11. NOISE

11.1 Introduction

Wind farms have the potential to create noise during their construction, operational and decommissioning phases. This chapter assesses the potential noise impacts at the nearest noise sensitive receptors (NSRs), within c. 2km of the Proposed Development, during each of the project phases.

This chapter considers the likely significant effects with respect to the noise associated with the construction and operation of the Proposed Development. The specific objectives of the chapter are to:

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

11.1.1.1 Statement of Authority

The noise assessments were carried out by TNEI Services Ltd. TNEI is a specialist energy consultancy with an Acoustics team that has undertaken noise assessments for over 4.5 GW of onshore wind farm developments. The construction noise assessment was undertaken by Alex Dell (MEng), who is an Associate Member of the Institute of Acoustics. The operational noise assessment was undertaken by Jason Baldwin (BSc, Dip) and Gemma Clark (BSc, MSc) who are both Associate Members of the Institute of Acoustics. The construction and operational noise assessments were reviewed and approved by Jim Singleton (BSc, Dip). Jim is a full member of the Institute of Acoustics and holds the Diploma in Acoustics and Noise Control.

This chapter is supported by the following figures and technical appendices:

- Figures
  - Figure 11-1: Construction Noise Assessment Locations;
  - Figure 11-2: Operational Noise Monitoring and Assessment Locations; and
  - Figure 11-3: Cumulative Turbine Locations.
- Technical Appendices
  - Appendix 11-1: Construction Noise Report; and
  - Appendix 11-2: Operational Noise Report.

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

11.2 Legislation, Policy and Guidelines

As well as the guidance listed in Section 1.8 of Chapter 1 of this EIAR, this assessment adhered to the following combination of guidance and assessment methodologies:

- British Standard BS 5228-1: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open developments - Noise'[1];

[1] *British Standards Institute, 2014. Code of practice for noise and vibration control on construction and open sites. Noise. UK : BSI, 2014. BS 5228-1:2009+A1:2014*

- Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006[2];
- The Working Group on Noise from Wind Turbines (NWG) (1996). ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms'[3];
- Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (2013) (IOA GPG)[4]; and
- ISO 9613-2: 1996 'Acoustics - Attenuation of sound during propagation outdoors Part 2: General method of calculation'[5].

The above documents are discussed in detail within Section 2 of Appendix 11-1 and Appendix 11-2:, where relevant.

It is noted that the WEDG are currently under review and a set of 'draft 2019 WEDG' updated guidelines were issued for consultation in December 2019. The draft 2019 WEDG included reference to, and reliance upon, some elements of ETSU-R-97 and the IOA GPG, however, significant concerns were raised during the consultation process regarding the noise section of the draft 2019 WEDGs and at the time of writing this report, no further updates have been issued. Given the limitations of the draft 2019 WEDGs and the likelihood that significant changes would need to be made to them before they could be adopted, an assessment using those draft guidelines has not been undertaken.

The guidance in the WEDG 2006 has been used to assess operational noise from the Proposed Development. In the absence of detailed guidance being included in WEDG 2006 the assessment methodology has been supplemented by the guidance in ETSU-R-97 and the IOA GPG where appropriate. The use of these documents is considered to represent best available evidence and expertise.

In 2018 the World Health Organisation issued noise guidelines *'Environmental Noise Guidelines for the European Region'*[6] that provide recommendations for protecting human health from exposure to environmental noise. The guidelines consider noise originating from various sources including wind turbine noise. The guidelines make a series of 'strong' and 'conditional' recommendations. Two conditional recommendations were made in relation to wind turbine noise. In relation to conditional recommendations the guidance notes that:

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

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

In relation to wind turbine noise the guidelines state:

'Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.'

[2] *Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006.*
[3] *ETSU for the DTI (Department of Trade and Industry), 1996 . The Working Group on Noise from Wind Turbines ETSU-R-97 The Assessment and Rating of Noise from Wind Farms'.*
[4] *Institute of Acoustics, 2013. Good Practice Guidance on the application of ETSU-R-97 for wind turbine noise assessment.*
[5] *(ISO), International Organisation for Standardisation. 1996. Acoustics – Attenuation of Sound During Propagation Outdoors: Part 2 – General Method of Calculation. Geneva: ISO, 1996. ISO 9613-2:1996*
[6] *World Health organisation, 2018. Environmental Noise Guidelines for the European Region'*

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

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

11.3 Consultation

An EIA Scoping Response for the Proposed Development was issued on 3rd August 2021 by Mayo County Council. The Scoping Response stated the following in relation to noise:

'4. Establish baseline noise conditions at noise sensitive receptors prior to works commencing on site. Submit a noise impact assessment for the proposed development.'

This Chapter addresses the requirements of the Scoping Response.

11.4 Assessment Methodology and Significance Criteria

11.4.1.1 Construction Noise Methodology

There is no published statutory Irish guidance that contains suggested noise limits for construction activities, other than for road construction works, however, the Association of Acoustic Consultants of Ireland (AACI) have published 'Environmental Noise Guidance for Local Authority Planning & Enforcement Departments'[7], which states;

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

The construction noise assessment has therefore been undertaken using the BS 5228 guidance. The prediction of construction noise levels was undertaken using the calculation methodology presented in ISO 9613:1996, together with published noise data for appropriate construction plant.

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

- identify noise sensitive receptors and select representative Noise Assessment Locations (NALs);
- identify applicable threshold of significant effects;
- predict noise levels for various construction noise activities;
- compare predicted noise levels against the applicable thresholds;
- where necessary, develop suitable mitigation measures to minimise any significant adverse effects during the construction phase; and, if required
- assess any residual adverse effects taking into account any identified mitigation measures.

[7] *Association of Acoustic Consultants of Ireland, 2021. Environmental Noise Guidance for Local Authority Planning & Enforcement Departments*

Construction of the Proposed Development will be undertaken in several successive phases. During each phase the plant and equipment, and the associated traffic, will influence the noise generated. The selection of plant and equipment to be used would be determined by the main contractor when they are commissioned, therefore the assessment has been based upon a typical selection of plant for a wind farm project of this size and an indicative construction timetable. In view of this, the plant has been modelled operating at the closest points to each receptor for a given activity in each construction phase, whereas in reality only certain plant would be working at the closest point for short periods of time.

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

Section 4.8.1 of Chapter 4 of this EIAR outlines the tasks that will be undertaken during the construction period, which is estimated to last 18-24 months. For the purposes of this assessment, noise modelling has been undertaken for a number of construction scenarios (or phases), which simulate the likely overlap of several tasks that could occur throughout the construction period:

Scenario 01: Forestry activities, including felling of trees and forwarding of timber for transportation off site. Instances of felling activity have been modelled around the turbines located closest to the site boundary, towards the nearest receptors. These locations are within 30 m of the proposed hardstanding areas for turbines 2, 5, 6, 8, 12, 15, 17 and 18. Scenario 01 assumes that alongside the felling, access track upgrades and construction is underway from the site entrance to each of the construction compounds and rock excavation has begun in the two proposed borrow pits. The Substation construction and associated electrical works (including construction of export cables) has begun and the four proposed construction compounds are operational.

Scenario 02: Felling activities are still active and are assumed to be occurring at the turbines listed above in Scenario 1. Access track upgrades and construction are continuing beyond the construction compounds. All construction compounds are operational. Substation construction and associated electrical works are continuing. Hardstandings for turbines 3, 4, 5, 8, 14 and 20 are under construction.

Scenario 03: Felling activities are still active and are assumed to be occurring in the worst-case locations, as per scenario 1. Access track upgrades and construction are continuing beyond the previously completed tracks. All construction compounds are operational. Substation construction and associated electrical works are continuing. Hardstandings for turbines 2, 6, 7, 11, 17, 18 and 19 are under construction. Concrete pouring for turbines 3, 4, 5, 8, 14 and 20 is underway. Construction of hardstand for the turbine storage area is underway.

