.8
H64	580503	791665	-14.9	-10.2	-5.9	-5.4	-5.4	-5.4
H65	574105	789577	-15.1	-10.4	-6.1	-5.6	-5.6	-5.6
H66	578262	790401	-17.2	-12.5	-8.2	-7.7	-7.7	-7.7
H67	575080	788834	-13.5	-8.8	-4.5	-4	-4	-4
H68*	577895	788194	-16.3	-11.6	-7.3	-6.8	-6.8	-6.8
H69	577829	790790	-17.9	-13.2	-8.9	-8.4	-8.4	-8.4
H70**	574487	790963	-15.5	-10.8	-6.5	-6	-6	-6
H71	574111	789384	-15.8	-11.1	-6.8	-6.3	-6.3	-6.3
H72	573979	789757	-15.9	-11.2	-6.9	-6.4	-6.4	-6.4
H73**	573981	789674	-16	-11.3	-7	-6.5	-6.5	-6.5
H74*	579571	789300	-15.6	-10.9	-6.6	-6.1	-6.1	-6.1
H75*	579562	789305	-15.6	-10.9	-6.6	-6.1	-6.1	-6.1
H76	575108	788747	-13.9	-9.2	-4.9	-4.4	-4.4	-4.4
H77	575142	788747	-13.7	-9	-4.7	-4.2	-4.2	-4.2
H78	578462	789878	-16.8	-12.1	-7.8	-7.3	-7.3	-7.3
H79	573944	789778	-16.2	-11.5	-7.2	-6.7	-6.7	-6.7
H80**	578086	790459	-17.3	-12.6	-8.3	-7.8	-7.8	-7.8
H81	580831	791693	-15.9	-11.2	-6.9	-6.4	-6.4	-6.4
H82	577723	792087	-21.7	-17	-12.7	-12.2	-12.2	-12.2
H83	578010	788170	-17	-12.3	-8	-7.5	-7.5	-7.5
H84	581772	791238	-17.4	-12.7	-8.4	-7.9	-7.9	-7.9
H85	576405	791229	-15.7	-11	-6.7	-6.2	-6.2	-6.2
H86	582149	790105	-18.1	-13.4	-9.1	-8.6	-8.6	-8.6
H87	575168	788691	-14	-9.3	-5	-4.5	-4.5	-4.5
H88**	579369	792536	-21.3	-16.6	-12.3	-11.8	-11.8	-11.8
H89	576255	787731	-16.4	-11.7	-7.4	-6.9	-6.9	-6.9

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H90*	578052	788124	-17.4	-12.7	-8.4	-7.9	-7.9	-7.9
H91	576332	787706	-16.4	-11.7	-7.4	-6.9	-6.9	-6.9
H92	579245	792624	-21.9	-17.2	-12.9	-12.4	-12.4	-12.4
H93	575167	788598	-14.5	-9.8	-5.5	-5	-5	-5
H94	581583	789236	-17.6	-12.9	-8.6	-8.1	-8.1	-8.1
H95	574258	790891	-16.5	-11.8	-7.5	-7	-7	-7
H96	576524	791190	-15.9	-11.2	-6.9	-6.4	-6.4	-6.4
H97*	574426	788836	-16.4	-11.7	-7.4	-6.9	-6.9	-6.9
H98	573960	790550	-17.1	-12.4	-8.1	-7.6	-7.6	-7.6
H99*	574065	790731	-17	-12.3	-8	-7.5	-7.5	-7.5
H100	582072	791047	-18.6	-13.9	-9.6	-9.1	-9.1	-9.1
H101	581635	789213	-18	-13.3	-9	-8.5	-8.5	-8.5
H102	576223	787673	-16.8	-12.1	-7.8	-7.3	-7.3	-7.3
H103	576377	791424	-16.8	-12.1	-7.8	-7.3	-7.3	-7.3
H104	573778	789924	-17.5	-12.8	-8.5	-8	-8	-8
H105**	580135	791968	-17	-12.3	-8	-7.5	-7.5	-7.5
H106	574375	788805	-16.9	-12.2	-7.9	-7.4	-7.4	-7.4
H107	573775	790044	-17.5	-12.8	-8.5	-8	-8	-8
H108	573872	789358	-17.6	-12.9	-8.6	-8.1	-8.1	-8.1
H109**	578863	792814	-23.1	-18.4	-14.1	-13.6	-13.6	-13.6
H110*	581834	789296	-18.6	-13.9	-9.6	-9.1	-9.1	-9.1
H111	581238	788967	-17.8	-13.1	-8.8	-8.3	-8.3	-8.3
H112	576252	787605	-17.3	-12.6	-8.3	-7.8	-7.8	-7.8
H113	574255	791111	-17.6	-12.9	-8.6	-8.1	-8.1	-8.1
H114	578254	788161	-18.2	-13.5	-9.2	-8.7	-8.7	-8.7
H115	573709	790073	-18.1	-13.4	-9.1	-8.6	-8.6	-8.6
H116	573701	789762	-18.1	-13.4	-9.1	-8.6	-8.6	-8.6
H117	582142	791162	-19.4	-14.7	-10.4	-9.9	-9.9	-9.9
H118	582175	791120	-19.5	-14.8	-10.5	-10	-10	-10
H119	581101	791829	-17.8	-13.1	-8.8	-8.3	-8.3	-8.3

