12. NOISE & VIBRATION

12.1 Introduction

Wind farms have the potential to create noise during their construction, operational and decommissioning phases. This chapter assesses the potential noise & vibration impacts at the nearest Noise Sensitive Receptors (NSRs), within c. 3 km of the Proposed Development, during each of the project phases. The full description of the Proposed Development is detailed in Chapter 4.

This chapter considers the likely significant effects with respect to the noise associated with the removal of the existing turbines and relevant ancillary infrastructure and the construction, operation and decommissioning 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;
- describe the comparison in predicted level between the Existing Kilgarvan Wind Farm and the Proposed Development;
- describe the mitigation measures proposed to address any likely significant effects; and
- assess the residual effects remaining, following the implementation of mitigation.

Construction of the Proposed Development requires the removal of the existing Kilgarvan wind turbines and associated infrastructure, the upgrading of the site roads, the construction of hardstands and borrow pit, and the erection of 11 no. wind turbines, and associated infrastructure as detailed in Chapter 4.

12.1.1.1 Statement of Authority

The noise assessments were carried out by TNEI Ireland Ltd. TNEI is a specialist energy consultancy with an Acoustics team that has undertaken noise assessments for over 4.5 GW of onshore wind farm developments. The construction noise assessment was undertaken by Alex Dell (Meng, PhD), 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 noise assessment was reviewed and approved by Jim Singleton (BSc, Dip). The operational noise assessment was reviewed by James Mackay (BSc, Dip). Jim and James are full members of the Institute of Acoustics and hold the Diploma in Acoustics and Noise Control.

This chapter is supported by the following figures and appendices:

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

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

12.2 Legislation, Policy and Guidelines

As well as the guidance listed in Section 1.2 of Chapter 1 of this EIAR, this assessment considered 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];
- British Standard BS5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 2: Vibration[2]
- Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006[3];
- The Working Group on Noise from Wind Turbines (NWG) (1996). ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms'[4];
- 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)[5];
- ISO 9613-2: 1996 'Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation'[6];
- British Standard BS7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'[7]; and
- British Standard BS6472: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration.'[8]

The above documents are discussed in detail within Section 2 of Appendix 12-1 and Appendix 12-2, where relevant.

It is noted that the Wind Energy Development Guidelines for Planning Authorities (2006) (henceforth referred to as the Guidelines) are currently under review and a set of draft updated guidelines were issued for consultation in December 2019 ('draft Guidelines). The draft Guidelines 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 Guidelines and at the time of writing this report, no further updates have been issued. Given the limitations of the draft 2019 Guidelines 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. On the 22 February 2023, a request for tender (RFT) was published for the review and redraft of the Guidelines by the Department of Environment. The timescales of the review indicated completion of the works by Q4 2023, in line with the Climate Action Plan 2023.

The guidance in the Guidelines has been used to assess operational noise from the Proposed Development. In the absence of detailed guidance being included in the Guidelines, the assessment methodology has been supplemented by the guidance in ETSU-R-97 and the IOA GPG where appropriate.

In 2018, the World Health Organisation issued noise guidelines *'Environmental Noise Guidelines for the European Region'*[9] that provide recommendations for protecting human health for exposure to

[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*
[2] *British Standard BS5228-2: 2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' – Part 2: Vibration*
[3] *Department of Environment Heritage and Local Government (DoEHLG) 'Wind Energy Development Guidelines,' 2006.*
[4] *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'.*
[5] *Institute of Acoustics, 2013. Good Practice Guidance on the application of ETSU-R-97 for wind turbine noise assessment.*
[6] *(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*
[7] *British Standard BS7385-2: 1993 'The Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'*
[8] *British Standard BS6472: 2008 'Guide to evaluation of human exposure to vibration in buildings. Blast-induced vibration'*
[9] *World Health organisation, 2018. Environmental Noise Guidelines for the European Region'*

environmental noise. The guidelines consider noise originating from various sources including from transportation noise (road traffic, railway and aircraft), leisure noise and wind turbine noise. The guidelines make a series of 'strong' and 'conditional' recommendations. Strong recommendations are made in relation to road, rail and aircraft noise whilst 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.'

'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 also 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.

12.3 Assessment Methodology and Significance Criteria

12.3.1.1 Scoping and Consultation

The scoping and consultation exercise carried out as part of the Proposed Development is described in Section 2.6 in Chapter 2 of this EIAR.

The HSE issued a scoping response in August 2022 which noted:

The potential impacts for noise and vibration from the proposed development on all noise sensitive locations must be clearly identified in the EIAR. The EIAR must also consider the appropriateness and effectiveness of all proposed mitigation measures to minimise noise and vibration.

A baseline noise monitoring survey should be undertaken to establish the existing background noise levels. Noise from any existing turbines in the area should not be included as part of the background levels.

In addition, an assessment of the predicted noise impacts during the construction phase and the operational phase of the proposed wind farm development must be undertaken which details the change in the noise environment resulting from the proposed development.

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

TNEI have considered the above and are cognisant of the HSE response within the Noise and Vibration assessment.

12.3.1.2 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'[10], 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 were undertaken using the calculation methodology presented in ISO 9613:1996, together with published noise data for appropriate decommissioning and construction plant.

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

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

The construction of the Proposed Development (including removal of the turbines associated with the Existing Kilgarvan Wind Farm) will be undertaken in two phases as detailed below. During each phase the plant and equipment, and the associated traffic, would influence the noise generated. The selection of plant and equipment to be used will be determined by the main contractor when they are commissioned, therefore the assessment has been based upon a typical selection of plant for a wind farm project of this size and an indicative timetable which is provided in Section 4.7 in Chapter 4 of this EIAR. In view of this, the plant has been modelled operating at the closest points to each receptor for a given activity in each phase, whereas in reality only certain plant will be working at the closest point for short periods of time.

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

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

Chapter 4: Description outlines the tasks that will be undertaken during the existing turbine removal and construction period, which is estimated to last 10 months. The works will be separated into two distinct phases as detailed in the Indicative Construction Timetable included in Section 4.7 in Chapter 4 of this EIAR, and summarised below:

- Phase 1 – Civil works involving the construction of site compounds, sections of new road within the site, new turbine foundations and hardstands; and
- Phase 2 – Removal of the existing turbines, upgrade and widening of existing roads, electrical works, substation upgrades and turbine delivery and installation.

For the purposes of this assessment, noise modelling has been undertaken for a number of scenarios, which simulate the likely overlap of several tasks within the phases that could occur during the existing turbine removal and construction period:

- Scenario 01(Phase 1): Construction and operation of the site compounds, construction of the proposed new roads within the site and the construction of the hardstands and foundations for the proposed new turbines.
- Scenario 02 (Phase 2): Operation of the site compounds, removal of the existing turbines, upgrades and widening to the existing roads within the site and along the access route and upgrades to the substation.
- Scenario 03 (Phase 2): Operation of the compounds, delivery and erection of all new turbines, upgrades and widening to the remaining existing roads within the site and along the access route, upgrades to the substation.
- Scenario 04 (Night-time[11]): Diesel generators for the cabin and lighting at both compounds are operational.

In addition to the above, for Scenario 1, forestry activities have been modelled including felling of trees in the vicinity of T2, T8 and T11 and forwarding for transportation off site.

More detailed information on each of the construction Scenarios can be found within Appendix 12-1 of this EIAR. The noise-generating equipment assessed for each phase is detailed in Appendix 12-1, which shows actual noise data measured at 10 m from the noise source as detailed in BS5228. The noise levels for all Scenarios have been calculated using the data contained in these tables. It is worth noting that for much of the working day the noise associated with the existing turbine removal and construction activities will be less than predicted, as the assessment has assumed all equipment is constantly operating at full power and is located at the closest point to each receptor, whereas in practice equipment load and precise location will vary.

The assessment has assumed that gravity-based foundations will be used onsite as is typical for most wind farm developments. Should piling be required then best practice mitigation measures will be used to limit noise output, as detailed in BS5228. The exact nature of the mitigation measures will vary depending on the pile type, strata to be penetrated and duration of the works required.

12.3.1.3 Cumulative Construction Noise Methodology

There is the potential for the existing turbine removal and construction activities at the Proposed Development to occur at the same time as the construction of Gortyrahilly Wind Farm (if consented) and Inchamore Wind Farm (if consented), which are located approximately 6 km to the southeast and approximately 3 km to the northeast respectively of the Proposed Development. The first stage of the cumulative assessment is to compare the predicted levels from the existing turbine removal and construction of the Proposed Development to the noise thresholds and establish the available margin.

[11] *No specific construction activities are proposed to occur during the night-time, however a fourth scenario has been assessed to consider any potential noise from the operation of generators and or plant that may be required to be left on over-night, for example, to provide lighting on site.*

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 existing turbine removal or 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 12.5.7 below.

12.3.1.4 Construction Vibration

If it is deemed pertinent to set limits for vibration then two sets of vibration limits should be considered, one in regard to potential for damage to buildings and one in regard to the vibration effects on people within buildings.

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

Table 12-1: Transient vibration guide values for building damage

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

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

Table 12-2: BS5228-2 Guidance on Effects of Vibration Levels

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

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

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

Internal PPV limits could be set at somewhere between 1 mm/s^{-1} and 10.0 mm/s^{-1}, however, it should be noted that the measurement of vibration levels indoors is invasive and can be problematic. It should also be noted that the limits in Table 12-2 are generally considered guideline levels that should not be exceeded regularly or for long periods of time (see note c of Table 12-2).