Scenario 04: Felling activities are still active and are assumed to be occurring in the worst-case locations, as per scenario 1. Access track upgrades and construction are continuing beyond the previously completed tracks. Substation construction and associated electrical works are continuing. Hardstands for turbines 1, 12, 15 and 16 are under construction. Concrete pouring for turbines 2, 6, 7, 11, 17, 18 and 19 is underway. Turbine installation at turbines 3, 4, 5, 8, 14 and 20 is underway.

Scenario 05: Felling activities are still active and are assumed to be occurring in the worst-case locations, as per scenario 1. All construction compounds are operational. Peat placement is taking place within the proposed areas near turbines 2, 4, 6, 15, 16 and 19.

Night-time: Diesel generators for the cabin and lighting at all construction compounds are operational.

The noise-generating equipment assessed for each construction phase is detailed in Appendix 11-1, which shows actual noise data measured at 10 m from the noise source as detailed in BS5228. Using the data contained in these tables the noise levels for all Scenarios have been calculated. It is worth noting that for much of the working day the noise associated with construction activities would be less than

predicted, as the assessment has assumed all equipment is constantly operating at full power and is located at the closest point to each receptor, whereas in practice equipment load and precise location will vary.

The assessment has assumed that gravity based foundations would be used onsite.

11.4.1.2 Cumulative Construction Noise Methodology

There is the potential for construction activities at the Proposed Development to occur at the same time as the construction of Oweninny 3 Wind Farm (assuming a planning application is made and the wind farm is consented), the site of which is located approximately 6km southeast of the Proposed Development. The first stage of the cumulative assessment is to compare the predicted levels from the construction of the Proposed Development to the noise thresholds and establish the available margin. Where noise levels are predicted to be at least 10 dB below the threshold levels then no further assessment is required. This is because the influence of noise from the construction of the Proposed Development would be such that it could not increase the overall cumulative construction noise to above the threshold levels. If predicted levels are within 10 dB of the threshold levels then it is necessary to predict the cumulative noise levels from the construction of the neighbouring developments and compare this to the threshold level. This is considered further in Section 11.6.5 below.

11.4.1.3 Operational Noise Methodology

The assessment has been undertaken in accordance with the Wind Energy Development Guidelines (WEDG) 2006.

The AACI Environmental Noise Guidance states the following in relation to the WEDG 2006:

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

In 2013 the ETSU-R-97 guidance was supplemented by a document produced by the Institute of Acoustics titled 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (IOA GPG). Given the lack of detail in parts of the WEDG, information contained in ETSU-R-97 and the IOA GPG has been used to supplement the WEDG.

The WEDG include limits for daytime and night time periods. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise levels at nearby noise sensitive properties would be below the noise limits derived in accordance with WEDG 2006.

The daytime and night time periods are not defined within the WEDG 2006, therefore the assessment has considered these periods as detailed within ETSU-R-97. The quiet daytime criteria are based upon background noise levels measured during 'quiet periods of the day' comprising:

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

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

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

The WEDG include guidance on how to derive limits for daytime and night time periods.

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

- 45 dB $L_{A90,\ 10\ min}$ or background noise + 5 dB, whichever is the greater, for daytime hours (applicable where background noise levels are greater than 30 dB L_{A90}); or
- 40 dB $L_{A90,\ 10\ min}$ where background noise is less than 30 dB L_{A90}.

The 40 dB $L_{A90,\ 10\ min}$ fixed minimum limit has been chosen for the daytime period with due consideration given to the limits already adopted for other schemes in the area.

The WEDG states that a "fixed limit of 43dB(A) will protect sleep inside properties during the night", however, whilst it is not explicit within the WEDG guidance, the addition of a night time 'background noise +5 dB' parameter is commonly applied in wind turbine noise assessments. This is detailed in numerous examples of planning conditions issued by local authorities and An Bord Pleanála. On that basis, the night time noise limits used in this assessment have been based on 43 dB or background noise + 5 dB, whichever is the greater.

Two sets of noise limits have been derived; the Total WEDG Noise limits apply to the cumulative noise level of all turbines operating in the area including the Proposed Development, whilst the Site Specific Noise limits apply to operational noise from the Proposed Development only. The 'Site Specific Noise Limits' are derived to take account of the proportion of the noise limit that has been allocated to, or could theoretically be used by, other wind farm developments.

The aim of the operational noise assessment is to establish the Total WEDG Noise Limits, determine whether a cumulative assessment is required at the nearest noise sensitive receptors, derive Site Specific Noise Limits and to establish whether the Proposed Development can meet those limits.

The exact model of turbine to be installed on the site will be the result of a future tendering process should planning permission be granted. Achievement of the Site Specific Noise Limits determined by this assessment will be a key determining factor in the final choice of turbine for the Proposed Development. Predictions of wind turbine noise for the Proposed Development were made, based upon the sound power level data for a candidate wind turbine with a rotor diameter of 170m, serrated trailing edge blades and a hub height of 115m. The candidate turbine modelled is considered to be representative of the type of turbine that will be installed at the site based on the proposed turbine dimensions.

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

Typically wind farm noise assessments assume all properties are downwind of all turbines at all times (as this would result in the highest wind turbine noise levels). However, where properties are located in between groups of turbines they cannot be downwind of all turbines simultaneously, so it is appropriate to consider the effect of wind direction on predicted noise levels and the impact of directivity has been considered in the assessment (see Section 6.3 of Appendix 11-2).

In line with the IOA GPG, an assessment has been undertaken to determine whether a concave ground profile correction (+3 dB) or barrier correction (-2 dB), is required due to the topography between the turbines and the noise sensitive receptors. Propagation across a valley (concave ground) increases the

number of reflection paths, and in turn, has the potential to increase sound levels at a given receptor. Terrain screening effects (barrier corrections) act as blocking points, subsequently reductions in sound levels at a given receptor can potentially be observed. A concave ground and barrier correction was found to be required for a number of turbines at a number of receptors as detailed in Annex 7 of Appendix 11-2.

Information relating to operational noise such as Amplitude Modulation (AM), a potential characteristic of wind turbine noise, and Low Frequency Noise (LFN), has been provided in Appendix 11-2. There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and at time of writing there is no agreed methodology which can be used to predict the occurrence of AM or an agreed methodology that can be used to determine whether the effects of AM, should it occur, are likely to be significant and as such they have not been considered further in the assessment.

11.4.1.4 Cumulative Operational Noise Methodology

The need for a cumulative noise assessment was considered in accordance with the guidance contained within the IOA GPG. Where predictions from the Proposed Development at a Noise Assessment Location (NAL) were found to be within 10 dB of the cumulative noise levels from other wind farm developments, a cumulative noise assessment has been undertaken. The noise assessment has been undertaken in three separate stages:

- Stage 1 - Establish the 'Total WEDG Noise Limits' which are applicable for all wind farm schemes in the area;
- Stage 2 – undertake noise predictions to determine whether predictions from the Proposed Development on its own are within 10 dB of the noise predictions from other wind farm developments within the area. Where turbine predictions are within 10 dB then a cumulative noise assessment will be undertaken and the results compared to the 'Total WEDG Noise Limits'. The predicted 'likely' cumulative levels are the actual levels expected at a noise assessment location and include the addition of an appropriate level of uncertainty to the turbine data as per Section 4.2 of the IOA GPG. The uncertainty level added is generally +2 dB but this can vary depending on the turbine manufacturer data available for each turbine; and
- Stage 3 – establish the 'Site Specific Noise Limits' for the Proposed Development (through apportioning the 'Total WEDG Noise Limits', where required) and compare the noise predictions from the Proposed Development on its own against the 'Site Specific Noise Limits'. In order to the derive the Site Specific Noise Limit an additional buffer is added to the 'likely' predicted levels summarised in Stage 2 which results in 'cautious' cumulative predictions. The buffer added is generally +2 dB but can be more or less and is determined using the assessment principles identified within Section 5.4 of the IOA GPG. Further information on the buffers added to derive the Site Specific Noise Limit are included within Section 11.6.4.3 below and Table 6.7 of Appendix 11-1.