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H120	573670	790116	-18.4	-13.7	-9.4	-8.9	-8.9	-8.9
H122	579464	792738	-22.2	-17.5	-13.2	-12.7	-12.7	-12.7
H123	578571	789420	-17.1	-12.4	-8.1	-7.6	-7.6	-7.6
H124	581131	791834	-17.9	-13.2	-8.9	-8.4	-8.4	-8.4
H125*	578555	789301	-17.1	-12.4	-8.1	-7.6	-7.6	-7.6
H126	581390	788941	-18.5	-13.8	-9.5	-9	-9	-9
H127	579559	792691	-21.8	-17.1	-12.8	-12.3	-12.3	-12.3
H128	581429	788941	-18.7	-14	-9.7	-9.2	-9.2	-9.2
H129	582357	790827	-20	-15.3	-11	-10.5	-10.5	-10.5
H130	578600	789118	-17.4	-12.7	-8.4	-7.9	-7.9	-7.9
H131	581345	791802	-18.5	-13.8	-9.5	-9	-9	-9
H132	576088	787540	-17.9	-13.2	-8.9	-8.4	-8.4	-8.4
H133	576525	791517	-17.7	-13	-8.7	-8.2	-8.2	-8.2
H134	577447	792218	-22	-17.3	-13	-12.5	-12.5	-12.5
H135	580831	792068	-18.7	-14	-9.7	-9.2	-9.2	-9.2
H136	574166	788703	-18.3	-13.6	-9.3	-8.8	-8.8	-8.8
H137*	575978	787531	-18.2	-13.5	-9.2	-8.7	-8.7	-8.7
H138	575347	787982	-17.2	-12.5	-8.2	-7.7	-7.7	-7.7
H139	573573	790098	-19	-14.3	-10	-9.5	-9.5	-9.5
H140	574110	791177	-18.7	-14	-9.7	-9.2	-9.2	-9.2
H141*	576056	787492	-18.3	-13.6	-9.3	-8.8	-8.8	-8.8
H142	582096	791405	-20	-15.3	-11	-10.5	-10.5	-10.5
H143	581382	791862	-19	-14.3	-10	-9.5	-9.5	-9.5
H144	573630	790453	-19.1	-14.4	-10.1	-9.6	-9.6	-9.6
H145	581531	791829	-19.4	-14.7	-10.4	-9.9	-9.9	-9.9
H146	582452	790855	-20.6	-15.9	-11.6	-11.1	-11.1	-11.1
H147	573530	790061	-19.3	-14.6	-10.3	-9.8	-9.8	-9.8
H148**	581005	792045	-18.9	-14.2	-9.9	-9.4	-9.4	-9.4
H149	578706	788900	-18	-13.3	-9	-8.5	-8.5	-8.5
H150	579539	792838	-22.6	-17.9	-13.6	-13.1	-13.1	-13.1