12.3.1.5 Operational Noise Methodology

The assessment has been undertaken in accordance with the Guidelines.

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

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

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 Guidelines, information contained in ETSU-R-97 and the IOA GPG has been used to supplement the Guidelines.

The Guidelines 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 will be below the noise limits derived in accordance with Guidelines.

The daytime and night-time periods are not defined within the Guidelines, therefore the assessment has considered these periods as detailed within IOA GPG. The 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 Guidelines include guidance on how to derive limits for daytime and night-time periods.

The daytime limits take account of existing background noise levels and include a fixed limit of 45 dB or background + 5 dB, whichever is the greater, except in low background noise environments where a fixed minimum limit in the range 35-40 dB should be considered. TNEIs interpretation of these 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
- 35 - 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 based on the noise limits included within some recent planning decisions issued by An Bord Pleanála.

The Guidelines state that a *"fixed limit of 43dB(A) will protect sleep inside properties during the night"*, however, whilst it is not explicit within the Guidelines, 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. 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.

ETSU-R-97 also includes provision for the use of a higher daytime and night-time fixed minimum noise limits of 45 dB where the occupiers of a property have a financial interest in the wind farm. Whilst the higher limits are not referenced directly in the Guidelines the higher limits have been presented in a number of wind farm noise assessments.

Two sets of noise limits have been derived:

1. the 'Total Guidelines Noise Limits' apply to the cumulative noise level of all turbines operating in the area including the Proposed Development, whilst;
2. 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 Total Guidelines 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 Guidelines 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. In addition, a comparison has been made between the predicted output of the Proposed Development and the Existing Kilgarvan Wind Farm turbines (Section 12.5.6.2 below).

The exact model of turbine to be installed on the Proposed Development will be the result of a future tendering process should planning permission be granted. Achievement of the Guidelines 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 163m rotor diameter, a maximum rated output capacity of 7 MW, serrated trailing edge blades and a hub height of 118m. In order to consider the full design envelope for the site, additional modelling has been undertaken using two other candidates, one with a 155m rotor diameter, a maximum rated output capacity of 6.6 MW, serrated trailing edge blades and a hub height of 122.5m and a 149m rotor diameter with a maximum rated output capacity of 5.7 MW, serrated trailing edge blades and a hub height of 125m. The 163m rotor turbine has been chosen as the candidate for the main assessment as it is the turbine which results in the highest predicted levels of the candidates being considered and therefore provides a worst case. Predictions for the other two candidates have been included when assessing the Proposed Development against its Site-Specific Noise Limits. All candidates modelled are considered to be representative of the type of turbine that could be installed at the site.

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 12-2).

In line with the IOA GPG, an assessment has been undertaken to determine whether a concave ground profile correction or barrier correction, 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 12-2.

Other topics relating to operational wind farm noise characteristics, such as tonality, Low Frequency Noise (LFN) and amplitude modulation were considered as part of this assessment. There is no evidence that LFN has adverse impacts on the health of wind farm neighbours and has therefore been scoped out - more information on LFN and is provided in Technical Appendix 12-2. Tonality associated with wind turbines is well understood and has been considered in accordance with the guidance in ETSU-R-97 and the IOA GPG. The topic of amplitude modulation is considered in more detail below.

12.3.1.6 Amplitude Modulation

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

'The modulation or rhythmic swish emitted by wind turbines has been considered by some to have a characteristic that is irregular enough to attract attention. The level and depth of modulation of the blade noise is, to a degree, turbine-dependent and is dependent upon the position of the observer. Some wind turbines emit a greater level of modulation of the blade noise than others. Therefore, although some wind turbines might be considered to have a character that may attract one's attention, others have noise characteristics which are considerably less intrusive and unlikely to attract one's attention and be subject to any penalty.

This modulation of blade noise may result in a variation of the overall A-weighted noise level by as much as 3dBA (peak to trough) when measured close to a wind turbine. As distance from the wind turbine [or] wind farm increases, this depth of modulation would be expected to decrease as atmospheric absorption attenuates the high frequency energy radiated by the blade.'

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

Persistent OAM can be a source of nuisance to wind farm neighbours. Indeed, in a recent decision of the Irish High Court on the 8th of March 2024, the court found that frequent and sustained periods of OAM arising from the operational Ballyduff Wind Farm was an unreasonable interference with a neighbour's use and enjoyment of their property which was located approximately 359 m from the

nearest turbine. The issue of damages and/or an injunction were held over for later determination by the court but in the meantime, the court directed all parties to engage in mediation with a view to devising ***'appropriate mitigation measures and if possible, to resolve all outstanding issues between them'***. In summary, therefore, where persistent and sustained OAM arises mitigation is possible and is the appropriate response.

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

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

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

To ensure that any future complaints relating to noise and OAM can be responded to appropriately, the Applicant proposes to appoint a community liaison officer who would be the first point of contact in the event that noise complaints were to occur and the mitigation strategy set out in Section 12.6.2 below will be employed.

12.3.1.7 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 Guidelines 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 Guidelines 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 Guidelines 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 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 12.6.4.3 below and Table 6.7 of Appendix 12-1.

All the turbines modelled, inclusive of those considered in the cumulative noise assessment (Stage 2), are summarised in Annex 7 of Appendix 12-2.

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 12.3.

12.3.2 Potential Effects Scoped Out

12.3.2.1 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[12]. 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'[13][14]. 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.

12.3.3 Method of Baseline Characterisation

12.3.3.1 Extent of the Study Area

Prior to the commencement of the operational noise assessment, an initial desktop review was undertaken in order to identify all NSRs and potential Noise Monitoring Locations (NMLs). Five NMLs were selected to represent all of the NSRs, which are located around the Proposed Development. The

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

actual NMLs and NSRs are shown on Figure 12-2. More information on the NMLs can be found in Section 5 of Appendix 12-2: Operational Noise Report.

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

- Midas Farm (operational);
- Silahertane Wind Farm (operational);
- Grousemount Wind Farm (operational);
- Barnastooka Wind Farm (operational);
- Derragh Wind Farm (operational);
- Gortyrahilly (in planning); and
- Inchamore Wind Farm (in planning).

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 12-2.

12.3.3.2 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 five noise sensitive receptors. The NMLs were chosen by TNEI to be representative of all other receptors located around the Proposed Development and were selected with the aim of minimising the potential influence from existing operational wind turbines in the area. The selection of the NMLs considered local noise sources such as boiler flues, watercourses and vegetation and also the location of existing operational wind farms in the area.

Background noise monitoring was undertaken over the period of 16 June 2022 to 22 September 2022 at the NMLs detailed in Table 12-3 and Figure 12-2. Further details of the NMLs can be found within Appendix 12-2.

Table 12-3 Summary of Noise Monitoring Locations

Receptor	X (ITM)	Y (ITM)
NML1	505304	577152
NML2	507373	579647
NML3	511865	577355
NML4	512648	575374
NML5	514819	574092

Simultaneous wind speed/direction data were recorded within the site at various heights using a LIDAR Unit (located at Irish Transverse Mercator reference 508124, 577319). The wind speed data collected directly at hub height (125 m) were 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 the IOA GPG. The noise monitoring equipment installed at NML2 was knocked over repeatedly by

animals during the survey and it was unclear on each occasion when the equipment was knocked over. In addition, the noise monitoring equipment installed at NML5 appears to have been affected by a nearby watercourse resulting in the collection of elevated noise data. On that basis the data collected at NML2 and NML5 has not been used to set noise limits at any NSRs. For the assessment locations where no background noise measurements were undertaken or the data collected was not suitable, noise data collected at proxy locations deemed representative of the background noise environment was used to derive noise limits at those receptors.

12.3.4 Criteria for the Assessment of Effects

The Environmental Protection Agency document *'Guidelines on the information to be contained in Environmental Impact Assessment Reports'* [15] has informed the criteria for the assessment of potential effects as summarised below. The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1, Section 1.7.2 of this EIAR.

12.3.4.1.1 *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 12-1).

The criteria for indicating a potential significance use a noise metric of $L_{Aeq,T}$,, as detailed in Table 12-4. 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).

Table 12-4 Construction Noise Significance Criteria

Significance of Effect	Significance Level	
	Not Significant	Significant
Category A[16] 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), Saturdays 13:00-23:00 and Sundays 07:00-23:00.	<55dB $L_{Aeq, T}$	>55dB $L_{Aeq, T}$
Category A Night-time (23:00 – 07:00)	<45dB $L_{Aeq, T}$	>45dB $L_{Aeq, T}$

It should be noted that exceedance of the limit does not in itself indicate a significant effect, rather, the standard states *'If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect'.*

[15] *The Environmental Protection Agency, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports*
[16] *Category A, B and C thresholds are provided within BS558. Category A thresholds have been used in this assessment as they are the most stringent. Further information on all Category Thresholds can be found in Appendix 11-1.*

12.3.4.1.2 Criteria for Assessing Significance – Operational Noise

The Guidelines 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 Guidelines 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' in this EIAR refers to compliance or non-compliance with the Guidelines derived noise limits. For situations where predicted wind turbine noise meets or is less than the noise limits defined in Guidelines, then the noise effects are deemed not significant. Any exceedance of the Guidelines derived noise limits due to the Proposed Development has the potential to result in a significant effect.