All the turbines modelled, inclusive of those considered in the cumulative noise assessment (Stage 2), are summarised in Annex 7 of Appendix 11-2.

Uncertainty in sound power data for the Proposed Development has been accounted for using the guidance contained within Section 4.2 of the IOA GPG (2013). The location of the wind turbines for the Proposed Development and the other schemes are shown on Figure 11-3.

11.4.2 Potential Effects Scoped Out

11.4.2.1 Decommissioning

Activities that occur during the decommissioning of the Proposed Development are unlikely to produce higher noise levels than those produced during construction and many of the activities will be similar in

nature. As such it is considered that if construction noise levels are predicted to be below the threshold levels, then decommissioning noise will also be within the threshold levels.

11.4.2.2 Blasting

The extent of any blasting requirement cannot be determined until intrusive site investigation tests are completed. Nevertheless, should blasting be required, a series of tests would be undertaken by the appointed contractor in accordance with guidance outlined in BS5228-2:2009+A1:2014[8]. Following on from these tests, blasts would be designed through appropriate specification of Maximum Instantaneous Charge (MIC) to ensure that vibration levels at the nearest NSR's would not exceed the guideline limits presented in BS 5228 and related standards such as BS 7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'[9][10]. A condition could be attached to the consent to require compliance with these limits.

Given the relative distances between the potential locations of blasting and the closest sensitive receptors, the blast engineer should be able to calculate appropriate Maximum Instantaneous Charge (MIC) values that will ensure that the guideline limits within BS7385-2: 1993 and BS 6472-2: 2008 would be met, and therefore this issue can be scoped out of further detailed consideration.

11.4.3 Method of Baseline Characterisation

11.4.3.1 Extent of the Study Area

Prior to the commencement of the operational noise assessment, initial desktop noise modelling was undertaken in order to identify all NSRs and potential Noise Monitoring Locations (NMLs). Three NMLs were selected to represent all of the NSRs, which are located to the north, west and south of the Proposed Development. The actual NMLs are shown on Figure 11-2. More information on the NMLs can be found in Section 5 of Appendix 11-2: Operational Noise Report.

There are a number of operational, consented and proposed (in planning) wind farms located in proximity to the Proposed Development, these include:

- Oweninny 1Wind Farm (operational);
- ABO Sheskin Wind Farm (under construction); and
- Oweninny 2 Wind Farm (under construction).

The operational Bellacorrick Wind Farm has not been considered in the cumulative assessment as it is understood that it will be decommissioned as part of the construction of Oweninny 2 and 3. Corvoderry Wind Farm has not been considered in the assessment as the planning permission expired mid October 2022. Oweninny 3 has also not been considered as the scheme is pre-planning and therefore at this stage there is too much uncertainty regarding turbine locations and turbine parameters. Due to the separation distances between the closest turbines and the NSRs (>5 km) it is anticipated that noise immissions from Oweninny 3 would have a negligible impact at the noise sensitive receptors located closest to the Proposed Development.

The wind farms detailed above have been considered as part of the cumulative noise assessment (Stage 2). Further information on the cumulative noise assessment can be found in Section 1.2.3 of Appendix 11-2.

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[8] *British Standard BS5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 2: Vibration*
[9] *British Standard BS7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'*
[10] *British Standard BS6472: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration'*

11.4.3.2 Field Survey

The noise survey to determine the existing background noise environment at noise sensitive receptors neighbouring the Proposed Development was undertaken in accordance with the guidance contained within ETSU-R-97 and current good practice (IOA GPG).

Background noise monitoring was undertaken at three noise sensitive receptors. The NMLs were chosen by TNEI to be representative of all other receptors located to the north, west and south of the Proposed Development. The selection of the NMLs considered local noise sources such as boiler flues, watercourses and vegetation.

Background noise monitoring was undertaken over the period of December 2020 to March 2021 at the NMLs detailed in Table 11-1 and Figure 11-2. Further details of the NMLs can be found within Appendix 11-2.

Simultaneous wind speed/direction data were recorded within the site at various heights using a LIDAR Unit (located at Irish Transverse Mercator reference 493244, 825379). The wind speed data collected at the two nearest heights to the proposed hub height, 110 m and 123 m, were used to derive hub height wind speeds (115 m), which were then standardised to 10 m height in accordance with good practice.

Wind speed/direction and rainfall data were collected over the same time scale and averaged over the same ten-minute periods as the noise data to allow analysis of the measured background noise as a function of wind speed and wind direction. All data analysis was undertaken in accordance with ETSU-R-97 and the IOA GPG.

Table 11-1 Summary of Noise Monitoring Locations

Receptor	Easting	Northing
NML1	491353	825479
NML2	494273	829996
NML3	493766	822338

11.4.4 Criteria for the Assessment of Effects

The Environmental Protection Agency document 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' [11] has informed the criteria for the assessment of potential effects as summarised below.

11.4.4.1.1 *Criteria for Assessing Significance – Construction Noise*

The significance criteria adopted for this assessment are based on Appendix E part E.3.2 of BS5228-1:2009+A1:2014, as detailed in Section 2.3 of the Construction Noise Report (Appendix 11-1).

The criteria for determining significance use a noise metric of $L_{Aeq,T}$,, as detailed in Table 11-2. The L_{Aeq} is the A-weighted, equivalent continuous sound level in decibels measured over a stated period of time, ($L_{Aeq,T}$) where T is the length of the assessment period (Time).

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

Table 11-2 Construction Noise Significance Criteria

Significance of Effect	Significance Level	
	Not Significant	Significant
Category A Daytime (07:00 – 19:00) and Saturdays (07:00 to 13:00)	≤65dB $L_{Aeq, T}$	>65dB $L_{Aeq, T}$
Category A Evenings and Weekends (19:00 – 23:00)	<55dB $L_{Aeq, T}$	>55dB $L_{Aeq, T}$
Category A Night time (23:00 – 07:00)	<45dB $L_{Aeq, T}$	>45dB $L_{Aeq, T}$

11.4.4.1.2 *Criteria for Assessing Significance – Operational Noise*

The WEDG and ETSU-R-97 do not define significance criteria but describe a framework for the measurement of wind farm noise and give indicative noise levels considered to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development. Achievement of the WEDG derived noise limits ensures that wind turbine noise will comply with current Government guidance.

In terms of the EIA Regulations, in this Chapter of the EIAR the use of the term "significance" refers to compliance or non-compliance with the WEDG derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in WEDG, then the noise effects are deemed not significant. Any breach of the WEDG derived noise limits due to the Proposed Development has the potential to result in a significant effect.

11.4.4.1.3 *Limitations and Assumptions*

It has been assumed that the noise data collected during the background noise survey are representative of the typical baseline noise levels at the nearest noise sensitive receptors; the guidance in the WEDG supplemented by ETSU-R-97 and the IOA GPG has been followed by suitably experienced Acoustic Consultants to ensure that the data collected is as representative as possible.

A candidate wind turbine has been used for predictions of operational noise from the Proposed Development, whilst the final model of wind turbine to be used may differ from that presented in this assessment, operational noise levels would have to comply with the noise limits imposed by An Bord Pleanála, informed by this noise assessment.

No other assumptions or data gaps have been identified.

