CONTENTS

13 NOISE AND VIBRATION 13-1
13.1 Introduction 13-1
13.2 Statement of Authority 13-1
13.3 Consultations 13-1
13.4 Methodology 13-1
13.4.1 Scope of assessment 13-1
13.4.2 Legislation and guidance 13-2
13.4.3 Baseline surveys / Data Gathering 13-3
13.4.4 Assessment Methodology 13-4
13.5 Receiving Environment 13-10
13.6 Potential Effects of the Proposed Development 13-10
13.6.1 Do-Nothing Scenario 13-10
13.6.2 Construction Phase 13-10
13.6.3 Operational Phase 13-11
13.6.4 Decommissioning Phase 13-12
13.7 Mitigation Measures 13-12
13.7.1 Construction Phase 13-12
13.7.2 Operational Phase 13-13
13.7.3 Decommissioning Phase 13-13
13.8 Residual Effects 13-13
13.8.1 Construction Phase 13-13
13.8.2 Operational Phase 13-13
13.8.3 Decommissioning Phase 13-13
13.9 Monitoring 13-13
13.10 Cumulative Effects 13-14
13.10.1 Do-Nothing Scenario 13-14
13.10.2 Construction Phase 13-14
13.10.3 Operational Phase 13-14
13.10.4 Decommissioning Phase 13-15
13.11 References 13-17

TABLES

Table 13.1: Noise survey locations 13-4
Table 13.2: Summary of Assessment of Effects – noise and vibration 13-16

FIGURES

Figure 13.1 Locations of sensitive receptors 13-9

13 NOISE AND VIBRATION

13.1 Introduction

This chapter considers the potential noise and vibration effects of the Proposed Development, for which planning permission is being sought, during construction, operation and decommissioning, presenting a summary of the detailed assessment contained within the Hoare Lea Technical Report included as **Appendix 13.1**. This chapter has been prepared with reference to information contained within EIAR **Chapter 5: Project Description** and EIAR **Chapter 16: Traffic & Transportation**.

13.2 Statement of Authority

The noise and vibration assessment was undertaken by Matthew Cand of Hoare Lea LLP (HL). Matthew (Dipl. Eng., PhD, MIOA) is a full member of the UK Institute of Acoustics. He is an Associate Director at Hoare Lea LLP who has responsibility for running the environmental noise group, which has a focus on Environmental Impact Assessments (EIAs). He has over 18 years' experience in the assessment of environmental acoustics and has conducted more than 70 noise assessments for EIA of wind farms. Matthew is an expert in the assessment of wind farm noise and is one of the authors of the UK Institute of Acoustics Good Practice Guide (IOA, 2013). He has also been engaged as expert witness at planning inquiries and noise nuisance cases.

13.3 Consultations

The proposed assessment approach and relevant guidance for the assessment of noise and vibration were outlined in the scoping report for the Proposed Development. No comments were received in response regarding the proposed approach from the consultees, including the Clare County Council Environment section.

13.4 Methodology

13.4.1 Scope of assessment

13.4.1.1 Effects assessed in full

The following effects of the proposed project have been assessed in full:

- The effect of on-site construction activity noise during construction and decommission of the Proposed Development.
- The effect of construction traffic noise on local roads during construction and decommission of the Proposed Development.
- The potential effect of noise during operation of the Proposed Development, including cumulative considerations.

13.4.1.2 Effects scoped out

Based on the desk-based work undertaken, the professional judgement of the authors and experience from other relevant projects and policy guidance or standards, the following effects have been 'scoped out' of detailed assessment:

- The results of previous research detailed in Annex A of **Appendix 13.1** has demonstrated that vibration resulting from the operation of wind farms is imperceptible at typical separation distances of 500 m or more. Therefore, vibration effects during operation do not warrant detailed assessment and have not been considered further as part of this chapter.
- The nature of works and distances of more than 200 m involved in the construction of a wind farm are such that the risk of significant effects relating to ground borne vibration are very low. Occasional momentary vibration can arise when heavy vehicles pass dwellings along the site access route at very short separation distances, but again this is not sufficient to constitute a risk of significant impacts in this instance, because of the short-term nature of the vibration impacts and as existing traffic is causing similar levels. Accordingly, vibration impacts do not warrant detailed assessment and are therefore not discussed further in this assessment.

The proposal to scope out the assessment of vibration was set out in the scoping report for the proposal and no adverse comments were received.