It is not possible to predict if OAM will occur at any given site and if it does, how frequent and sustained it might be. In the event that OAM occurs frequently and for sustained periods, it has the potential to result in adverse impacts.

12.3.4.1.3 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 Guidelines supplemented by the IOA GPG has been followed by suitably experienced Acoustic Consultants to ensure that the data collected is as representative as possible.

No other assumptions or data gaps have been identified.

12.4 Baseline Conditions

12.4.1 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 as defined in the Guidelines[17]) at low windspeeds. The predominant noise sources in the area are wind induced noise (wind passing through vegetation and around buildings), local watercourses and birdsong.

Tables 12-5 and 12-6 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 12-2). The prevailing background noise levels are also shown on Figures A1.2a-A1.2c included in Annex 1 of Appendix 12-2.

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

Table 12-5 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	25.6	26.3	27.2	28.4	29.7	31.3	33.1	35.3	37.7	40.4	43.5	46.9
NML3	22.6	24.8	26.5	27.9	29.2	30.5	32	33.8	36.2	39.2	43.1	48
NML4	22.8	24.5	26.0	27.4	28.8	30.2	31.9	33.8	36.1	38.8	42.0	45.8

Table 12-6 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	19.2	19.2	19.6	20.6	22.2	24.3	27	30.4	34.4	39.1	39.1*	39.1*
NML3	23.4	25.1	26.1	26.8	27.4	28.2	29.5	31.5	34.5	38.9	38.9*	38.9*
NML4	22.9	23.7	24.7	25.7	26.7	27.4	27.9	27.9*	27.9*	27.9*	27.9*	27.9*

** flatlined at higher wind speeds, see Section 5.8.6 of the Operational Noise Report (Appendix 12-2)*

12.4.2 Summary of Sensitive Receptors

12.4.2.1 Scoped Out Receptors

All buildings within ~3 km of the Proposed Development were identified. Of the 102 buildings identified, two were subsequently classified as derelict (H34 and H42). These locations are not considered to be NSRs for the purposes of this assessment and have not been considered further.

All NSRs are shown on EIAR Figure 12-2. For clarity a series of inset maps showing the individual numbering of the NSRs are also included as Figures A1.1a-b within Annex 1 of Technical Appendix 12-2.

12.4.2.2 Scoped In Receptors

Of the identified NSRs, a total of 14 were chosen as Noise Assessment Locations (NALs) for the operational noise assessment and 11 Construction Noise Assessment Locations (CNALs) were selected for the Proposed Development 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 larger groups of NSRs. The modelling results for the CNALs/ NALs has been presented within the main body of this chapter and Appendices 12-1 and 12-2, whilst an assessment for all NSRs has been included within Annex C of Appendix 12-1 and Annex 5 of Appendix 12-2.

For the Grid Connection, the existing onsite Coomagearlahy 110 kV substation and overhead lines which connect the 110 kV substation at Cloonkeen will be used. The site will be accessed via the existing entrance but some upgrades to the access road will be required.

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' and numbered 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 12-7 and 12-8 below. A list of all NSRs is included within Annex C of Appendix 12-1 and Annex 5 of Appendix 12-2. All CNALs and NSRs are shown on Figure 12-1 and NALs and NSRs on Figure 12-2.

12.5 Assessment of Likely Effects

12.5.1 Construction Noise Assessment Locations

The Construction Noise Assessment Locations (CNAL) are summarised in Table 12-7: Summary of Construction Noise Assessment Locations below and are shown on Figure 12-1.

Table 12-7 Summary of Construction Noise Assessment Locations

Receptor	X (ITM)	Y (ITM)
CNAL1 – H3	508647	575524
CNAL2 – H5	506263	575547
CNAL3 – H6	507766	574676
CNAL4 – H7	506736	575142
CNAL5 – H9	508019	579110
CNAL6 – H14	505296	577210
CNAL7 – H16	511783	575938
CNAL8 – H17	511821	577236
CNAL9 – H25	511684	577866
CNAL10 – H32	504921	576134
CNAL11 – H97	510461	579590

12.5.2 Operational Noise Assessment Locations

Predictions of wind turbine noise have been made at each of the NALs as detailed in Table 12-8 and shown on Figure 12-2. Table 12-8 also details which NML has been used to set noise limits for each NAL. Predictions for all other NSRs are included within Annex 5 of Appendix 12-2.

Table 12-8 Summary of Operational Noise Assessment Locations

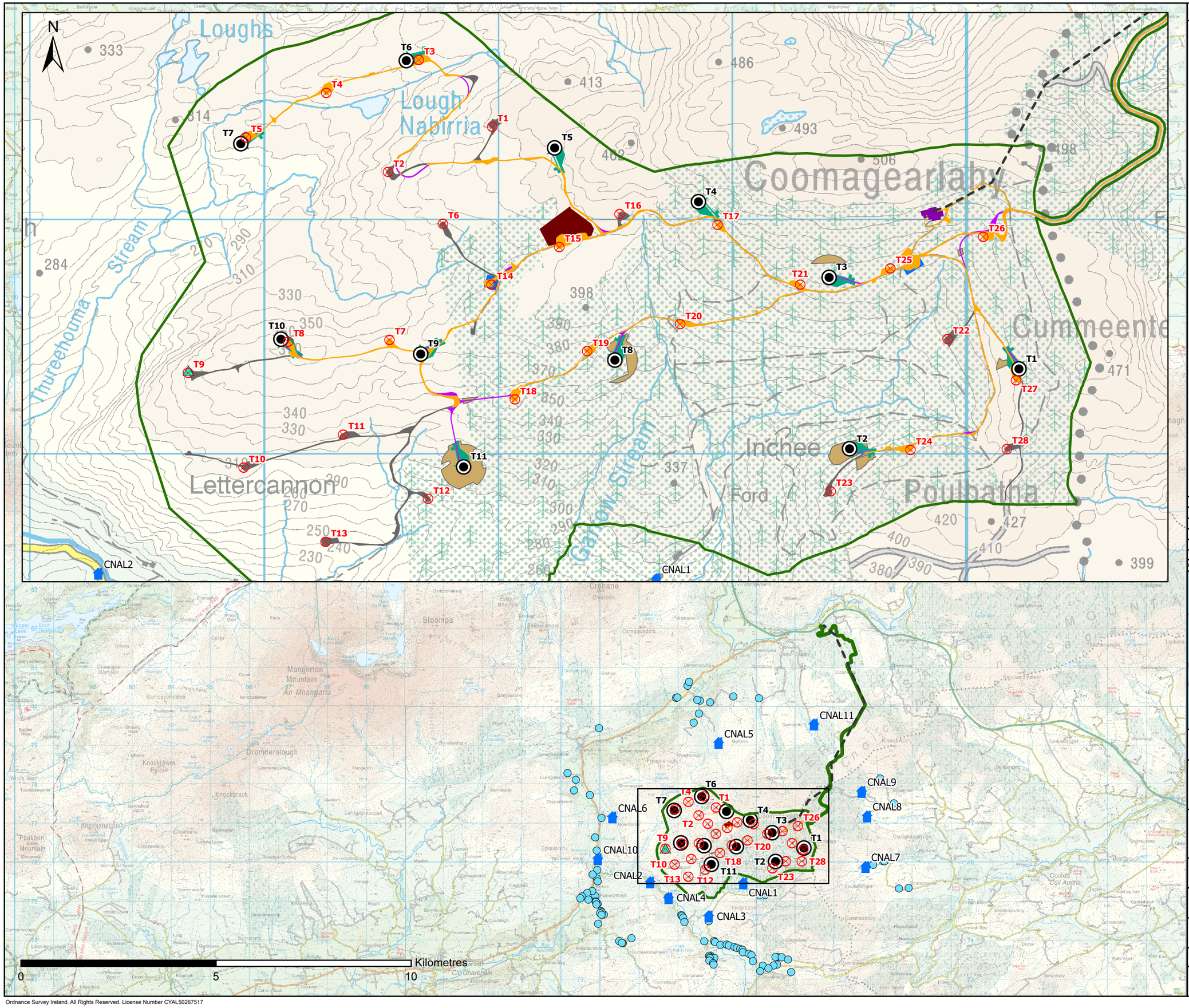
Receptor	X (ITM)	Y (ITM)	Elevation (m AOD)	Background Noise Data Used
NAL1 (H14)	505296	577210	149	NML3
NAL2 (H9)	508019	579110	190	NML3
NAL3 (H97)	510461	579590	212	NML3
NAL4 (H17)	511821	577236	252	NML3
NAL5 (H16)	511783	575938	240	NML3
NAL6 (H73)	512633	575387	236	NML3
NAL7 (H1)	509205	575221	317	NML3
NAL8 (H2)	509035	575259	298	NML3

Receptor	X (ITM)	Y (ITM)	Elevation (m AOD)	Background Noise Data Used
NAL9 (H4)	509059	575212	299	NML4
NAL10 (H3)	508647	575524	288	NML3
NAL11 (H6)	507766	574676	201	NML3
NAL12 (H10)	507755	574547	194	NML3
NAL13 (H7)	506736	575142	160	NML3
NAL14 (H8)	506715	575165	160	NML1

12.5.3 Potential Noise Effects

12.5.4 Potential Construction Noise Effects

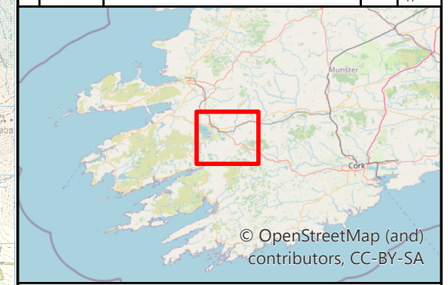
Table 12-9 presents the calculated noise immission levels at each CNAL for all modelled scenarios. The construction noise assessment results show that the predicted noise levels are below the Category A Threshold Levels for all threshold value periods. For all of the CNALs and for all assessment scenarios, therefore, there will be no significant effects. Full details of the modelling and assessment can be found in Appendix 12-1 along with the results for all other NSRs.