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H151	582347	791161	-20.7	-16	-11.7	-11.2	-11.2	-11.2
H152	581965	791612	-20.2	-15.5	-11.2	-10.7	-10.7	-10.7
H153**	573614	790539	-19.4	-14.7	-10.4	-9.9	-9.9	-9.9
H154**	575862	787492	-18.7	-14	-9.7	-9.2	-9.2	-9.2
H155	575892	787468	-18.7	-14	-9.7	-9.2	-9.2	-9.2
H156*	573611	790654	-19.7	-15	-10.7	-10.2	-10.2	-10.2
H157	573450	789791	-19.8	-15.1	-10.8	-10.3	-10.3	-10.3
H158	573584	790617	-19.7	-15	-10.7	-10.2	-10.2	-10.2
H159	574239	788490	-18.9	-14.2	-9.9	-9.4	-9.4	-9.4
H160	582624	790445	-21.3	-16.6	-12.3	-11.8	-11.8	-11.8
H161	573440	790099	-19.9	-15.2	-10.9	-10.4	-10.4	-10.4
H162	578764	788621	-18.8	-14.1	-9.8	-9.3	-9.3	-9.3
H163	575797	787449	-19	-14.3	-10	-9.5	-9.5	-9.5
H164	575776	787432	-19.2	-14.5	-10.2	-9.7	-9.7	-9.7
H165	573397	790172	-20.2	-15.5	-11.2	-10.7	-10.7	-10.7
H166	579833	788466	-19.7	-15	-10.7	-10.2	-10.2	-10.2
H167	579134	788925	-18.3	-13.6	-9.3	-8.8	-8.8	-8.8
H168	573907	791216	-19.8	-15.1	-10.8	-10.3	-10.3	-10.3
H169	581853	791862	-20.8	-16.1	-11.8	-11.3	-11.3	-11.3
H170	575722	787417	-19.4	-14.7	-10.4	-9.9	-9.9	-9.9
H171	578619	788034	-20	-15.3	-11	-10.5	-10.5	-10.5
H172*	582726	790363	-21.9	-17.2	-12.9	-12.4	-12.4	-12.4
H173	582265	791557	-21.5	-16.8	-12.5	-12	-12	-12
H174	581814	791931	-21	-16.3	-12	-11.5	-11.5	-11.5
H175	573896	791311	-20.3	-15.6	-11.3	-10.8	-10.8	-10.8
H176*	582760	790336	-22.1	-17.4	-13.1	-12.6	-12.6	-12.6
H177*	577104	787131	-20.2	-15.5	-11.2	-10.7	-10.7	-10.7
H178	581962	788805	-21.5	-16.8	-12.5	-12	-12	-12
H179	581421	788524	-21	-16.3	-12	-11.5	-11.5	-11.5
H180	580060	792788	-22.5	-17.8	-13.5	-13	-13	-13

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H181	574930	787930	-18.8	-14.1	-9.8	-9.3	-9.3	-9.3
H182**	573507	790887	-20.8	-16.1	-11.8	-11.3	-11.3	-11.3
H183	577360	792710	-23.5	-18.8	-14.5	-14	-14	-14
H184	573814	791313	-20.6	-15.9	-11.6	-11.1	-11.1	-11.1
H185	573950	788440	-20.3	-15.6	-11.3	-10.8	-10.8	-10.8
H186	573795	791321	-20.8	-16.1	-11.8	-11.3	-11.3	-11.3
H187	573787	791327	-20.8	-16.1	-11.8	-11.3	-11.3	-11.3
H188	575706	787261	-20.2	-15.5	-11.2	-10.7	-10.7	-10.7
H189	582696	789585	-22.6	-17.9	-13.6	-13.1	-13.1	-13.1
H190	581621	792153	-21.4	-16.7	-12.4	-11.9	-11.9	-11.9
H191	582851	790127	-22.7	-18	-13.7	-13.2	-13.2	-13.2
H192	577352	792783	-23.7	-19	-14.7	-14.2	-14.2	-14.2
H193*	577234	787044	-20.7	-16	-11.7	-11.2	-11.2	-11.2
H194	581925	792029	-21.9	-17.2	-12.9	-12.4	-12.4	-12.4
H195	581448	788441	-21.5	-16.8	-12.5	-12	-12	-12
H196	573749	791340	-21	-16.3	-12	-11.5	-11.5	-11.5
H197*	573814	788467	-20.8	-16.1	-11.8	-11.3	-11.3	-11.3
H198	577301	792783	-23.7	-19	-14.7	-14.2	-14.2	-14.2
H199	573727	791349	-21.2	-16.5	-12.2	-11.7	-11.7	-11.7
H200	573161	790216	-21.6	-16.9	-12.6	-12.1	-12.1	-12.1
H201	573465	791017	-21.4	-16.7	-12.4	-11.9	-11.9	-11.9
H202	580263	792756	-22.3	-17.6	-13.3	-12.8	-12.8	-12.8
H203**	577375	787010	-21.1	-16.4	-12.1	-11.6	-11.6	-11.6
H204**	573728	791388	-21.3	-16.6	-12.3	-11.8	-11.8	-11.8
H205	575504	787289	-20.5	-15.8	-11.5	-11	-11	-11
H206	579241	788497	-19.7	-15	-10.7	-10.2	-10.2	-10.2
H207	581172	792413	-21.5	-16.8	-12.5	-12	-12	-12
H208	582138	788751	-22.6	-17.9	-13.6	-13.1	-13.1	-13.1
H209	578974	793434	-25.5	-20.8	-16.5	-16	-16	-16
H210	574858	787816	-19.6	-14.9	-10.6	-10.1	-10.1	-10.1