13.4.2 Legislation and guidance

The 2006 Wind Energy Development Guidelines (WEDG) from the Department of the Environment, Heritage and Local Government (DoEHLG, 2006) include recommendations on noise. They require that an appropriate balance is achieved between power generation and noise impact. More recently (December 2019), revised Wind Energy Development Guidelines have been published in draft form only at this stage.

The 2006 guidance essentially proposes limits of 45 dB(A) or 5 dB above the background, subject to lower limits of 35-40 dB(A) for day-time periods or 43 dB(A) at night which may apply in low noise environments. Whilst subject to a degree of interpretation, these guidelines appear based on the ETSU-R-97 recommendations which apply in the UK Working Group on Noise from Wind Turbines, 1996) which are described in further detail below. ETSU-R-97 has become the accepted standard for wind energy developments within the UK. These more detailed UK guidelines, and related good practice measures, will therefore be referenced when applying the (still extant) 2006 WEDGs in the assessment of the Proposed Development.

Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in an Institute of Acoustics (IOA Good Practice Guide (GPG) (IOA, 2013) has also been referenced and applied.

Operational noise from other non-turbine components of the Proposed Development (such as an on-site substation) can be assessed with reference to general guidance on noise for commercial installations, such as for example to the EPA Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA, 2016).

There are no general statutory guidelines in Ireland on construction noise and its control, although some guidance is provided in the context of national road schemes in Ireland in the National Roads Authority guidelines (NRA, 2004). It is therefore general practice to reference the UK guidance set out in British Standard Institute (BSI) BS 5228-1 (BSI 2009, amended 2014). BS 5228-1 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels and example criteria which may be considered when assessing effect significance. The NRA (2004) guidelines also make reference to the assessment methodology of 'Calculation of Road Traffic Noise' (CRTN, UK Department of Transport, 1988) for evaluating noise from road traffic. This methodology can therefore be used to evaluate changes in noise associated with construction traffic, which can then be assessed using the guidance in the UK Design Manual for Roads and Bridges (Highways Agency (UK), 2019) which is also referenced by the NRA. This guidance or any updated version would also apply to works associated with the decommissioning phase.

13.4.3 Baseline surveys / Data Gathering

13.4.3.1 Study Area

The study area for the assessment of operational noise includes the noise-sensitive residential properties nearest to the proposed turbines. The locations considered are shown on Figure 13.1 and they are located at distances of 610 m to 1.5 km from the turbines of the Proposed Development.

The locations of all residential properties assessed are detailed in Table 3 of **Appendix 13.1**, indicated by their Irish Transverse Mercator (ITM) coordinates. The assessment of construction noise has also considered these dwellings. This included several properties which are currently unoccupied, generally because they are dilapidated; however, these properties were included in the assessment, as a precautionary measure, as they may become occupied at a later date. Several consented residential developments were also included in the assessment although they may not currently be constructed/inhabited.

Some of the properties identified are also financially involved or associated with the Proposed Development and would therefore be less noise-sensitive in practice as they would be more tolerant to noise from the Proposed Development.

13.4.3.2 Desktop study

The following data sources have informed the assessment:

- Mapping data concerning the locations of all noise sensitive receptors in the vicinity of the Site;
- Manufacturer data for the Vestas V150 turbine, chosen as the noisiest out of three potential candidate turbine models within the dimensions of the proposed turbines as set out in **Appendix 13.1**. Similar manufacturer data for other models considered for the Proposed Development (Nordex N133 and N149 turbines) were also referenced.

13.4.3.3 Field work

A background noise survey has been undertaken by RSK (in discussion with Hoare Lea) in line with the ETSU-R-97 methodology. In addition, technical guidance on current good practice on the application of ETSU-R-97, as described in the Institute of Acoustics (IOA) Good Practice Guide (GPG) has also been referenced and applied.

The survey is detailed in **Appendix 13.1.** In summary, the noise monitoring exercise was conducted between 13/09/2023 to 19/10/2023 at six locations (see **Table 13.1**), with more than four weeks of data obtained at all locations except Location 5 where the effective survey duration was 27 days. The differences in measurement durations at the properties are due to property access difficulties. The total survey period was in all cases more than the minimum of one week required by ETSU-R-97, and the extent of the data collected, and range of wind conditions obtained are compliant with the IOA GPG requirements, as detailed in **Appendix 13.1**.