11.5 Baseline Conditions

11.5.1 Current Baseline

The Proposed Development is located within a rural location where existing background noise levels at the NSRs are generally considered to be low (<30 dB at low wind speeds as defined in the WEDG 2006[12]). The predominant noise sources in the area are wind induced noise (wind passing through

[12] *Section 5.4 of WEDG 2006 refers to ' low noise environments where background noise is less than 30 dB(A)'*

vegetation and around buildings), local watercourses and birdsong. At some receptors the soundscape is affected by some distant road traffic noise.

Tables 11-3 and 11-4 provide a summary of the background noise levels measured during the monitoring period during the quiet daytime and night time periods. Background noise data recorded during periods of rainfall (including the preceding 10 minute period in line with IOA GPG) have been excluded from the dataset, as well as data following periods of heavy rainfall. Further information of the data recorded during the noise survey can be found in Section 5 of Appendix 11-2). The prevailing background noise levels are also shown on Figures A1.2a-A1.2c included in Annex 1 of Appendix 11-2.

Table 11-3 Summary of Prevailing Background Noise Levels during Quiet Daytime Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	24.4*	24.4	24.9	26.1	27.9	30.2	32.9	36.0	39.3	42.7	46.3	49.8
NML2	26.7	27.5	28.6	29.9	31.4	33.2	35.2	37.5	40.0	42.7	45.7	48.9
NML3	28.4*	28.4*	28.4*	28.4	29.4	31.0	33.1	35.5	38.0	40.6	43.2	45.5

**restricted where derived minimum occurs at lower wind speeds, see Section 5.7.4 of the Operational Noise Report (Appendix 11-2: Operational Noise Report)*

Table 11-4 Summary of Prevailing Background Noise Levels during Night time Periods (dB(A))

Noise Monitoring Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NML1	24.6*	24.6	25.0	26.1	27.8	30.0	32.7	35.7	39.1	42.6	46.3	50.0
NML2	26.8	27.7	28.9	30.3	32.0	33.9	36.0	38.4	41.0	43.8	46.8	50.1
NML3	26.5*	26.5*	26.5	27.0	28.1	29.5	31.4	33.7	36.3	39.2	42.4	45.8

**restricted where derived minimum occurs at lower wind speeds, see Section 5.7.4 of the Operational Noise Report (Appendix 11-2).*

11.5.2 Summary of Sensitive Receptors

11.5.2.1 Scoped Out Receptors

During the initial search to identify the closest receptors a dwelling immediately to the east of the site known as Sheskin Lodge' was identified. The building is referred to as a ruin on OS mapping for the area. Due to the status of the dwelling, it has not been considered as a noise sensitive receptor.

11.5.2.2 Scoped In Receptors

There are 23 NSRs in proximity (~2 km search area) to the Proposed Development. Of the 23 identified NSRs a total of seven NSRs were chosen as Noise Assessment Locations (NALs) for the operational noise assessment or CNALs for the construction noise assessment. The CNALs/ NALs were chosen to represent the noise sensitive receptors located closest to the Proposed Development and also some additional receptors were included to consider cumulative noise impacts or larger groups of NSRs. The modelling results for the CNALs/ NALs has been presented within the main body of this chapter and Appendices 11-1 and 11-2, whilst an assessment for all NSRs has been included within Annex 3 of Appendix 11-1 and Annex 6 of Appendix 11-2.

For the assessment locations where no background noise measurements were undertaken, noise data collected at proxy locations deemed representative of the background noise environment was used to assess the noise impacts at those receptors. For clarity, all NSRs are labelled with the letter 'H', to ensure consistency with the labelling within the rest of the EIAR.

The receptors considered as NALs within the noise assessment are summarised in Tables 11-5 and 11-6 below. A list of all NSRs is included within Annex C of Appendix 11-1 and Annex 6 of Appendix 11-2. All CNALs and NSRs are shown on Figure 11-1 and NALs and NSRs on Figure 11-2.

11.6 Assessment of Likely Effects

11.6.1 Construction Noise Assessment Locations

The Construction Noise Assessment Locations (CNAL) are summarised in Table 11-5 below and are shown on Figure 11-1.

Table 11-5 Summary of Construction Noise Assessment Locations

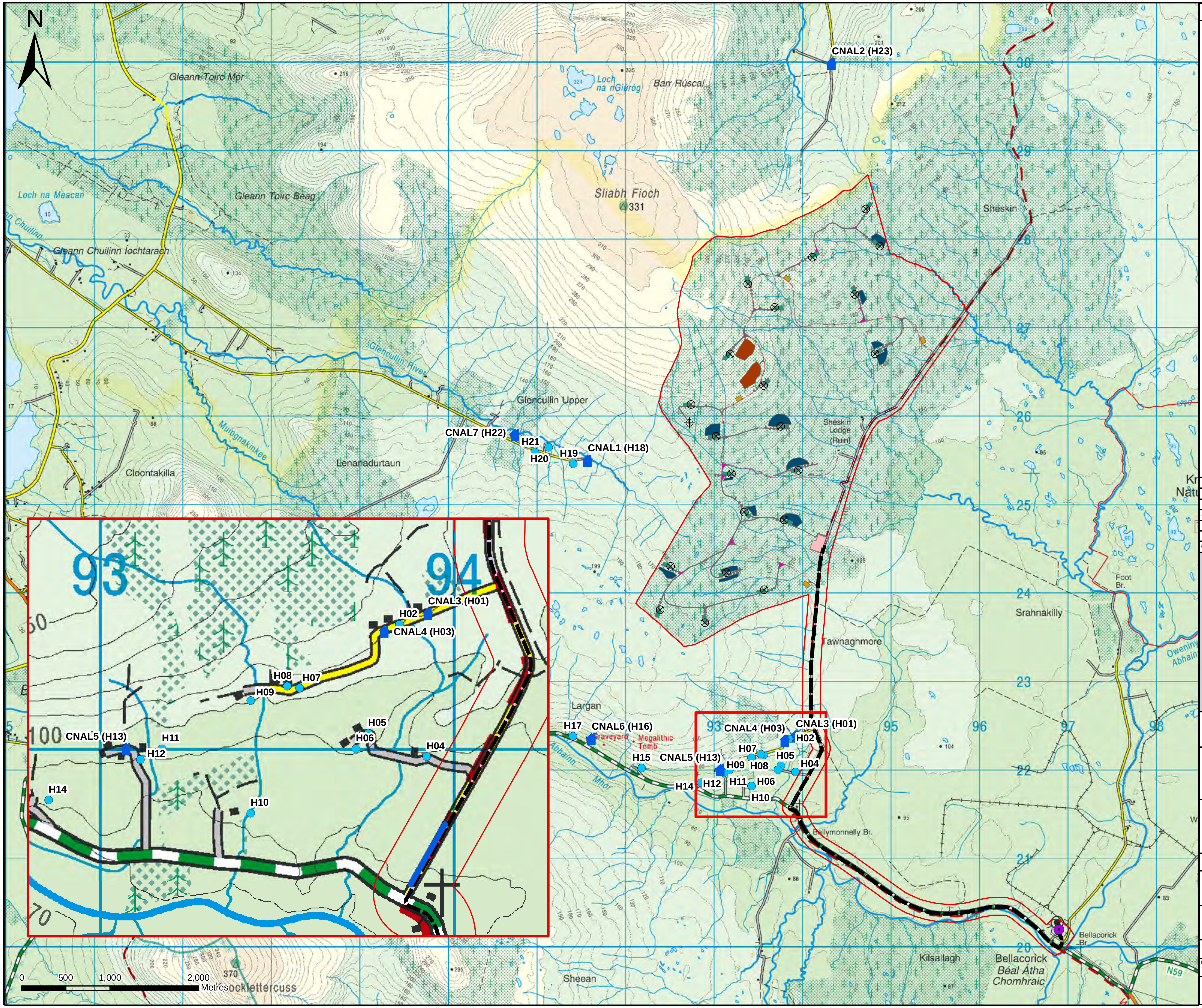
Receptor	Easting	Northing
CNAL01 – H18	491517	825521
CNAL02 – H23	494271	830004
CNAL03 – H01	493866	822407
CNAL04 – H03	493743	822357
CNAL05 – H13	493014	822026
CNAL06 – H16	491561	822376
CNAL07 – H22	490697	825812

11.6.2 Operational Noise Assessment Locations

The NALs have been located in the external amenity area on the wind farm side of the property. Predictions of wind turbine noise have been made at each of the NALs as detailed in Table 11-6 and shown on Figure 11-2. This approach ensures that the assessment considers the worst case (loudest) noise immission level expected at the noise sensitive receptor. Table 11-6 also details which NML has been used to set noise limits for each NAL. Predictions for all other NSRs are included within Annex 6 of Appendix 11-2.