LEGEND

- EIAR Site Boundary
- Construction Noise Assessment Location (CNAL)
- Noise Sensitive Receptor (NSR)
- As Built Turbines
- Proposed Turbine Location
- Proposed Met Mast Location
- Roads to be Upgraded
- Proposed Roads and Widening
- Proposed Hardstands
- Existing Site Roads
- Proposed Construction Compounds
- Proposed Borrow Pit Location
- Proposed Felling Area
- As Built Substation
- Existing 110 kV OHL

Rev.	Date	Amendment Details	Drawn	Approved
1	13/05/2023	CLIENT COMMENTS	JCM	JB
0	03/04/2023	FIRST ISSUE	AD	JB



tnei

Client
Orsted Onshore Ireland Midco Ltd

Drawing Status:
FOR INFORMATION

Project Title:
PROPOSED REPOWERING OF KILGARVAN WIND FARM

Drawing Title:
FIGURE 11-1 DECOMMISSIONING AND CONSTRUCTION NOISE ASSESSMENT LOCATIONS

Scale:	Original Size:	Spatial Reference:
1:90,000	A3	IRENET95 Irish Transverse Mercator

Drawing Number:
IE00065-016

N

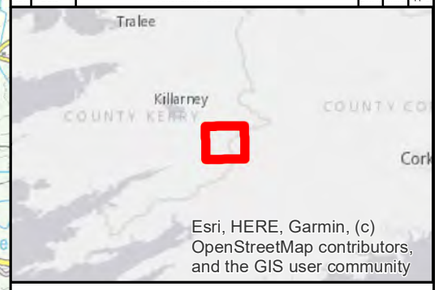
0 0.5 1 Kilometre

NOTES

Legend

- EIAR Site Boundary
- Proposed Turbine Location
- Noise Monitoring Location (NML)
- Noise Assessment Location (NAL)
- Noise Sensitive Receptor (NSR)
- Derelict Property

Rev.	Date	Amendment Details	Dw'n	Chk'd	App'd
00	15/02/23	First Issue	GC	JB	JB



tnei

Client: Orsted Onshore Ireland Midco Ltd

Drawing Status: FOR PLANNING

Project Title: Proposed Repowering of Kilgarvan Wind Farm

Drawing Title: EIAR Figure 12-2 Noise Monitoring and Assessment Locations

Scale	Designed	Drawn	Checked	Approved
1:35,000	GC	GC	JB	JB
Original Size: A3	Date: 15/02/2023	Date: 15/02/2023	Date: 15/02/2023	Date: 15/02/2023

Drawing Number: IE00065-017

Revision: 0

Table 12-9 Predicted Decommissioning and Construction Noise Immission Levels

CNAL	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)	Scenario 1*	Scenario 2*	Scenario 3*	Night*
CNAL1 – H3	65	55	45	40.2	40.0	39.0	19.0
CNAL2 – H5	65	55	45	31.0	34.0	30.0	4.0
CNAL3 – H6	65	55	45	36.3	34.0	34.0	15.0
CNAL4 – H7	65	55	45	37.1	43.0	34.0	15.0
CNAL5 – H9	65	55	45	30.6	29.0	29.0	12.0
CNAL6 – H14	65	55	45	27.2	27.0	26.0	9.0
CNAL7 – H16	65	55	45	24.6	26.0	26.0	9.0
CNAL8 – H17	65	55	45	25.2	24.0	26.0	6.0
CNAL9 – H25	65	55	45	29.3	30.0	30.0	9.0
CNAL10 – H32	65	55	45	21.3	22.0	21.0	nil
CNAL11 – H97	65	55	45	32.1	33.0	33.0	8.0

*As detailed in Section 12.1.2

12.5.5 Potential Construction Vibration Effects

Due to the large separation distances between the existing turbine removal and construction activity areas on the Proposed Development and the nearest receptors, no significant effects are anticipated.

12.5.6 Potential Operational Noise Effects

12.5.6.1 Setting the Total Guidelines Noise Limits (Stage 1)

Based on the prevailing background noise levels, the Total Guidelines Noise Limits have been established for each of the NALs detailed in Table 12-6 above. The Total Guidelines Noise Limits for the other NSRs are detailed in Annex 6 of Appendix 12-2. It is understood that the occupiers of NALs 7-10 have a financially involved in the Proposed Development and as such the higher fixed minimum noise limit of 45 dB has been adopted at those NALs for both daytime and night-time, as per ETSU-R-97.

The Total Guidelines Noise Limits are as detailed in Table 12-10 and Table 12-11 below.

Table 12-10 Total Guidelines Noise Limit - Daytime

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H14)	40	40	40	40	40	45	45	45	45	45.4	48.5	51.9
NAL2 (H9)	40	40	40	40	40	45	45	45	45	45	47	50.8
NAL3 (H97)	40	40	40	40	40	45	45	45	45	45	47	50.8
NAL4 (H17)	40	40	40	40	40	45	45	45	45	45	47	50.8
NAL5 (H16)	40	40	40	40	40	45	45	45	45	45	47	50.8
NAL6 (H73)	40	40	40	40	40	45	45	45	45	45	47	50.8
NAL7 (H1)	45	45	45	45	45	45	45	45	45	45	48.1	53
NAL8 (H2)	45	45	45	45	45	45	45	45	45	45	48.1	53
NAL9 (H4)	45	45	45	45	45	45	45	45	45	45	48.1	53
NAL10 (H3)	45	45	45	45	45	45	45	45	45	45	48.1	53
NAL11 (H6)	40	40	40	40	40	45	45	45	45	45	48.1	53
NAL12 (H10)	40	40	40	40	40	45	45	45	45	45	48.1	53
NAL13 (H7)	40	40	40	40	40	45	45	45	45	45	48.1	53
NAL14 (H8)	40	40	40	40	40	45	45	45	45	45	48.1	53

Table 12-11 Total Guidelines Noise Limit – Night-time

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H14)	43	43	43	43	43	43	43	43	43	44.1	44.1	44.1
NAL2 (H9)	43	43	43	43	43	43	43	43	43	43	43	43

Noise Assessment Location	Wind Speed (ms^{-1}) as standardised to 10m height											
	1	2	3	4	5	6	7	8	9	10	11	12
NAL3 (H97)	43	43	43	43	43	43	43	43	43	43	43	43
NAL4 (H17)	43	43	43	43	43	43	43	43	43	43	43	43
NAL5 (H16)	43	43	43	43	43	43	43	43	43	43	43	43
NAL6 (H73)	43	43	43	43	43	43	43	43	43	43	43	43
NAL7 (H1)	45	45	45	45	45	45	45	45	45	45	45	45
NAL8 (H2)	45	45	45	45	45	45	45	45	45	45	45	45
NAL9 (H4)	45	45	45	45	45	45	45	45	45	45	45	45
NAL10 (H3)	45	45	45	45	45	45	45	45	45	45	45	45
NAL11 (H6)	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
NAL12 (H10)	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
NAL13 (H7)	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
NAL14 (H8)	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9

12.5.6.2 Comparison of the Existing Kilgarvan Wind Farm and the Proposed Development

A simple comparison has been undertaken which compares predicted noise levels from the Existing Kilgarvan Wind Farm turbines, and those turbines associated with the Proposed Development at the 14 NALs considered in this assessment. The predictions are presented in Table 12-12 below, and the change in predicted levels has also been quantified. Predictions for the existing turbines have been undertaken in accordance with the methodology set out in Section 12.3.1.5 using sound power level data detailed in Technical Appendix Annex 8.