Table 13.1: Noise survey locations

Background Noise (BN) Survey Location	Easting (ITM)	Northing (ITM)	Corresponding noise-sensitive location
Location 1 – BN1	552740	668075	H2
Location 2 – BN2	554211	667353	H38
Location 3 – BN3	555728	668753	H12
Location 4 – BN4	552422	670212	H39
Location 5 – BN5	557378	671520	H11 (survey position in field west of property)
Location 6 – BN6	557739	670631	H4

13.4.4 Assessment Methodology

13.4.4.1 Methodology for Assessing Construction and Decommissioning Noise Effects

Detailed guidance on construction noise and its control is provided by British Standard BS 5228-1 ‘Code of practice for noise and vibration control on construction and open sites’ (BSI 2009, amended 2014). BS 5228-1 provides guidance on a range of considerations relating to construction noise including the legislative framework, general control measures, example methods for estimating construction noise levels and example criteria which may be considered when assessing effect significance. Similarly, BS 5228-2 provides general guidance on legislation, prediction, control and assessment criteria for construction vibration.

Analysis of construction noise impacts has been undertaken in accordance with the methodologies outlined in this standard, which provides methods for predicting construction noise levels on the basis of reference data for the emissions of typical construction plant and activities. These methods include the calculation of construction traffic along access tracks and haul routes, and construction activities at fixed locations including the bases of turbines, temporary construction compounds, and the substation.

The construction noise assessment has been based on worst-case assumptions for noise emissions for the types of plant typically used during the proposed construction works, using information presented in BS 5228-1.

The predictions of construction noise were made using the methodology of BS 5228-1 and representative emission levels based on the types and number of equipment typically associated with key phases of constructing a windfarm. The predictions used conservative assumptions, such as considering when each activity would be closest to the neighbouring properties, and assuming the plant would operate for between 75% and 100% of the working day, on a conservative basis. This would represent the upper sound emission level during the day and actual noise levels are likely to be lower. Furthermore, the calculation has assumed there were no screening effects and the ground cover was 50% hard, therefore representing a conservative prediction as it will neglect most of the sound absorption likely to be experienced for propagation above agricultural land or forest.

Predicted noise level from the expected construction traffic on existing roads has been calculated using the relevant methodology in BS5228 based on the information provided in **Chapter 16 Traffic and Transportation Assessment**. For roads with substantial levels of existing traffic, reference is made to the accepted UK prediction methodology provided by 'Calculation of Road Traffic Noise' (CRTN, UK Department of Transport, 1988). Further details of the construction noise assessment methodology are included in **Appendix 13.1**.

The noise-sensitive locations considered for the construction noise assessment include those closest to the proposed turbines and those considered in the operational noise assessment (see Figure 13.1). Residential dwellings located alongside the proposed site access track and the construction traffic route were also considered, as detailed in **Appendix 13.1**.

De-commissioning is likely to involve similar activities but of less intensity and duration and traffic levels which would be similar or lower. Therefore, this phase would likely result in less noise than during construction. It will affect the same locations considered in the assessment of construction effects.

13.4.4.2 Assessment and significance for Construction and Decommissioning Noise Effects

Example significance criteria provided in Annex E of BS 5228-1 suggest that, in relatively quiet rural areas, sustained construction activities associated with daily noise levels in excess of 65 dB L_{Aeq} during the weekday daytime hours (07:00 – 19:00) or Saturday mornings (08:00 to 13:00) would represent a moderate or major impact. As the residential receptors considered are of high sensitivity, this translates to a short-term, temporary adverse moderate or major effect, which is significant. Conversely, noise levels below this level of 65 dB L_{Aeq} would correspond to a negligible or minor impact, which translates as a short-term, temporary adverse negligible or minor effect which is not significant. Table 1 in **Appendix 13.1** sets out the relevant impact criteria in more detail, taking into consideration the duration of the different construction activities considered. If work is undertaken outside of the standard construction hours noted above, this may increase the impacts and therefore effect significance.

Changes in traffic noise can be assessed using the relevant guidance in the UK Design Manual for Roads and Bridges (DMRB, Highways Agency, 2019), with short-term noise level changes associated with the construction period of less than 1 dB(A) corresponding to a negligible impact. Short-term traffic changes of 1 to 3 dB(A) correspond to a minor impact according to the DMRB which represents a short-term, temporary adverse minor effect which is not significant.

13.4.4.3 Methodology for Assessing Operational Noise Effects

The assessment of operational noise effects has been carried out in accordance with the guidance set out in the 2006 WEDGs from the Department of the Environment, Heritage and Local Government (DoEHLG, 2006). As described in more detail in **Appendix 13.1,** the noise limits for operational wind turbine noise recommended in the WEDGs are consistent with those set out in UK ETSU-R-97 document, which is the accepted standard for such Proposed Developments within the UK and is commended in current UK planning policy.