Table 11-6 Summary of Operational Noise Assessment Locations

Receptor	Easting	Northing	Elevation (m AOD)	Approximate Distance to Nearest Sheskin South Turbine	Background Noise Data Used
NAL1 (H18)	491517	825521	134	1,348 (T5)	NML1
NAL2 (H23)	494271	830004	134	1,707 (T12)	NML2



Legend

- EIAR Site Boundary
- Construction Noise Assessment Location (CNAL)
- Noise Sensitive Receptor
- Turbine Layout
- Proposed Met Mast Location
- Bellacorick Substation
- Proposed Grid Connection Route
- SHE Turbine Storage Area
- Turbine Foundation & Crane Hardstands
- Proposed New Roads
- Proposed Met Mast Platform
- Proposed Construction Compounds
- Proposed Borrow Pits
- Peat Placement Areas
- Existing Roads - Upgrade Required
- Existing Roads - Upgrade Proposed
- Proposed Substation Compound

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
02	13/02/2023	Minor Updates	AD	GC	GC
01	19/12/2022	Minor Updates	AD	GC	GC
00	05/12/2022	For Planning	AD	GC	GC

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Client

sse

Drawing Status

For Planning

Project Title

Sheskin South Wind Farm

Drawing Title

EIAR Figure 11-1: Construction Noise Assessment Locations

Scale	Designed	Drawn	Checked	Approved
1:40,000	AD	AD	GC	GC
Original Size	**Date**	**Date**	**Date**	**Date**
A3	13/02/2023	13/02/2023	13/02/2023	13/02/2023

Drawing Number: 14192-011

Revision: 2

N

0 250 500 1,000 Metres

NAL2 (H23) NML2

Loch na nGiúróg

Barr Ruscaí

Sliabh Fioch 331

Sheskin

Glencullin River

Glencullin Upper

NAL7 (H22)

H20 NML1

H21 H19 NAL1 (H18)

anadurtaun

Lough Boleynagee

Sheskin Lodge (Ruin)

Lough Doo

Knockmoy Nature Rese

Foot Br.

Srahnakilly

Tawnaghmor

River Abhainn Mhór

Largan

Graveyard

Megalithic Tomb

H17 NAL6 (H16)

H15

NML3

NAL4 (H03)

NAL3 (H01)

H08 H02

NAL5 (H13) H07 H06 H04

H14 H12 H11 H10 H05

H02 NAL3 (H01)

NAL4 (H03)

NML3

H08 H07

H09 H05

NAL5 (H13) H06 H04

H12 H11

H14 H10

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

Legend

- Proposed Turbine Location
- Noise Monitoring Location (NML)
- Noise Assessment Location (NAL)
- Noise Sensitive Receptor

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
00	11/10/2022	First Issue	GC	JB	JB

Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

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Client: sse

Drawing Status: For Planning

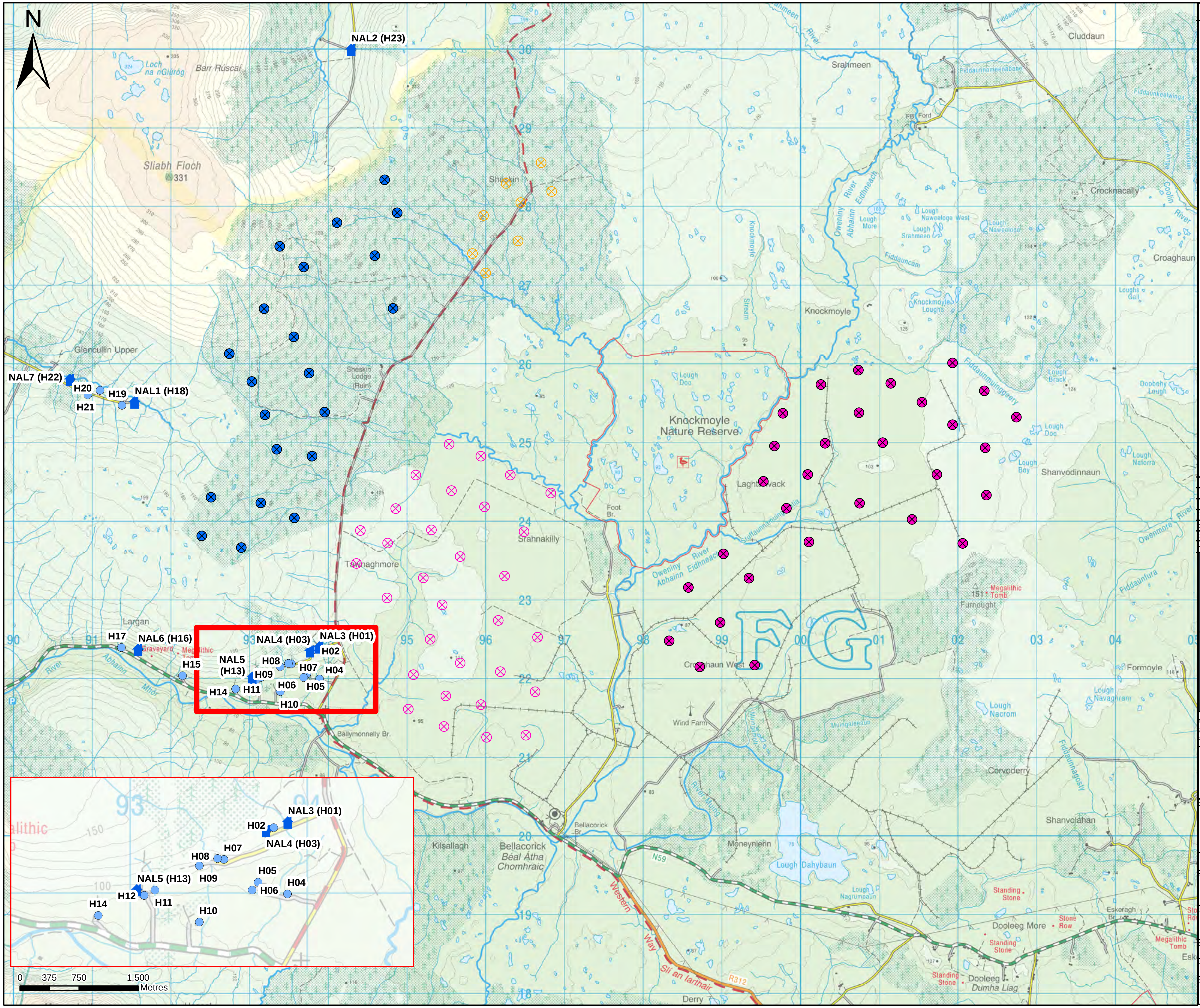
Project Title: Sheskin South Wind Farm

Drawing Title: EIAR Figure 11.2 - Noise Monitoring and Assessment Locations

Scale	Designed	Drawn	Checked	Approved
1:30,000	GC	GC	JB	JB
Original Size: A3	Date: 11/10/2022	Date: 11/10/2022	Date: 11/10/2022	Date: 11/10/2022