Table 12-12 Compliance Table – Comparison of predicted noise from Kilgarvan Original to Proposed Development

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H14)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	20.6	22.2	27	31.4	32.2	32.2	32.2	32.2	32.2	32.2
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	30.7	33.7	34.9	35.5	35.5	35.5	35.5	35.5
	Difference	-	-	-	-	-3.7	-2.3	-2.7	-3.3	-3.3	-3.3	-3.3	-3.3
NAL2 (H9)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	23.4	25	29.8	34.2	35	35	35	35	35	35
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	31.7	34.8	36.1	36.7	36.7	36.7	36.7	36.7
	Difference	-	-	-	-	-1.9	-0.6	-1.1	-1.7	-1.7	-1.7	-1.7	-1.7
NAL3 (H97)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	17.8	19.4	24.3	28.6	29.4	29.4	29.4	29.4	29.4	29.4
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	25.6	28.8	30.4	31.2	31.2	31.2	31.2	31.2
	Difference	-	-	-	-	-1.3	-0.2	-1	-1.8	-1.8	-1.8	-1.8	-1.8
NAL4 (H17)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	19.4	21	25.8	30.2	31	31	31	31	31	31
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	27.7	30.9	32.7	33.6	33.6	33.6	33.6	33.6

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Difference	-	-	-	-	-1.9	-0.7	-1.7	-2.6	-2.6	-2.6	-2.6	-2.6
NAL5 (H16)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	19.9	21.5	26.3	30.7	31.5	31.5	31.5	31.5	31.5	31.5
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	28.2	31.4	33.3	34.1	34.2	34.2	34.2	34.2
	Difference	-	-	-	-	-1.9	-0.7	-1.8	-2.6	-2.7	-2.7	-2.7	-2.7
NAL6 (H73)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	16.4	18	22.9	27.2	28	28	28	28	28	28
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	25.9	29.2	31	31.8	31.9	31.9	31.9	31.9
	Difference	-	-	-	-	-3	-2	-3	-3.8	-3.9	-3.9	-3.9	-3.9
NAL7 (H1)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	28	29.6	34.4	35	35	35	35	35	38.1	39.6
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	37.7	40.9	42.6	43.5	43.5	43.5	43.5	43.5
	Difference	-	-	-	-	-3.3	-5.9	-7.6	-8.5	-8.5	-8.5	-5.4	-3.9
NAL8 (H2)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	28	29.6	34.4	35	35	35	35	35	38.1	39.6

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	37.8	41	42.7	43.6	43.6	43.6	43.6	43.6
	Difference	-	-	-	-	-3.4	-6	-7.7	-8.6	-8.6	-8.6	-5.5	-4
NAL9 (H4)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	27.7	29.3	34.1	35	35	35	35	35	38.1	39.3
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	37.5	40.7	42.4	43.3	43.4	43.4	43.4	43.4
	Difference	-	-	-	-	-3.4	-5.7	-7.4	-8.3	-8.4	-8.4	-5.3	-4.1
NAL10 (H3)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	29.6	31.2	36	40.4	35	35	35	35	38.1	41.2
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	38.9	42.1	43.8	44.6	44.7	44.7	44.7	44.7
	Difference	-	-	-	-	-2.9	-1.7	-8.8	-9.6	-9.7	-9.7	-6.6	-3.5
NAL11 (H6)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	24.4	26	30.8	35.2	36	35	35	35	36	36
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	35.1	38.1	39.4	40	40.1	40.1	40.1	40.1
	Difference	-	-	-	-	-4.3	-2.9	-3.4	-5	-5.1	-5.1	-4.1	-4.1

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL12 (H10)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	23.5	25.2	30	34.3	35.1	35	35	35	35.1	35.1
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	34.4	37.4	38.7	39.3	39.3	39.3	39.3	39.3
	Difference	-	-	-	-	-4.4	-3.1	-3.6	-4.3	-4.3	-4.3	-4.2	-4.2
NAL13 (H7)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	24.7	26.3	31.1	35.5	36.3	36.3	36.3	36.3	36.3	36.3
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	38.2	41.2	42.3	42.9	42.9	42.9	42.9	42.9
	Difference	-	-	-	-	-7.1	-5.7	-6	-6.6	-6.6	-6.6	-6.6	-6.6
NAL14 (H8)	Predicted Kilgarvan Repowering Wind Turbine Noise L_{A90}	-	-	24.8	26.4	31.2	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Predicted Kilgarvan Original Wind Turbine Noise L_{A90}	-	-	-	-	38.3	41.4	42.5	43	43	43	43	43
	Difference	-	-	-	-	-7.1	-5.8	-6.2	-6.7	-6.7	-6.7	-6.7	-6.7

The comparison shows that the Proposed Development is predicted to have a lower output at each of the NALs than the Existing Kilgarvan Wind Farm turbines.

12.5.6.3 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 12-13 and 12-14 below. The Tables detail the Total Guidelines Noise Limits and predicted likely cumulative wind turbine noise levels for Guidelines daytime hours and Guidelines 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 Guidelines Noise Limits established in accordance with Guidelines 2006 at NALs 1-6, and 10-14 and therefore, there would be **no significant effects** at these receptors. At NALs 7 -9 predicted noise from all other wind farms already exceeds the Total Guidelines Noise Limit for certain wind speeds and wind directions during the daytime and night-time periods. In practice, the existing turbines may be operated in a low noise mode to ensure compliance but there is no public information available to confirm this. Accordingly, the assessment has assumed that the turbines operate in unconstrainted mode as this represents a precautionary / worst-case scenario. Based on this precautionary / worst case scenario, **significant effects** are predicted at NALs 7-9. Where significant effects have been predicted due to the operation of the existing wind farms, noise from the Proposed Development has been reduced such that it is 10 dB below the Total Guidelines Noise Limits to ensure that it has an imperceptible additional effect; this is reflected in the calculation of the Site Specific Noise Limits which is discussed further below. In order to achieve the reduction based on the proposed candidate turbines, certain turbines will need to operate in reduced noise mode for certain wind speeds and wind directions. Further information can be found in Sections 12.6.2 below.

It is not possible to predict if OAM will occur at the NALs surrounding this Proposed Development and if it does, how frequent and sustained it might be. In the event that frequent and sustained OAM occurs there is the potential for this to result in a negative effect in the absence of mitigation.

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

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H14)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45.4	48.5	51.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	32.3	33.4	33.6	33.6	33.6	33.6	33.6
	Exceedance Level	-	-	-	-	-	-12.7	-11.6	-11.4	-11.4	-11.8	-14.9	-18.3
NAL2 (H9)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	47	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	34.7	35.6	35.8	35.8	35.8	35.8	35.8
	Exceedance Level	-	-	-	-	-	-10.3	-9.4	-9.2	-9.2	-9.2	-11.2	-15
NAL3 (H97)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	47	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	31.3	32.6	32.8	32.9	32.9	32.9	32.9
	Exceedance Level	-	-	-	-	-	-13.7	-12.4	-12.2	-12.1	-12.1	-14.1	-17.9
NAL4 (H17)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	47	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	33.1	34.5	34.8	34.8	34.8	34.8	34.8
	Exceedance Level	-	-	-	-	-	-11.9	-10.5	-10.2	-10.2	-10.2	-12.2	-16
NAL5 (H16)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	47	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	34.6	36.5	37	37.2	37.2	37.2	37.2
	Exceedance Level	-	-	-	-	-	-10.4	-8.5	-8	-7.8	-7.8	-9.8	-13.6
NAL6 (H73)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	47	50.8
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	33	35	35.5	35.6	35.6	35.6	35.6
	Exceedance Level	-	-	-	-	-	-12	-10	-9.5	-9.4	-9.4	-11.4	-15.2
NAL7 (H1)	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	44.4	47	47.7	47.9	47.9	47.9	47.9
	Exceedance Level	-	-	-	-	-	-0.6	**2***	**2.7***	**2.9***	**2.9***	-0.2	-5.1
	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	48.1	53

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL8 (H2)	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	43.2	45.7	46.4	46.6	46.6	46.6	46.6
	Exceedance Level	-	-	-	-	-	-1.8	**0.7***	**1.4***	**1.6***	**1.6***	-1.5	-6.4
NAL9 (H4)	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	43.1	45.6	46.3	46.5	46.5	46.5	46.5
	Exceedance Level	-	-	-	-	-	-1.9	**0.6***	**1.3***	**1.5***	**1.5***	-1.6	-6.5
NAL10 (H3)	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	41.4	43.4	43.9	44.1	44.1	44.1	44.1
	Exceedance Level	-	-	-	-	-	-3.6	-1.6	-1.1	-0.9	-0.9	-4	-8.9
NAL11 (H6)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.9	40	40.7	40.9	40.9	40.9	40.9
	Exceedance Level	-	-	-	-	-	-7.1	-5	-4.3	-4.1	-4.1	-7.2	-12.1
NAL12 (H10)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.7	39.9	40.6	40.7	40.7	40.7	40.7
	Exceedance Level	-	-	-	-	-	-7.3	-5.1	-4.4	-4.3	-4.3	-7.4	-12.3
NAL13 (H7)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.3	38.7	39.1	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-	-	-	-7.7	-6.3	-5.9	-5.8	-5.8	-8.9	-13.8
NAL14 (H8)	Total Guidelines Noise Limit	40	40	40	40	40	45	45	45	45	45	48.1	53
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.3	38.8	39.1	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-	-	-	-7.7	-6.2	-5.9	-5.8	-5.8	-8.9	-13.8
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 6 ms^{-1} therefore no cumulative predictions are included for wind speeds less than 6 ms^{-1}.													

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
*cumulative noise exceeds the noise limits but this is due to the contribution of the existing wind farms in the area as detailed in section 12.5.6.3 above. At these wind speeds predicted noise from the Proposed Development will be at least 10 dB below the Total Guidelines Noise Limits and will therefore have a negligible additional contribution. To ensure noise from the Proposed Development is at least 10 dB below certain turbines will need to be operated in low noise mode for certain wind speeds and wind directions.													