More recently (December 2019), revised Wind Energy Development Guidelines have been published, but these are currently in draft status.

Noise limits are defined in terms of the $L_{A90,10\ min}$ noise indicator (a definition of the $L_{A90,10min}$ index is given in **Appendix 13.1**, Annex A). The WEDGs prescribe separate day-time limits and night-time limits which are determined in part based on measured baseline background noise levels. In the absence of details in the WEDG, the more detailed guidance in ETSU-R-97 and associated good practice documents (IOA, 2013) will be referenced.

Three wind turbine models are considered for the Proposed Development. The Vestas V150-6MW was determined to be marginally noisier than the other candidate turbine models considered for the Proposed Development (Nordex N133 and N149 turbines). This model has therefore been assumed for the operational noise assessment.

To undertake the assessment of noise impact in accordance with the methodology in ETSU-R-97, the following steps are required:

- Specify the number and locations of the wind turbines and other windfarms to be included in the assessment;
- Determine the day-time and night-time noise limits from the measured background noise levels at the nearest neighbours (see above);
- Specify the type and noise emission characteristics of the wind turbines;
- Calculate noise immission levels from the operation of the turbines associated with the proposed windfarm as well as the contribution to cumulative noise immission levels from other nearby windfarms as a function of Site wind speed at the nearest neighbours; and
- Compare the calculated windfarm noise immission levels with the derived noise limits and assess in relation to the derived noise limits.

In this assessment, the term ‘noise emission’ relates to the sound power level actually radiated from each wind turbine, whereas the term ‘noise immission’ relates to the sound

pressure level (the perceived noise) at any receptor location due to the combined operation of all wind turbines on the site.

The derived noise limits relate to the total noise occurring at a dwelling due to the combined noise of all operational wind turbines. The assessment would therefore need to consider the combined operational noise of the Proposed Development with other windfarms in the area to be satisfied that the combined cumulative noise levels are within the derived criteria. In this present instance, the analysis set out in section 5.5 of **Appendix 13.1** has determined that the separation distances from other existing or consented wind farms in the area are such that cumulative effects would be negligible: these are therefore not considered further.

Further details of the operational noise assessment, including details of the noise output of the candidate turbine and the calculation parameters on which predictions have been based, can be found in **Appendix 13.1**. Technical guidance on current good practice in the application of the ETSU-R-97 methodology, as described in an Institute of Acoustics Good Practice Guide (IOA GPG, IOA, 2013) has also been referenced.

Low Frequency Noise, Vibration and Amplitude Modulation

Low frequency noise and vibration resulting from the operation of wind farms are all issues that have been attracting a certain amount of attention over recent years. Consequently, **Appendix 13.1** includes a detailed discussion of these topics. In summary of the information provided therein, modern turbines do not emit perceptible levels of infrasound and vibration at typical separation distances of 500m or more and therefore this does not require further specific assessment.

Annex A of **Appendix 13.1** also discusses the most recently published research on the subject of wind turbine blade swish or Amplitude Modulation (or AM). This summarises relatively recent research undertaken on some instances of increased AM outside what is generally expected from a normal wind farm. This is still subject to some discussion, and there no definitive guidance as to the appropriate assessment of atypical AM noise in current Irish planning guidelines. The limits considered above have however been determined on the basis of wind turbine noise including some AM character.

Noise from the substation

The likely noise emissions from the proposed substation equipment will also be considered in relation to existing baseline noise levels and related guidance such as the Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (EPA, 2016).

13.4.4.4 Assessment and significance for Operational Noise Effects

The acceptable limits for wind turbine operational noise are defined in the WEDG. Consequently, the test applied to operational noise is whether or not the calculated wind farm noise immission levels at nearby noise sensitive properties lie below the derived noise limits. The satisfaction of these criteria can lead to a situation whereby, at some locations under some wind conditions and for a certain proportion of the time, the wind farm noise may be audible. However, noise levels at the properties in the vicinity of the wind farm will still be within levels considered acceptable under relevant guidelines.

For noise associated with the proposed substation, , the relevant EPA guidelines described above set out a series of stringent noise limit for commercial/industrial type noise of 35 to 45 dB L_{Ar}[1] (for night and day-time periods respectively) in areas of low background noise. Noise levels in excess of these criteria could represent significant effects.

[1] Rated noise level, based on the L_{Aeq} level with a correction to account for the character of the noise in some cases.