Drawing Number: 14192-012

Revision: 0



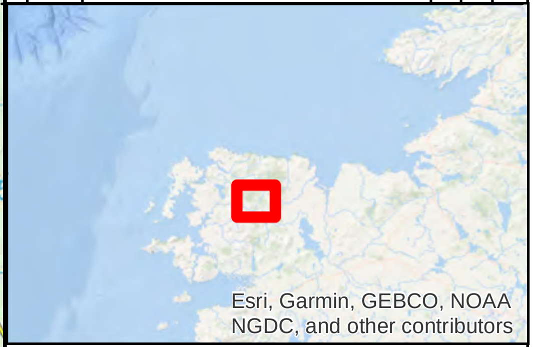
Legend

- Noise Assessment Location (NAL)
- Noise Sensitive Receptor

Wind Farm/ Turbine

- Sheskin South
- Oweninny 1
- Oweninny 2
- ABO Sheskin

Rev.	Date	Amendment Details	Drw'n	Chk'd	App'd
02	19/12/2022	Minor Updates	GC	JB	JB
01	21/10/2022	Removal of Corvoderry	GC	JB	JB
00	11/10/2022	First Issue	GC	JB	JB



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Drawing Status: For Planning

Project Title: Sheskin South Wind Farm

Drawing Title: EIAR Figure 11.3 - Cumulative Turbine Locations

Scale	Designed	Drawn	Checked	Approved
1:45,000	GC	GC	JB	JB
Original Size	Date	Date	Date	Date
A3	11/10/2022	11/10/2022	11/10/2022	11/10/2022

Drawing Number: 14192-013

Revision: 2

Receptor	Easting	Northing	Elevation (m AOD)	Approximate Distance to Nearest Sheskin South Turbine	Background Noise Data Used
NAL3 (H01)	493866	822407	115	1,611 (T18	NML3
NAL4 (H03)	493743	822357	118	1,580 (T18)	NML3
NAL5 (H13)	493014	822026	100	1,655 (T18)	NML3
NAL6 (H16)	491561	822376	89	1,654 (T17)	NML3
NAL7 (H22)	490697	825812	113	2,044 (T5)	NML1

** Please note the distances to nearest turbines quoted above may differ from those reported elsewhere in the EIAR. Distances for the noise assessment are taken from the nearest turbine to the closest edge of the amenity area (usually the garden).*

11.6.3 Potential Construction Noise Effects

Table 11-7: Predicted Construction Noise Immission Levels presents the calculated noise immission levels at each CNAL for all modelled scenarios. The construction noise assessment results show that the predicted construction noise levels are below the Category A Threshold Levels for all threshold value periods. For all of the CNALs and for all assessment scenarios, therefore, there would be **no significant effects**. Full details of the modelling and assessment can be found in Appendix 11-1 along with the results for all other NSRs.

Table 11-7 Predicted Construction Noise Immission Levels

Noise Assessment Location	Category A Threshold dB $L_{Aeq, t}$			Immission Level, dB $L_{Aeq, t}$ for each Scenario					
	Daytime (07:00 – 19:00) and Saturdays (07:00 - 13:00)	Evenings (19:00-23:00 weekdays.) Weekends (13:00-23:00 Saturdays and 07:00-23:00 Sundays)	Night-Time (23:00 – 07:00)	1	2	3	4	5	Night
CNAL1 (H18)	65	55	45	40	40	41	40	37	16
CNAL2 (H23)	65	55	45	34	34	34	35	30	13
CNAL3 (H01)	65	55	45	40	34	39	39	39	16
CNAL4 (H03)	65	55	45	38	33	40	38	37	16
CNAL5 (H13)	65	55	45	31	30	36	32	31	12
CNAL6 (H16)	65	55	45	27	27	28	27	23	7
CNAL7 (H22)	65	55	45	36	36	37	36	32	13

11.6.4 Potential Operational Noise Effects

11.6.4.1 Setting the Total WEDG Noise Limits (Stage 1)

Based on the prevailing background noise levels, the Total WEDG Noise Limits have been established for each of the NALs detailed in Table 11-6 above. The Total WEDG Noise Limits for the other NSRs are detailed in Annex 6 of Appendix 11-2.

The Total WEDG Noise Limits are as detailed in Table 11-8 and Table 11-9 below.

Table 11-8 Total WEDG Noise Limit - Daytime

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H18)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.7	51.3	54.8
NAL2 (H23)	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.7	50.7	53.9
NAL3 (H01)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
NAL4 (H03)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
NAL5 (H13)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
NAL6 (H16)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
NAL7 (H22)	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.7	51.3	54.8

Table 11-9 Total WEDG Noise Limit – Night time

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H18)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	47.6	51.3	55.0
NAL2 (H23)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	46.0	48.8	51.8	55.1
NAL3 (H01)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
NAL4 (H03)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
NAL5 (H13)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
NAL6 (H16)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
NAL7 (H22)	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	47.6	51.3	55.0

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

A likely cumulative noise assessment was undertaken at the NALs and the results of the cumulative assessment are shown in Tables 11-10 and 11-11 below. The Tables detail the Total WEDG Noise Limits and predicted likely cumulative wind turbine noise levels for WEDG daytime hours and WEDG night time hours. The result of the likely cumulative noise assessment show that the Proposed Development can operate concurrently with the operational and permitted wind farms near to the NALs, whilst still meeting the Total WEDG Noise limits established in accordance with WEDG at all NALs and therefore, there would be **no significant effects.**

Table 11-10 Compliance Table – Comparison of predicted likely cumulative noise levels (all schemes) against the Total WEDG Noise Limit at each receptor - Daytime

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H18)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.7	51.3	54.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	28.8	33.7	36.7	37.1	37.1	37.1	37.1	37.1	37.1
	Exceedance Level	-	-	-	-11.2	-6.3	-8.3	-7.9	-7.9	-7.9	-10.6	-14.2	-17.7
NAL2 (H23)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.7	50.7	53.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	24.6	29.4	32.6	33.3	33.3	33.3	33.3	33.3	33.3
	Exceedance Level	-	-	-	-15.4	-15.6	-12.4	-11.7	-11.7	-11.7	-14.4	-17.4	-20.6
NAL3 (H01)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	31.4	36.8	39.3	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-	-8.6	-3.2	-5.7	-5.2	-5.2	-5.2	-5.8	-8.4	-10.7
NAL4 (H03)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	30.8	36.2	38.8	39.2	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-	-	-	-9.2	-3.8	-6.2	-5.8	-5.7	-5.7	-6.3	-8.9	-11.2
NAL5 (H13)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	27.2	32.5	35.2	35.6	35.6	35.6	35.6	35.6	35.6
	Exceedance Level	-	-	-	-12.8	-7.5	-9.8	-9.4	-9.4	-9.4	-10.0	-12.6	-14.9
NAL6 (H16)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	23.6	28.7	31.6	32.0	32.0	32.0	32.0	32.0	32.0
	Exceedance Level	-	-	-	-16.4	-11.3	-13.4	-13.0	-13.0	-13.0	-13.6	-16.2	-18.5
NAL7 (H22)	Total WEDG Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.7	51.3	54.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	24.9	29.8	32.8	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-	-	-	-15.1	-10.2	-12.2	-11.8	-11.8	-11.8	-14.5	-18.1	-21.6
Note: For the cumulative noise predictions the noise model considers the range of noise data available for each turbine type modelled. For some turbines noise data was not available for wind speeds less than 4 ms^{-1} therefore no cumulative predictions are included for wind speeds less than 4 ms^{-1}.													