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

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL1 (H14)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	44.1	44.1	44.1
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	32.3	33.4	33.6	33.6	33.6	33.6	33.6
	Exceedance Level	-	-	-	-	-	-10.7	-9.6	-9.4	-9.4	-10.5	-10.5	-10.5
NAL2 (H9)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43	43	43
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	34.7	35.6	35.8	35.8	35.8	35.8	35.8
	Exceedance Level	-	-	-	-	-	-8.3	-7.4	-7.2	-7.2	-7.2	-7.2	-7.2
NAL3 (H97)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43	43	43
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	31.3	32.6	32.8	32.9	32.9	32.9	32.9
	Exceedance Level	-	-	-	-	-	-11.7	-10.4	-10.2	-10.1	-10.1	-10.1	-10.1
NAL4 (H17)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43	43	43
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	33.1	34.5	34.8	34.8	34.8	34.8	34.8
	Exceedance Level	-	-	-	-	-	-9.9	-8.5	-8.2	-8.2	-8.2	-8.2	-8.2
NAL5 (H16)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43	43	43
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	34.6	36.5	37	37.2	37.2	37.2	37.2
	Exceedance Level	-	-	-	-	-	-8.4	-6.5	-6	-5.8	-5.8	-5.8	-5.8
NAL6 (H73)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43	43	43
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	33	35	35.5	35.6	35.6	35.6	35.6
	Exceedance Level	-	-	-	-	-	-10	-8	-7.5	-7.4	-7.4	-7.4	-7.4
NAL7 (H1)	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	45	45
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	44.4	47	47.7	47.9	47.9	47.9	47.9
	Exceedance Level	-	-	-	-	-	-0.6	**2***	**2.7***	**2.9***	**2.9***	**2.9***	**2.9***
	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	45	45

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL8 (H2)	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	43.2	45.7	46.4	46.6	46.6	46.6	46.6
	Exceedance Level	-	-	-	-	-	-1.8	**0.7***	**1.4***	**1.6***	**1.6***	**1.6***	**1.6***
NAL9 (H4)	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	45	45
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	43.1	45.6	46.3	46.5	46.5	46.5	46.5
	Exceedance Level	-	-	-	-	-	-1.9	**0.6***	**1.3***	**1.5***	**1.5***	**1.5***	**1.5***
NAL10 (H3)	Total Guidelines Noise Limit	45	45	45	45	45	45	45	45	45	45	45	45
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	41.4	43.4	43.9	44.1	44.1	44.1	44.1
	Exceedance Level	-	-	-	-	-	-3.6	-1.6	-1.1	-0.9	-0.9	-0.9	-0.9
NAL11 (H6)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.9	40	40.7	40.9	40.9	40.9	40.9
	Exceedance Level	-	-	-	-	-	-5.1	-3	-2.3	-2.1	-3	-3	-3
NAL12 (H10)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.7	39.9	40.6	40.7	40.7	40.7	40.7
	Exceedance Level	-	-	-	-	-	-5.3	-3.1	-2.4	-2.3	-3.2	-3.2	-3.2
NAL13 (H7)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.3	38.7	39.1	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-	-	-	-5.7	-4.3	-3.9	-3.8	-4.7	-4.7	-4.7
NAL14 (H8)	Total Guidelines Noise Limit	43	43	43	43	43	43	43	43	43	43.9	43.9	43.9
	Predicted Cumulative Wind Turbine Noise L_{A90}	-	-	-	-	-	37.3	38.8	39.1	39.2	39.2	39.2	39.2
	Exceedance Level	-	-	-	-	-	-5.7	-4.2	-3.9	-3.8	-4.7	-4.7	-4.7

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 6 ms^{-1} therefore no cumulative predictions are included for wind speeds less than 6 ms^{-1}.

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
*cumulative noise exceeds the noise limits but this is due to the contribution of the existing wind farms in the area as detailed in section 12.5.6.3 above. At these wind speeds predicted noise from the Proposed Development will be at least 10 dB below the Total Guidelines Noise Limits and will therefore have a negligible additional contribution. To ensure noise from the Proposed Development is at least 10 dB below certain turbines will need to be operated in low noise mode for certain wind speeds and wind directions.													

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

As summarised in Table 6.8 of Appendix 12-2; for four NALs, predicted operational noise levels from all other wind farm developments are at least 10 dB below the Total Guidelines Noise Limits. At these receptors it would be appropriate to allocate the entire Total Guidelines Noise Limit to the Proposed Development, as the other wind farms would use a negligible proportion of the Total Guidelines Noise Limit. This approach was adopted at NALs 1 to 4.

At NALs 5, 6, 13 and 14 there is significant headroom (>5 dB margin) between the cumulative noise predictions from the other wind farm developments and the Total Guidelines 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 Guidelines Noise Limits to determine the Site Specific Noise Limits for the Proposed Development at these NALs.

For NALs 7 to 9 operational noise from the existing wind farms already exceed the Total Guidelines Noise Limits, therefore Site Specific Noise Limits have been set 10 dB below the Total Guidelines Noise Limits such that the Proposed Development would not contribute further to these exceedances.

At NALs 10 to 12 no significant headroom exists between the cumulative noise predictions from the other wind farm developments and the Total Guidelines Noise Limit. Given no headroom exists for the Proposed Development to use, Site Specific Noise Limits have been set 10dB below the Total Guidelines Noise Limits.

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 12.10 for the daytime and Table 12-11 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 A1.4a-n in Appendix 12-2: Operational Noise Report.

The assessment shows that the predicted wind turbine noise emission levels meet the Site Specific Noise Limits under all conditions at NALs 1-6 and 13-14 for both daytime and night-time periods at all receptors and as such there would be **no significant effects** at those receptors. At NALs 7-12 exceedances are predicted within the range of wind speeds between 5-12 ms^{-1} but the Site Specific Noise Limits have been set 10 dB below the Total Guidelines Noise Limit therefore the additional cumulative effect of the Proposed Development would result in **no additional significant effects** at these receptors.

Table 12-15 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 (H14)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.4	48.5	51.9
	Predicted Wind Turbine Noise L_{A90}	-	-	20.6	22.2	27.0	31.4	32.2	32.2	32.2	32.2	32.2	32.2
	Exceedance Level	-	-	-19.4	-17.8	-13.0	-13.6	-12.8	-12.8	-12.8	-13.2	-16.3	-19.7
NAL2 (H9)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.0	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	23.4	25.0	29.8	34.2	35.0	35.0	35.0	35.0	35.0	35.0
	Exceedance Level	-	-	-16.6	-15.0	-10.2	-10.8	-10.0	-10.0	-10.0	-10.0	-12.0	-15.8
NAL3 (H97)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.0	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	17.8	19.4	24.3	28.6	29.4	29.4	29.4	29.4	29.4	29.4
	Exceedance Level	-	-	-22.2	-20.6	-15.7	-16.4	-15.6	-15.6	-15.6	-15.6	-17.6	-21.4
NAL4 (H17)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.0	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	19.4	21.0	25.8	30.2	31.0	31.0	31.0	31.0	31.0	31.0
	Exceedance Level	-	-	-20.6	-19.0	-14.2	-14.8	-14.0	-14.0	-14.0	-14.0	-16.0	-19.8
NAL5 (H16)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	44.3	44.1	44.1	44.1	47.0	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	19.9	21.5	26.3	30.7	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-20.1	-18.5	-13.7	-14.3	-12.8	-12.6	-12.6	-12.6	-15.5	-19.3
NAL6 (H73)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	45.0	45.0	45.0	45.0	47.0	50.8
	Predicted Wind Turbine Noise L_{A90}	-	-	16.4	18.0	22.9	27.2	28.0	28.0	28.0	28.0	28.0	28.0
	Exceedance Level	-	-	-23.6	-22.0	-17.1	-17.8	-17.0	-17.0	-17.0	-17.0	-19.0	-22.8
NAL7 (H1)	Site Specific Noise Limit	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	38.1	50.3
	Predicted Wind Turbine Noise L_{A90}	-	-	28.0	29.6	34.4	**35.0***	**35.0***	**35.0***	**35.0***	**35.0***	**38.1***	39.6
	Exceedance Level	-	-	-7.0	-5.4	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	-10.7
NAL8 (H2)	Site Specific Noise Limit	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	38.1	51.2
	Predicted Wind Turbine Noise L_{A90}	-	-	28.0	29.6	34.4	**35.0***	**35.0***	**35.0***	**35.0***	**35.0***	**38.1***	39.6
	Exceedance Level	-	-	-7.0	-5.4	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	-11.6
NAL9 (H4)	Site Specific Noise Limit	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	38.1	51.2
	Predicted Wind Turbine Noise L_{A90}	-	-	27.7	29.3	34.1	**35.0***	**35.0***	**35.0***	**35.0***	**35.0***	**38.1***	39.3
	Exceedance Level	-	-	-7.3	-5.7	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	-11.9
NAL10 (H3)	Site Specific Noise Limit	42.3	42.3	42.3	42.3	42.3	42.3	35.0	35.0	35.0	35.0	38.1	52.2
	Predicted Wind Turbine Noise L_{A90}	-	-	29.6	31.2	36.0	40.4	**35.0***	**35.0***	**35.0***	**35.0***	**35.0***	41.2
	Exceedance Level	-	-	-12.7	-11.1	-6.3	-1.9	0.0	0.0	0.0	0.0	0.0	-11.0