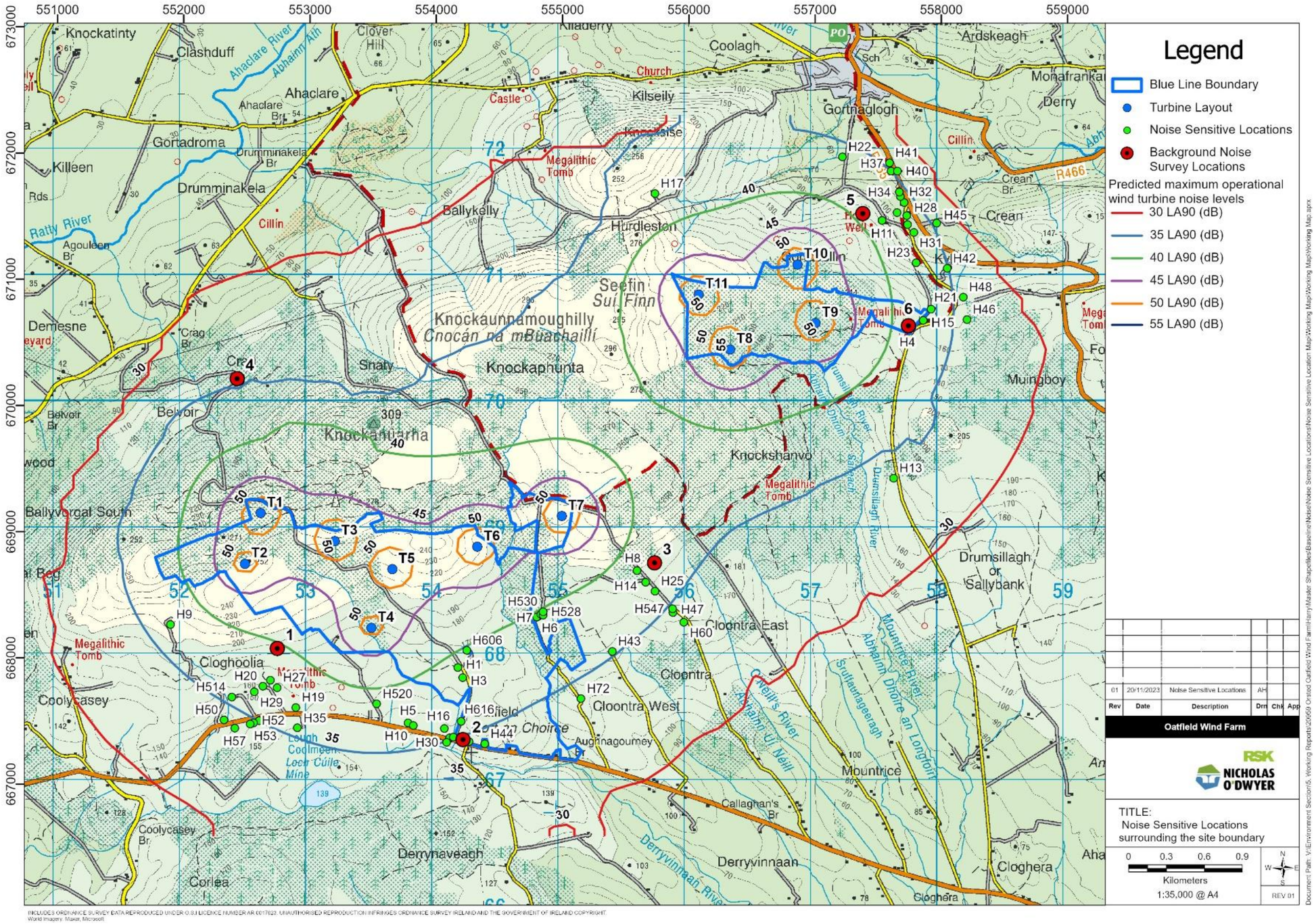

Figure 13.1 Locations of sensitive receptors

13.5 Receiving Environment

The baseline noise environment in the area surrounding the Proposed Development is of low population density and is typically dominated by 'natural' noise sources such as wind disturbed vegetation and birdsong and farm animals. Other sources of noise include intermittent local road and agricultural vehicle movements in the area. The existing baseline noise levels were characterised in further detail through a background noise survey as described above in 13.4.3.3.