	ITM	ITM	4m/s	5m/s	6m/s	7m/s	8m/s	9+m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA
H211**	580306	792746	-22.3	-17.6	-13.3	-12.8	-12.8	-12.8
H212	573694	791359	-21.3	-16.6	-12.3	-11.8	-11.8	-11.8
H213	573709	791400	-21.4	-16.7	-12.4	-11.9	-11.9	-11.9
H214	577284	792838	-23.9	-19.2	-14.9	-14.4	-14.4	-14.4
H215	573431	791052	-21.6	-16.9	-12.6	-12.1	-12.1	-12.1
H216	573406	791023	-21.7	-17	-12.7	-12.2	-12.2	-12.2
H217	573668	791368	-21.5	-16.8	-12.5	-12	-12	-12
H218	573681	791412	-21.6	-16.9	-12.6	-12.1	-12.1	-12.1
H219	573419	791072	-21.7	-17	-12.7	-12.2	-12.2	-12.2
H220	574770	787815	-19.9	-15.2	-10.9	-10.4	-10.4	-10.4
H221	573655	791422	-21.7	-17	-12.7	-12.2	-12.2	-12.2
H222	581116	792532	-22	-17.3	-13	-12.5	-12.5	-12.5
H223	574710	787840	-20	-15.3	-11	-10.5	-10.5	-10.5
H224	574792	787749	-20.1	-15.4	-11.1	-10.6	-10.6	-10.6
H225	573637	791449	-21.9	-17.2	-12.9	-12.4	-12.4	-12.4
H226	574711	787812	-20.1	-15.4	-11.1	-10.6	-10.6	-10.6
H227	573621	791456	-22	-17.3	-13	-12.5	-12.5	-12.5
H228**	574727	787768	-20.2	-15.5	-11.2	-10.7	-10.7	-10.7
H229	581269	792518	-22.3	-17.6	-13.3	-12.8	-12.8	-12.8
H230	581315	792498	-22.3	-17.6	-13.3	-12.8	-12.8	-12.8
H231	581336	792571	-22.7	-18	-13.7	-13.2	-13.2	-13.2
H232	581210	792659	-22.9	-18.2	-13.9	-13.4	-13.4	-13.4
H233	581614	792586	-23.4	-18.7	-14.4	-13.9	-13.9	-13.9
H234	581624	792634	-23.7	-19	-14.7	-14.2	-14.2	-14.2
H235*	573483	790037	-19.6	-14.9	-10.6	-10.1	-10.1	-10.1

\*(FI) – Financially Involved

\*\* (DP) – Derelict Property

A noise contour map of the cumulative effects of all 11 no. turbines is presented with a maximum sound power output at a wind speed of 12ms<sup>-1</sup> at 10m height in **Appendix 13.4**.

The contour map in **Appendix 13.4** assumes that all turbines are simultaneously downwind at the same time to each location which results in an overprediction of the noise levels.

There are thirty-eight properties within 5 dB of the 43 dB night-time limit, when all of the turbines are operating at their maximum noise levels. There is an inherent conservatism in the prediction noise modelling when it is carried out in line with ETSU-R-97 and the IOAGPG. Scientific papers referenced within the IOAGPG note that predicted noise levels are in the region of 2dB more conservative than the measured levels taken during post compliance monitoring.

The turbines to be installed on this site are able to operate in various modes. If specific conditions arise that AM is generated, the operator can amend the operating mode to sufficiently mitigate the generation of AM or reduce the overall noise level in compensation to achieved set noise limits.