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL11 (H6)	Site Specific Noise Limit	38.7	38.7	38.7	38.7	38.7	43.7	42.5	35.0	35.0	35.0	46.8	53.0
	Predicted Wind Turbine Noise L_{A90}	-	-	24.4	26.0	30.8	35.2	36.0	**35.0***	**35.0***	**35.0***	36.0	36.0
	Exceedance Level	-	-	-14.3	-12.7	-7.9	-8.5	-6.5	0.0	0.0	0.0	-10.8	-17.0
NAL12 (H10)	Site Specific Noise Limit	38.7	38.7	38.7	38.7	38.7	43.7	42.6	35.0	35.0	35.0	46.8	53.0
	Predicted Wind Turbine Noise L_{A90}	-	-	23.5	25.2	30.0	34.3	35.1	**35.0***	**35.0***	**35.0***	35.1	35.1
	Exceedance Level	-	-	-15.2	-13.5	-8.7	-9.4	-7.5	0.0	0.0	0.0	-11.7	-17.9
NAL13 (H7)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	44.1	43.9	43.9	43.9	48.1	53.0
	Predicted Wind Turbine Noise L_{A90}	-	-	24.7	26.3	31.1	35.5	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-	-	-15.3	-13.7	-8.9	-9.5	-7.8	-7.6	-7.6	-7.6	-11.8	-16.7
NAL14 (H8)	Site Specific Noise Limit	40.0	40.0	40.0	40.0	40.0	45.0	44.2	44.0	43.9	43.9	48.1	53.0
	Predicted Wind Turbine Noise L_{A90}	-	-	24.8	26.4	31.2	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-	-	-15.2	-13.6	-8.8	-9.4	-7.9	-7.7	-7.6	-7.6	-11.8	-16.7

**Predicted levels assume mode management is applied to meet the Site Specific Noise Limit. This would only apply for certain wind directions.*

Table 12-16 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 (H14)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.1	44.1	44.1
	Predicted Wind Turbine Noise L_{A90}	-	-	20.6	22.2	27.0	31.4	32.2	32.2	32.2	32.2	32.2	32.2
	Exceedance Level	-	-	-22.4	-20.8	-16.0	-11.6	-10.8	-10.8	-10.8	-11.9	-11.9	-11.9
NAL2 (H9)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predicted Wind Turbine Noise L_{A90}	-	-	23.4	25.0	29.8	34.2	35.0	35.0	35.0	35.0	35.0	35.0
	Exceedance Level	-	-	-19.6	-18.0	-13.2	-8.8	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
NAL3 (H97)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predicted Wind Turbine Noise L_{A90}	-	-	17.8	19.4	24.3	28.6	29.4	29.4	29.4	29.4	29.4	29.4
	Exceedance Level	-	-	-25.2	-23.6	-18.7	-14.4	-13.6	-13.6	-13.6	-13.6	-13.6	-13.6
NAL4 (H17)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Predicted Wind Turbine Noise L_{A90}	-	-	19.4	21.0	25.8	30.2	31.0	31.0	31.0	31.0	31.0	31.0
	Exceedance Level	-	-	-23.6	-22.0	-17.2	-12.8	-12.0	-12.0	-12.0	-12.0	-12.0	-12.0
NAL5 (H16)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	41.7	41.5	41.4	41.4	41.4	41.4
	Predicted Wind Turbine Noise L_{A90}	-	-	19.9	21.5	26.3	30.7	31.5	31.5	31.5	31.5	31.5	31.5
	Exceedance Level	-	-	-23.1	-21.5	-16.7	-12.3	-10.2	-10.0	-9.9	-9.9	-9.9	-9.9
NAL6 (H73)	Site Specific Noise Limit	43.0	43.0	43.0	43.0	43.0	43.0	42.0	41.8	41.8	41.8	41.8	41.8
	Predicted Wind Turbine Noise L_{A90}	-	-	16.4	18.0	22.9	27.2	28.0	28.0	28.0	28.0	28.0	28.0
	Exceedance Level	-	-	-26.6	-25.0	-20.1	-15.8	-14.0	-13.8	-13.8	-13.8	-13.8	-13.8
NAL7 (H1)	Site Specific Noise Limit	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	Predicted Wind Turbine Noise L_{A90}	-	-	28.0	29.6	34.4	**35***	**35***	**35***	**35***	**35***	**35***	**35***
	Exceedance Level	-	-	-7.0	-5.4	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NAL8 (H2)	Site Specific Noise Limit	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	Predicted Wind Turbine Noise L_{A90}	-	-	28.0	29.6	34.4	**35***	**35***	**35***	**35***	**35***	**35***	**35***
	Exceedance Level	-	-	-7.0	-5.4	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NAL9 (H4)	Site Specific Noise Limit	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
	Predicted Wind Turbine Noise L_{A90}	-	-	27.7	29.3	34.1	**35***	**35***	**35***	**35***	**35***	**35***	**35***
	Exceedance Level	-	-	-7.3	-5.7	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NAL10 (H3)	Site Specific Noise Limit	42.3	42.3	42.3	42.3	42.3	42.3	35.0	35.0	35.0	35.0	35.0	35.0
	Predicted Wind Turbine Noise L_{A90}	-	-	29.6	31.2	36.0	40.4	**35***	**35***	**35***	**35***	**35***	**35***
	Exceedance Level	-	-	-12.7	-11.1	-6.3	-1.9	0.0	0.0	0.0	0.0	0.0	0.0

NAL		Wind Speed (ms^{-1}) as standardised to 10m height											
		1	2	3	4	5	6	7	8	9	10	11	12
NAL11 (H6)	Site Specific Noise Limit	40.8	40.8	40.8	40.8	40.8	40.8	33.0	33.0	33.0	33.9	33.9	33.9
	Predicted Wind Turbine Noise L_{A90}	-	-	24.4	26.0	30.8	35.2	**33***	**33***	**33***	**33.9***	**33.9***	**33.9***
	Exceedance Level	-	-	-16.4	-14.8	-10.0	-5.6	0.0	0.0	0.0	0.0	0.0	0.0
NAL12 (H10)	Site Specific Noise Limit	40.8	40.8	40.8	40.8	40.8	40.8	33.0	33.0	33.0	33.9	33.9	33.9
	Predicted Wind Turbine Noise L_{A90}	-	-	23.5	25.2	30.0	34.3	**33***	**33***	**33***	**33.9***	**33.9***	**33.9***
	Exceedance Level	-	-	-17.3	-15.6	-10.8	-6.5	0.0	0.0	0.0	0.0	0.0	0.0
NAL13 (H7)	Site Specific Noise Limit	42.2	42.2	42.2	42.2	42.2	42.2	41.5	41.2	41.1	42.4	42.4	42.4
	Predicted Wind Turbine Noise L_{A90}	-	-	24.7	26.3	31.1	35.5	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-	-	-17.5	-15.9	-11.1	-6.7	-5.2	-4.9	-4.8	-6.1	-6.1	-6.1
NAL14 (H8)	Site Specific Noise Limit	42.2	42.2	42.2	42.2	42.2	42.2	41.6	41.2	41.2	42.5	42.5	42.5
	Predicted Wind Turbine Noise L_{A90}	-	-	24.8	26.4	31.2	35.6	36.3	36.3	36.3	36.3	36.3	36.3
	Exceedance Level	-	-	-17.4	-15.8	-11.0	-6.6	-5.3	-4.9	-4.9	-6.2	-6.2	-6.2

**Predicted levels assume mode management is applied to meet the Site Specific Noise Limit. This would only apply for certain wind directions.*

12.5.7 Potential Decommissioning Noise Effects

In relation to the decommissioning phase, similar overall noise levels as those calculated for the construction phase of the Proposed Development would arise, as similar tools and equipment will be used. Considering that in all aspects of the construction phase, the predicted noise levels are expected to be below the appropriate criteria at all NSLs, it can be concluded that for the decommissioning phase, the effect is not significant.

The likely predicted noise and vibration effects are below the limits and/or thresholds identified, therefore there will be no significant effects.

12.6 Mitigation

12.6.1 Mitigation during Construction

No significant effects resulting from the removal of the existing turbines and construction of the Proposed Development 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:

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

While it was concluded above that there will be no significant vibration effects associated with the turbine removal / construction of the Proposed Development, and that no specific mitigation measures were required, it is recommended that vibration from turbine removal or construction activities will be limited to the values set out in Section 12.4.1.2. Given that construction activities are only likely to occur for a short duration, the use of internal vibration limits is likely to be unnecessary. Therefore, no mitigation measures are proposed.

12.6.2 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. The final choice of turbine will, however, have to meet the derived Guidelines noise limits and/or noise limits determined and contained within any planning permission condition imposed. In the event that mitigation is required, modern turbine control systems allow for turbines to operate in a reduced noise mode for a range of wind speeds and wind directions as required, referred to as 'mode management'.

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.