The measured noise levels were related to wind speed measurements from a temporary LIDAR wind monitoring system, located on the site of the Proposed Development. Wind speed measurements taken at a height of 105 metre, representative of the hub height of the turbines for the Proposed Development, were expressed at ten metres height as required in ETSU-R-97, to provide a suitable reference to determine the prevailing background noise level during the quiet daytime and night-time periods. This therefore incorporates site-specific wind shear effects in accordance with the preferred method described in the IOA GPG, as set out in detail in Annex F of **Appendix 13.1**.

Data from all survey locations was also inspected to identify periods which may have been influenced by rainfall or atypical sources. This analysis was undertaken in accordance with the method described in the IOA GPG, as detailed in **Appendix 13.1.** The measured baseline noise levels are considered consistent with those that would be expected in a rural environment.

Following analysis of this data, noise limits were determined based on these background levels at all properties, in accordance with the method set out in Section 13.4.4.3 above: see Tables 4 and 5 in **Appendix 13.1**. The noise limits have been set at the greatest of either the prevailing measured background level plus 5 dB, or at a fixed lower limit of 40 dB(A) and 43 dB(A) for day and night-time periods respectively. For properties which are financially involved or associated with the Proposed Development, the noise limits were increased to a minimum of 45 dB(A). These minimum noise limits were selected as consistent with the 2006 WEDG guidelines when taking into account the more detailed guidance of ETSU-R-97.

13.6 Potential Effects of the Proposed Development

13.6.1 Do-Nothing Scenario

In the do-nothing scenario, the local noise environment will remain broadly similar to the current baseline situation.

13.6.2 Construction Phase

Predicted worst-case noise levels at relevant noise-sensitive receptors for each of the key activities during construction of the Proposed Development are presented in Table 6 of **Appendix 13.1**. Most of the proposed construction activities would occur at relatively large distances from the residential properties considered, such that the resulting predicted noise levels would not exceed 52 dB L_{Aeq}. Based on the guidance set out in BS 5228-1 summarised in Section 13.4.4.2 above and detailed in Table 1 of **Appendix 13.1**, this would represent negligible impacts.

For activities such as existing track upgrade, construction of a new site track, road widening works for turbine component delivery or substation connection and most grid connection works along the existing road network, higher worst-case levels would occur but these would only occur for a brief periods of time. Noise levels will quickly diminish as the works progress, moving the activity further from each property. The particularly short-term nature of this activity consequently categorises the impact to be of minor magnitude at most on highly sensitive receptors, which therefore represents a short-term minor temporary adverse effect.

This would also be the case for Horizontal Directional Drilling (HDD) works likely to be required along the grid connection route, if construction was restricted to standard working hours. However, HDD drilling may need to continue outside of these hours once a bore has been started, due to safety/operational reasons, hence the potential need for some night-time working. Under these worst-case assumptions, and in the absence of further mitigation measures, this would represent a major impact on some highly-sensitive receptors and therefore represents a short-term major temporary adverse effect.

In addition to onsite activities, construction-related traffic passing to and from the Proposed Development site would also represent a potential source of noise to surrounding properties. **Appendix 13.1** considers the effect of the peak construction traffic on noise for properties adjacent to the construction access route. The predicted increase in traffic noise calculated using the CRTN method is generally less than 1 dB(A), corresponding to a negligible impact. However, the worst-case increase would be for traffic site assessment point 5, where a predicted increase of 1.3 dB(A) in the day-time average noise level is predicted during particular phases of the construction programme. This would correspond to a minor impact based on DMRB guidance and therefore a short-term minor temporary reversible adverse effect.

In conclusion, noise from most construction activities has been assessed and is predicted to result in temporary negligible to minor adverse effects which are not significant. However, HDD drilling at night could represent a short-term major temporary reversible adverse effect, which is significant, in the absence of further mitigation.

13.6.3 Operational Phase

The predictions of operational noise for the Proposed Development in isolation at the noise-sensitive locations identified are detailed in **Table 9** of **Appendix 13.1** - these varied between 22 and 30 dB(A) at low wind speeds and 35 to 40 dB(A) at high wind speeds. This is illustrated in Figure 13.1**.**

The detailed assessment of **Tables 10 and 11** of **Appendix 13.1** then demonstrated that these predicted noise levels comply with the noise limits derived from the baseline survey and described above (**Tables 4 and 5** in **Appendix 13.1)** at all properties and all locations. This assumed the use of a reduced noise operational mode ("SO2") for turbines 2 and 4 of the Proposed Development. For other turbine models, different operational restrictions (or none at all) may be required to achieve a similar conclusion. This means that the operational noise levels from the Proposed Development are considered acceptable in line with relevant guidelines. This therefore represents a long-term permanent reversible adverse effect which is not significant.