Table 11-11 Compliance Table – Comparison of predicted likely cumulative noise levels (all schemes) against the Total WEDG Noise Limit at each receptor – Night time

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H18)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	47.6	51.3	55.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	28.8	33.7	36.7	37.1	37.1	37.1	37.1	37.1	37.1
	Exceedance Level	-	-	-	-14.2	-9.3	-6.3	-5.9	-5.9	-7.0	-10.5	-14.2	-17.9
NAL2 (H23)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	46.0	48.8	51.8	55.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	24.6	29.4	32.6	33.3	33.3	33.3	33.3	33.3	33.3
	Exceedance Level	-	-	-	-18.4	-13.6	-10.4	-9.7	-10.1	-12.7	-15.5	-18.5	-21.8
NAL3 (H01)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	31.4	36.8	39.3	39.8	39.8	39.8	39.8	39.8	39.8
	Exceedance Level	-	-	-	-11.6	-6.2	-3.7	-3.2	-3.2	-3.2	-4.4	-7.6	-11.0
NAL4 (H03)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	30.8	36.2	38.8	39.2	39.3	39.3	39.3	39.3	39.3
	Exceedance Level	-	-	-	-12.2	-6.8	-4.2	-3.8	-3.7	-3.7	-4.9	-8.1	-11.5
NAL5 (H13)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	27.2	32.5	35.2	35.6	35.6	35.6	35.6	35.6	35.6
	Exceedance Level	-	-	-	-15.8	-10.5	-7.8	-7.4	-7.4	-7.4	-8.6	-11.8	-15.2
NAL6 (H16)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	23.6	28.7	31.6	32.0	32.0	32.0	32.0	32.0	32.0
	Exceedance Level	-	-	-	-19.4	-14.3	-11.4	-11.0	-11.0	-11.0	-12.2	-15.4	-18.8
NAL7 (H22)	Total WEDG Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	47.6	51.3	55.0
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	24.9	29.8	32.8	33.2	33.2	33.2	33.2	33.2	33.2
	Exceedance Level	-	-	-	-18.1	-13.2	-10.2	-9.8	-9.8	-10.9	-14.4	-18.1	-21.8

11.6.4.3 Operational Phase - Derivation of Site Specific Noise Limits for the Development (Stage 3)

As summarised in Table 6.8 of Appendix 11-2; for four NALs, operational noise from the other wind farm developments would be at least 10 dB below the Total WEDG Noise Limits. At these receptors it would be appropriate to allocate the entire noise limit to the Proposed Development, as the other wind farms would use a negligible proportion of the Total WEDG Noise Limit. This approach was adopted at NALs 1,2, 6 and 7.

For NAL 3 and NAL 4, noise limits have already been set due to the consented Oweninny Wind Farms (see Section 6.5 of Appendix 11-1). NAL3 is the closest property to Oweninny 2 Wind Farm, and is considered to be a 'controlling property', i.e. noise budget cannot be fully used at properties further away than NAL3, without first exceeding their limits at NAL3. On that basis the predicted turbine noise levels for the Oweninny Wind Farms were increased by 4.1 dB at NAL3 to meet their consented noise limits at the receptor. This increase in level has been determined based on the minimum difference between the predicted level from Oweninny 2 and the noise limits at NAL3 and that difference has been applied across all wind speeds. The same 4.1 dB increase was then added to the predicted levels for NAL4.

A 2 dB buffer was also added to the turbine noise predictions from ABO Sheskin Wind Farm and the resulting *'cautious'* predictions of cumulative wind turbine noise have then been logarithmically subtracted from the Total WEDG Noise Limits to determine the Site Specific Noise Limits at each NALs 3 and 4.

At NAL5, there is significant headroom (>5 dB margin) between the cumulative noise predictions from the other wind farm developments and the Total WEDG Noise Limit. A 2 dB buffer was added to the turbine noise predictions from the other wind farm developments and the resulting 'cautious' predictions of cumulative wind turbine noise from the other wind farms were then logarithmically subtracted from the Total WEDG Noise Limits to determine the Site Specific Noise Limits for the Proposed Development at NAL5.

The Site Specific Noise Limits were compared to the predictions of the Proposed Development operating on its own and the results are summarised below in Table 11-10 for the daytime and Table 11.11 for the night time. The tables also show the exceedance level, which is the difference between the predicted noise level and the Site Specific Noise Limit at a given wind speed. A negative exceedance level indicates satisfaction of the noise limit. The Site Specific Noise Limits and predictions are also shown on Figures A1.5a – 5g in Appendix 11-2: Operational Noise Report.

The assessment shows that the predicted wind turbine noise immission levels meet the Site Specific Noise Limits under all conditions at NALs 1-2 and 4-7 for both daytime and night time periods at all receptors and as such there would be **no significant effects** at those receptors. At NAL3 a minor exceedance of the Site Specific Noise Limit is predicted during the daytime at 5 ms^{-1} (0.1 dB) and during the night time at 6-9 ms^{-1} (0.4 dB). In addition, at NSR H02 (which is located in close proximity to NAL3) a minor exceedance (0.1 dB) is predicted during the daytime at 5 ms^{-1} (0.1 dB) and during the night time at 7-9 ms^{-1}. There would therefore be a potential **significant effect** at two receptors.

To put the exceedances above into context it is worth noting that decibels are logarithmic units meaning that a 3 dB change represents a doubling (or halving) of the sound energy. In terms of human perception, the WEDG state that:

'A 10 dB(A) increase in sound level represents a doubling of loudness. A change of 3 dB(A) is the minimum perceptible under normal circumstances.'

Table 11-12 Compliance Table –Comparison of predicted noise levels from the Proposed Development against the SSNL at each receptor - Daytime

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H18)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.7	51.3	54.8
	Predicted Wind Turbine Noise L_{A90}	-	-	23.4	28.3	33.2	36.2	36.5	36.5	36.5	36.5	36.5	36.5
	Exceedance Level	-	-	-16.6	-11.7	-6.8	-8.8	-8.5	-8.5	-8.5	-11.2	-14.8	-18.3
NAL2 (H23)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.7	50.7	53.9
	Predicted Wind Turbine Noise L_{A90}	-	-	18.3	23.1	28.0	31.1	31.4	31.4	31.4	31.4	31.4	31.4
	Exceedance Level	-	-	-21.7	-16.9	-17.0	-13.9	-13.6	-13.6	-13.6	-16.3	-19.3	-22.5
NAL3 (H01)	Site Specific Noise Limit	38.6	38.6	38.6	38.6	30.0	41.4	40.7	40.7	40.7	42.1	46.6	49.6
	Predicted Wind Turbine Noise L_{A90}	-	-	20.4	25.2	**30.0***	33.1	33.4	33.4	33.4	33.4	33.4	33.4
	Exceedance Level	-	-	-18.2	-13.4	**0.0***	-8.3	-7.3	-7.3	-7.3	-8.7	-13.2	-16.2
NAL4 (H03)	Site Specific Noise Limit	38.8	38.8	38.8	38.8	31.7	42.3	41.8	41.8	41.8	42.9	46.9	49.8
	Predicted Wind Turbine Noise L_{A90}	-	-	20.4	25.2	30.1	33.1	33.4	33.4	33.4	33.4	33.4	33.4
	Exceedance Level	-	-	-18.4	-13.6	-1.6	-9.2	-8.4	-8.4	-8.4	-9.5	-13.5	-16.4
NAL5 (H13)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	38.5	44.2	44.1	44.1	44.1	44.8	48.2	50.5
	Predicted Wind Turbine Noise L_{A90}	-	-	18.2	23.1	28.0	31.0	31.3	31.3	31.3	31.3	31.3	31.3
	Exceedance Level	-	-	-21.8	-16.9	-10.5	-13.2	-12.8	-12.8	-12.8	-13.5	-16.9	-19.2
NAL6 (H16)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.6	48.2	50.5
	Predicted Wind Turbine Noise L_{A90}	-	-	17.0	21.9	26.8	29.8	30.1	30.1	30.1	30.1	30.1	30.1
	Exceedance Level	-	-	-23.0	-18.1	-13.2	-15.2	-14.9	-14.9	-14.9	-15.5	-18.1	-20.4
NAL7 (H22)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	47.7	51.3	54.8
	Predicted Wind Turbine Noise L_{A90}	-	-	19.2	24.1	29.0	32.0	32.3	32.3	32.3	32.3	32.3	32.3
	Exceedance Level	-	-	-20.8	-15.9	-11.0	-13.0	-12.7	-12.7	-12.7	-15.4	-19.0	-22.5