#### **13.4.4 Cumulative Effects Assessment**

There are no wind turbines or wind farms located within 2km of the proposed Wind Turbines. Therefore, a cumulative assessment is not required.

### **13.5 MITIGATION MEASURES AND RESIDUAL EFFECTS**

#### **13.5.1 Construction and Decommissioning Noise Mitigation**

No significant construction noise effects have been identified. Therefore, no specific mitigation measures are required. However, general guidance for controlling construction noise through the use of good practice given in BS 5228 will be followed. Construction and Decommissioning phases shall be limited to working times given and any controls incorporated in any planning permission.

During the Decommissioning phase of the Wind Farm Site, noise levels are likely be no more than predicted in **Table 13.10**, however, it is envisaged that decommissioning will be of shorter duration. Any legislation, guidance or best practice relevant at the time of decommissioning will be complied with. Construction and decommissioning is a short-term day time activity.

##### **13.5.1.1 Residual Construction and Decommissioning Effects**

The residual effects are the same as the construction and Decommissioning effects identified in this assessment.

### 13.5.2 Operational Noise Mitigation

The Project has been designed to comply with the 2006 noise Guidelines and noise limits attached as conditions to recent 2022 An Coimisiún Pleanála decisions. As can be seen from **Table 13.13** that the predicted noise levels exceed the daytime noise limit of 45 dB at one receptor, H1 at certain wind speeds. In addition, the predicted noise levels are higher than the night-time noise limit of 43 dB at one additional receptor at various wind speeds – H3. However, it has been confirmed by the applicant that H1 is a derelict building and shall not be occupied for the duration of the operational phase of the Wind Farm Site.

It has also been confirmed by the applicant that H3 is financially involved with the Project, to which a 45 dB limit may be applied.

Therefore, there are no third-party exceedances of the 43 dB night-time noise limit.

The predicted noise levels are lower than the noise limits at the remaining receptors, at all wind speeds, and are therefore compliant with the noise limits and are not significant in terms of EIA.

Therefore, no specific mitigation measures are required for the Project.

#### 13.5.2.1 Residual Operational Effects

The residual effects are the same as the operational effects identified in this assessment.

### 13.5.3 Cumulative Effects

There are no additional wind turbines located within 2km of the Project.

### 13.5.4 Description of Effects – Operational Noise

The criteria for description of effects for all operational noise activity and the potential worst-case effects, at the nearest receptors is given in **Table 13.15** below.

**Table 13.15: Description of Effects – Operational Noise**

Quality	Significance	Duration
Negative	Not Significant	Long Term

## 13.6 SUMMARY OF EFFECTS

Table 13.16 below summarises the Effects.

**Table 13.16: Summary of Effects**

	Quality	Significance	Duration
<b>Construction noise</b>	Negative	Not Significant	Short Term
<b>Operational Noise</b>	Negative	Not Significant	Long Term
<b>Decommissioning Noise</b>	Negative	Not Significant	Temporary

## 13.7 STATEMENT OF SIGNIFICANCE

This Section has assessed the significance of the potential effects of the Project during operation, construction and decommissioning.

The effects of noise from the operation of the Project have been assessed using 2006 Guidelines with the methodology described in ETSU-R-97, the IOA Good Practice Guide and the NG4 Guidance document. Noise levels during operation of the Project have been predicted using the best practice of calculation technique. They have been compared with the noise limits in the 2006 Guidelines, recent 2021 An Coimisiún Pleanála limits and the NG4 Guidance document and found to be compliant.

There has been a consultation process in relation to the revision of the 2019 Wind Energy Development Guidelines. This document provided the basis for a discussion on amendments of the noise limits applicable to wind turbine developments. It is understood that there will be revisions to the draft consultation documents, however a mitigation strategy to incorporate a reduction in sound power level outputs with respect to directionality can be put in place to comply with any specific variation in noise limit levels if new more restrictive guidelines are adopted. All turbines have software incorporated so that the sound power levels can be reduced by direction and energy output.

The noise levels predicted at the nearest receptors are orders of magnitude below the level at which risk of hearing damage, or indeed negative health effects are possible.

Noise during construction of the Project and decommissioning will be managed to comply with best practice, legislation and guidelines current at that time so that effects are not significant.