13.6.3.1 Proposed substation

The main noise sources associated with the substation are likely to be the power transformers and their cooling fans. Given the separation distance of 580 m between the substation and the nearest non-involved residential properties, the associated noise levels at these properties will be of less than 30 dB L_{Aeq} due to separation distances involved. This would be clearly below the most stringent noise limit of 35 dB L_{Aeq} recommended in the NG4 guidance for classified installations, even accounting for the potential character of the noise. Therefore, are considered acceptable in line with relevant guidelines. This therefore represents a long-term permanent reversible adverse effect which is not significant.

13.6.4 Decommissioning Phase

De-commissioning is likely to result in less noise than during construction, due to the reduced amount of activity and traffic likely to be involved, and would also not involve HDD drilling out of hours in particular. This phase of the Proposed Development would therefore be associated with short-term minor temporary reversible adverse effects at most which is not significant.

13.7 Mitigation Measures

13.7.1 Construction Phase

BS:5228-1, outlines general measures for the reduction of construction noise and vibration levels at source. Most construction activities will be restricted to the hours of 07:00 to 19:00 Monday to Friday and 08:00 to 13:00 on Saturdays, excluding those unlikely to produce substantial noise levels, some turbine deliveries or concrete pours, or as otherwise agreed with Clare County Council. Out of hours works may also be associated with HDD drilling, but the following additional measures will be implemented:

- HDD drilling works to be undertaken during standard day-time hours where possible and completed in the shortest practical timescale.
- Use of Best Practical Means to minimise noise generation at nearest residents, including use of quiet drilling/pumping equipment and/or temporary noise barriers installed around trenchless compounds in order to provide screening for sources located at low heights.
- The closest local residents (within 200m of the HDD works) will be kept informed of the likely period during which the work will take place, the times and durations of planned works, measures that are being taken to avoid unnecessary noise and following completion of the works.

These measures where relevant will be implemented during the construction and decommission period. These measures will be referenced within the Construction and Environmental Management Plan (CEMP) for the Proposed Development (**Appendix 5.1 to EIAR Chapter 5 Project Description**).

13.7.2 Operational Phase

The selection of the final turbine to be installed at the site will be made on the basis of ensuring relevant noise limits as set out in **Tables 4 and 5** in **Appendix 13.1 (**or reduced limits specific to the Proposed Development, see cumulative section 13.10.3 below) are achieved at the surrounding residential properties.

13.7.3 Decommissioning Phase

Similar mitigation measures will be employed as for the construction phase.

13.8 Residual Effects

13.8.1 Construction Phase

The adoption of the identified mitigation measures will reduce the potential noise effects of construction. In particular, the potential noise impacts of out-of-hours HDD drilling would be reduced to a minor magnitude at most.

Comparing the predicted noise levels to the range of background noise levels measured around the Proposed Development suggests that the noisier construction activities could be audible at various times throughout the construction phase. However, based on the considerations presented above, the associated effects will be negligible to minor short-term temporary reversible adverse and therefore not significant.

13.8.2 Operational Phase

The basis of the WEDG guidelines is to define acceptable noise limits thought to offer reasonable protection to residents in areas around windfarm developments. At some locations under some wind conditions and for a certain proportion of the time, noise from the Proposed Development may be audible; however, operational noise immission levels are acceptable in terms of the relevant guidance for the assessment of wind farm noise. This therefore represents a long-term permanent reversible adverse effect which is not significant.

13.8.3 Decommissioning Phase

Decommissioning would still be associated with minor short-term temporary reversible adverse effects at most which is not significant.

13.9 Monitoring

If planning consent is granted for the Proposed Development, conditions attached to the planning consent should reference the relevant noise limits for the Development (either **Tables 4 and 5 in Appendix 13.1** or reduced limits specific to the Proposed Development, see cumulative section 13.10.3 below). These conditions may require that monitoring is undertaken at a sample of representative locations following construction and commissioning of the wind farm. Such monitoring should be undertaken with reference to relevant good practice as set out in the IOA GPG and associated supplementary guidance notes

13.10 Cumulative Effects

13.10.1 Do-Nothing Scenario

In the do-nothing scenario, the local noise environment will remain broadly similar to the current baseline situation.

13.10.2 Construction Phase

The construction traffic assessment considers that there is a potential for cumulative traffic increases during the construction phase associated with the Fahybeg Onshore Wind Farm, which may result in increased traffic as a worst-case. This would however not change the outcome of the above traffic noise assessment as it would still result in negligible to minor impacts.