**a 0.1dB exceedance was predicted. The values shown in the table include the application of turbine 18 in a reduced noise mode for a limited range of wind speeds and wind directions.*

Table 11-13 Compliance Table – Comparison of predicted noise levels from the Proposed Development against the SSNL at each receptor - Night time

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H18)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	47.6	51.3	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	23.4	28.3	33.2	36.2	36.5	36.5	36.5	36.5	36.5	36.5
	Exceedance Level	-	-	-19.6	-14.7	-9.8	-6.8	-6.5	-6.5	-7.6	-11.1	-14.8	-18.5
NAL2 (H23)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.4	46.0	48.8	51.8	55.1
	Predicted Wind Turbine Noise L_{A90}	-	-	18.3	23.1	28.0	31.1	31.4	31.4	31.4	31.4	31.4	31.4
	Exceedance Level	-	-	-24.7	-19.9	-15.0	-11.9	-11.6	-12.0	-14.6	-17.4	-20.4	-23.7
NAL3 (H01)	Site Specific Noise Limit	42.3	42.3	42.3	42.3	39.9	33.4	33.0	33.0	33.0	38.0	45.4	50.0
	Predicted Wind Turbine Noise L_{A90}	-	-	20.4	25.2	30.1	33.1	**33.0***	**33.0***	**33.0***	33.4	33.4	33.4
	Exceedance Level	-	-	-21.9	-17.1	-9.8	-0.3	**0.0***	**0.0***	**0.0***	-4.6	-12.0	-16.6
NAL4 (H03)	Site Specific Noise Limit	42.5	42.5	42.5	42.5	40.6	37.1	35.3	35.3	35.3	39.9	45.8	50.2
	Predicted Wind Turbine Noise L_{A90}	-	-	20.4	25.2	30.1	33.1	33.4	33.4	33.4	33.4	33.4	33.4
	Exceedance Level	-	-	-22.1	-17.3	-10.5	-4.0	-1.9	-1.9	-1.9	-6.5	-12.4	-16.8
NAL5 (H13)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	41.7	41.5	41.5	41.5	43.1	47.4	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	18.2	23.1	28.0	31.0	31.3	31.3	31.3	31.3	31.3	31.3
	Exceedance Level	-	-	-24.8	-19.9	-15.0	-10.7	-10.2	-10.2	-10.2	-11.8	-16.1	-19.5
NAL6 (H16)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.2	47.4	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	17.0	21.9	26.8	29.8	30.1	30.1	30.1	30.1	30.1	30.1
	Exceedance Level	-	-	-26.0	-21.1	-16.2	-13.2	-12.9	-12.9	-12.9	-14.1	-17.3	-20.7
NAL7 (H22)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	47.6	51.3	55.0
	Predicted Wind Turbine Noise L_{A90}	-	-	19.2	24.1	29.0	32.0	32.3	32.3	32.3	32.3	32.3	32.3
	Exceedance Level	-	-	-23.8	-18.9	-14.0	-11.0	-10.7	-10.7	-11.8	-15.3	-19.0	-22.7

**a 0.4dB exceedance was predicted. The values shown in the table include the application of turbine 18 in a reduced noise mode for a limited range of wind speeds and wind directions.*

11.6.5 Potential Cumulative Effects

The predicted construction noise levels at all NSRs are significantly below the threshold levels (by at least 10 dB) such that any contribution from the Proposed Development would not increase the received noise levels attributable to other nearby construction activities above the threshold levels at any NSR. Accordingly, there would be **no significant cumulative construction noise effects.**

The result of the likely cumulative operational noise assessment show that the Proposed Development can operate concurrently with the operational and consented wind farms near to the NALs, whilst still meeting the Total WEDG Noise limits established in accordance with WEDG at all NALs. There would therefore be **no significant cumulative operational noise effects**.

11.7 Mitigation

11.7.1 Mitigation during Construction

No significant effects resulting from construction noise are predicted. Nevertheless, a range of good practice measures are presented in the Construction Environmental Management Plan (CEMP), included as Appendix 4-3 of this EIAR, and these will be employed to minimise noise impacts. At this stage of the development process, the assessment is based on a precautionary approach, as a detailed construction programme is not available.

Good site practices will be implemented to minimise the likely effects. Section 8 of BS5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that will be employed onsite:

- Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;
- Any extraordinary site work occurring outside of the core working hours (for example, crane operations lifting components onto the tower) will be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid anticipated periods of high traffic flows;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance;
- Inherently quiet plant will be selected where appropriate and available - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use;
- All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines will be shut down between work periods (or when not in use) or throttled down to a minimum;
- All equipment used on site will be regularly maintained, including maintenance related to noise emissions;
- Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and
- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures will be provided.

11.7.2 Mitigation during Operation

The exact model of wind turbine to be used for the proposed development will be the result of a future tendering process. Achievement of the noise limits determined by this assessment would be a key determining factor in the final choice of wind turbines for the site. In order to meet the noise limits at NAL3 and H02, Turbine 18 will need to be operated in a lower noise mode for a limited range of wind speeds (5 ms^{-1} during the daytime and 7-9 ms^{-1} during the night time period) and wind directions (north westerlies) when considering the 170 m rotor diameter candidate wind turbine modelled in the noise assessment.

11.8 Assessment of Residual Effects

11.8.1 Residual Construction Effects

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

11.8.2 Residual Operational Effects

Following the implementation of mode management for NAL3, predicted wind farm operational noise levels at all the NALs lie below the Site Specific daytime and night time Noise Limits. In addition, the cumulative noise predictions from the Proposed Development and other operational and consented wind farms lie below the Total WEDG Noise Limits. There would be **no significant residual effects.**

At some locations, under some wind conditions and for a certain proportion of the time operational wind farm noise would be audible; however, it would be at an acceptable level in relation to the WEDG guidelines and there would be **no significant residual effects**.

11.8.3 Residual Cumulative Effects

The predicted construction noise levels at all CNALs are significantly below the threshold levels (by at least 10 dB) such that any contribution from the Proposed Development would not increase the received noise levels attributable to other nearby construction activities above the threshold levels at any CNAL. Accordingly, there would be **no significant residual construction noise effects.**

Predicted cumulative wind farm operational noise levels at all the NALs lie below the Total WEDG daytime and night time Noise Limits. There would be **no significant residual effects.**

11.9 Summary

Predicted construction noise levels compared with the Category A criteria outlined in Section E.3 of BS5228: Part 1 2009+A1:2014 indicate that construction noise levels are below the guidelines considered acceptable at all receptors for all construction phases and therefore **no significant effects** are anticipated.

The guidance contained within the WEDG 2006 was used to assess the likely operational noise impact of the Proposed Development. Predicted levels and measured background noise levels indicate that for dwellings neighbouring the Site, wind turbine noise would meet the noise criteria established in accordance with the WEDG 2006, therefore the operational noise impact is **not significant.** In order to

meet the noise limits at NAL3 and H02, mode management would be required for one turbine for certain wind speeds and wind directions based on the candidate turbine considered in this assessment.

There are a range of wind turbine models that may be appropriate for the Proposed Development. If the proposal receives planning permission, further data would be obtained from the supplier for the final choice of wind turbine model to demonstrate compliance with the operational noise limits derived in this report, this may include the implementation of mode management if required.