Given the localised nature of the noise effects from other construction activities, there would be negligible cumulative construction effects from the consented Carrownagowan Wind Farm and the proposed Fahybeg Wind Farm, which are located more than 4km away from the noise-sensitive receptors considered.

No cumulative construction noise assessment was undertaken for the Knockshanvo Wind Farm as it has not been submitted for planning. It is however considered unlikely that additional significant effects would arise.

Overall, cumulative construction effects will remain negligible to minor short-term temporary reversible adverse and therefore not significant.

13.10.3 Operational Phase

The analysis set out in section 5.5 of **Appendix 13.1** has determined that the separation distances from other existing, proposed or consented wind farms in the area are such that cumulative effects from these wind farms would be negligible.

Section 5.10 of **Appendix 13.1** presents a preliminary cumulative operational assessment for the Knockshanvo Wind Farm based on a likely final layout and turbine specification for this development. The assessment demonstrates that predicted cumulative operational levels do not exceed the derived noise limits, with some negligible exceptions which would be unlikely to arise in practice. Therefore, cumulative noise levels would still likely represent a long-term permanent reversible adverse effect which is not significant.

Satisfactory control of cumulative noise immission levels would be achieved through enforcement of individual consent limits for each of the individual wind farms. These specific limits would be determined by splitting the total noise limit (**tables 4 and 5** in **Appendix 13.1**) into individual parts such that each wind farm could operate within their respective noise limits. These specific limits would need to be determined following submission of the planning application for the Knockshanvo Wind Farm. The resulting specific noise limits would be such that compliance of the Proposed Development and the Knockshanvo Wind Farm with their respective noise limits would maintain the conclusion of the cumulative assessment and result in cumulative levels which do not exceed the derived cumulative noise criteria.

13.10.4 Decommissioning Phase

Decommissioning would still be associated with minor short-term temporary reversible adverse effects at most which is not significant.

Table 13.2: Summary of Assessment of Effects – noise and vibration

Potential Effect	Beneficial / Adverse / Neutral	Extent (Site / Local / National / Transboundary)	Short term/ Long term	Direct / Indirect	Permanent / Temporary	Reversible / Irreversible	Significance of Effects (according to defined criteria)	Proposed Mitigation	Residual Effects (according to defined criteria)
Construction Phase									
Construction activity noise	Adverse	Local	Short-term	Direct	Temporary	Reversible	Minor effect, not significant	Good practice measures, restrictions on working hours. Minimise effects of night-time HDD drilling: liaise with closest affected residents; minimise associated noise levels (e.g. using temporary screening), works duration and interrupt drilling out of hours wherever possible.	Minor effect, not significant
Construction traffic noise	Adverse	Local	Short-term	Indirect	Temporary	Reversible	Minor effect, not significant	None	Minor effect, not significant
Operational Phase									
Operational wind turbine noise	Adverse	Local	Long-term	Direct	Permanent	Reversible	Not significant	Selection of final turbine model and potential mode management to achieve noise limits	Not significant
Substation noise	Adverse	Local	Long-term	Direct	Permanent	Reversible	Not significant	None	Not significant
Decommissioning Phase									
Decommissioning activity noise	Adverse	Local	Short-term	Direct	Temporary	Reversible	Minor effect, not significant	Good practice measures, restrictions on working hours.	Minor effect, not significant

13.11 References

- Department of the Environment, Heritage and Local Government (DoEHLG), 2006, Wind Energy Development Guidelines (WEDG).
- The Working Group on Noise from Wind Turbines (1996), ETSU-R-97, the Assessment and Rating of Noise from Wind Farms, Final Report for the Department of Trade & Industry (UK).
- Institute of Acoustics (IOA, 2013), M. Cand, R. Davis, C. Jordan, M. Hayes, R. Perkins, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, May 2013.
- National Roads Authority (NRA, 2004), Guidelines for the Treatment of Noise and Vibration in National Road Schemes Revision 1, 25th October 2004.
- British Standard Institute (BSI 2009, amended 2014), BS 5228:2009-A:2014 'Code of practice for noise and vibration control on construction and open sites. Part 1: noise (BS 5228-1).
- Environmental Protection Agency (EPA, 2016), Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), Office of Environmental Enforcement, Ireland (2016).
- The Highways Agency (2019), Transport Scotland, Transport Wales, The Department for Regional Development (Northern Ireland) (UK). Design Manual for Roads and Bridges (DMRB). LA 111 Noise and Vibration.
- UK Department of Transport (1988), Calculation of Road Traffic Noise.