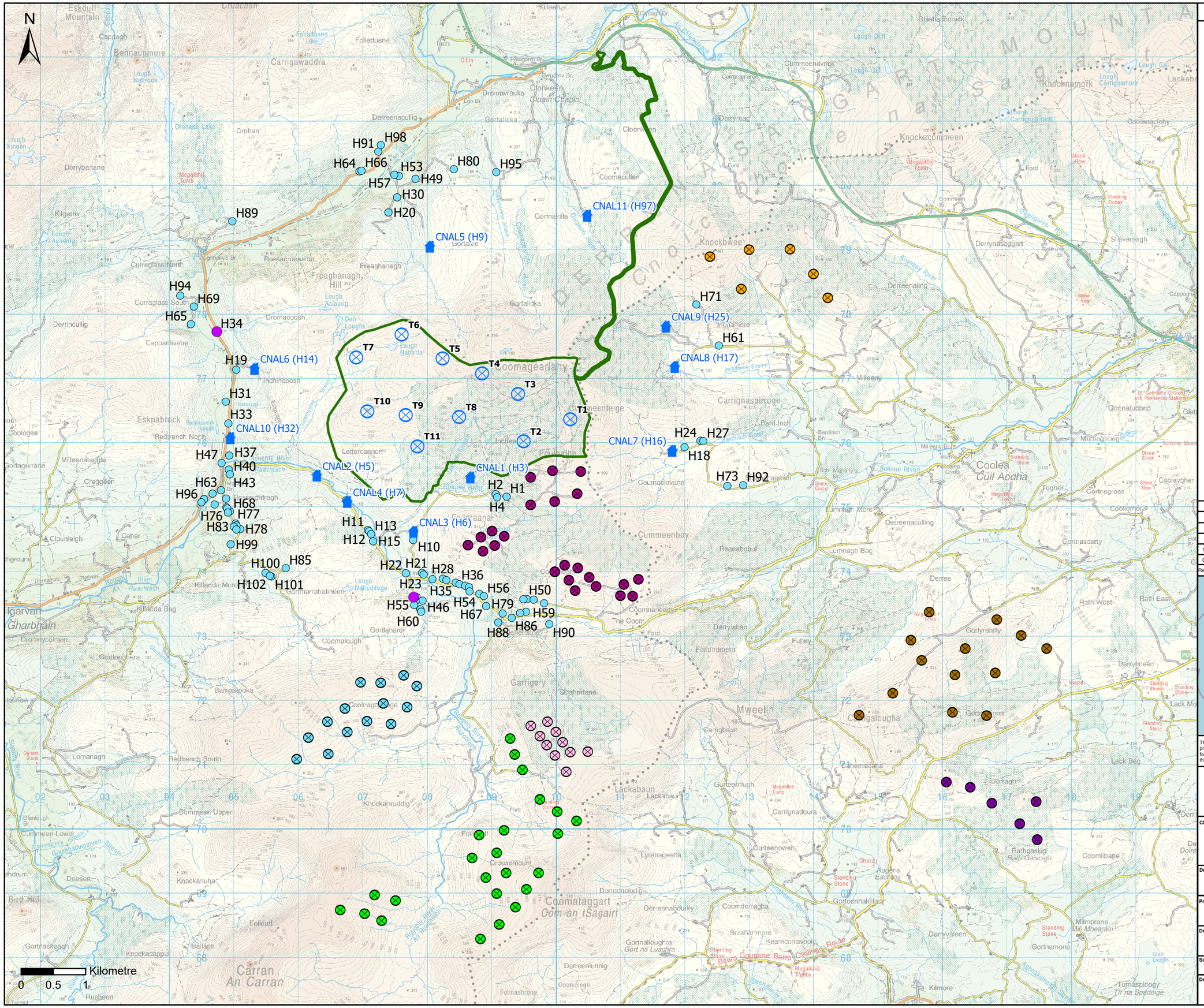
Based on the candidate wind turbine modelled in the noise assessment, in order to meet the Site Specific Noise Limits at NAL7-12 initial predictions suggest that low noise management would be required at 7 of 11 turbines. The required reductions can be achieved using the standard modes available for the turbine; no turbines will need to be switched off to meet the noise limits.

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

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

12.6.3 Mitigation during Decommissioning

No specific mitigation measures are required for decommissioning, they are similar to that detailed during the construction phase. To ameliorate any potential noise effects that may present during the decommissioning phase, a schedule of noise control measures has been formulated in accordance with best practice guidance. These are outlined in the Construction and Environmental Management Plan (CEMP) in Appendix 4-3, that has been prepared for the Proposed Development.



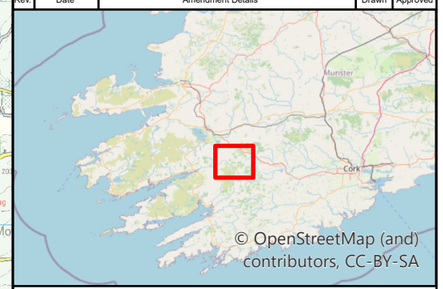
LEGEND

- EIAR Site Boundary
- Proposed Turbine Location
- Noise Assessment Location (NAL)
- Noise Sensitive Receptor (NSR)
- Derelict Property

Wind Farms

- Barnastooka
- Derragh
- Gortyrahilly
- Grousemount
- Inchamore
- Midas
- Sillahertane

Rev.	Date	Amendment Details	Drawn	Approved
1	13/05/2023	CLIENT COMMENTS	JCM	JB
0	15/02/2023	FIRST ISSUE	AD	JB



tnei

Client

Orsted Onshore Ireland Midco Ltd

Drawing Status:

FOR INFORMATION

Project Title:

PROPOSED REPOWERING OF KILGARVAN WIND FARM

Drawing Title:

FIGURE 11-3 CUMULATIVE WIND FARM LOCATIONS

Scale:	Original Size:	Spatial Reference:
1:55,000	A3	IRENET95 Irish Transverse Mercator

Drawing Number:

IE00065-018

12.7 Assessment of Residual Effects

12.7.1 Residual Construction Effects

Predicted construction noise levels (including existing turbine removal) are below the assessment criteria at all receptors, for all phases. Good practice mitigation measures are outlined above, however, with or without the good practice mitigation measures there will be **no significant residual effects**.

12.7.2 Residual Operational Effects

Predicted wind turbine operational noise levels at all the NALs and NSRs lie below the Site Specific Noise Limits at all locations during the daytime and night-time period. The addition of the noise from the Proposed Development would result in a negligible increase in noise where the existing turbine noise levels already exceeds the Total Guidelines Noise Limit, at all other locations cumulative noise predictions from the Proposed Development and other operational/ proposed wind farms lie below the Total Guidelines Noise Limits. There would be **no significant residual effects** resulting from the Proposed Development after the Sites Specific Noise Limits are adopted.

Whilst it is not possible to predict if OAM will occur, potential mitigation measures to reduce OAM have been identified in Section 12.6.2 above. The detail of the appropriate mitigation to be adopted will be determined once the wind farm is operational if and when OAM were to occur, following on-site noise measurements and assessments triggered by a complaint investigation. Having applied appropriate mitigation measures 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 Guidelines and there would be **no significant residual effects**.

12.7.3 Residual Decommissioning Effects

During the decommissioning phase of the Proposed Development, there will be some effect on nearby noise sensitive locations due to noise emissions from site traffic and other on-site activities. Assuming similar overall noise levels as those calculated for the construction phase can be considered for elements that are proposed to be decommissioned. The noise and vibration effects associated with any decommissioning of the site are considered to be less than those outlined in relation to the construction of the Proposed Development, and therefore, are not significant.

12.8 Cumulative Effects

Cumulative effects on noise and vibration between the Proposed Development and other permitted or proposed projects and plans in the area, (wind energy or otherwise), as set out in Section 2.7 in Chapter 2 of this EIAR, were also considered as part of this assessment. The developments considered as part of the cumulative effect assessment are described in Section 2.7 of this EIAR.

The predicted existing turbine removal and 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 proposed wind farms near to the NALs, whilst still meeting the Total Guidelines Noise limits established in accordance with the Guidelines at NALs 1-6

and 10-14, Therefore there would therefore be **no significant cumulative operational noise effects** at these NALs. At NALs 7-9 predicted noise from existing wind farms already exceeds the Total Guidelines Noise Limit for certain wind speeds and wind directions during the daytime and night-time periods. In practice, the existing turbines may be operated in a low noise mode to ensure compliance but there is no public information available to confirm this. Accordingly, the assessment has assumed that the turbines operate in unconstrainted mode as this represents a precautionary / worst-case scenario. Based on this precautionary / worst case scenario, significant effects are predicted at NALs 7-9. Where significant effects have been predicted due to the operation of the existing wind farms, noise from the Proposed Development has been reduced such that it is 10 dB below the Total Guidelines Noise Limits to ensure that it has a negligible additional impact; therefore there would be **no additional significant effects** at NAL7-9.

12.9 Summary

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

Activities related to the decommissioning of the Proposed Development would use similar plant to that used for the existing turbine removal and construction activities, and would occur at the same locations. As such noise level output during the decommissioning phase is expected to be no higher than the construction phase. Therefore, no significant noise and vibration effects are anticipated for the decommissioning phase. Good practice during construction and decommissioning is recommended to minimise any potential noise impacts. **No significant noise and vibration effects are anticipated for the construction and decommissioning phases**. Good practice during construction and decommissioning is recommended to minimise any potential noise impacts.

The guidance contained within the Guidelines was used to assess the likely operational noise impact of the Proposed Development. Predicted levels and measured background noise levels indicate that for sensitive receptors neighbouring the Proposed Development, the operational impact of the Proposed Development is **not significant** after the Site-Specific Noise Limits are adopted. In order to meet the noise limits, mode management would be required based on the candidate turbine considered in this assessment.

An additional comparison was made between predicted noise levels from the Existing Kilgarvan Wind Farm turbines, and those turbines associated with the Proposed Development at the 14 NALs considered in this assessment. The comparison showed that the predicted output of the Proposed Development will be lower at each of the NALs than the Existing Kilgarvan Wind Farm turbines.

There are a range of wind turbine models that may be appropriate for the Proposed Development. If the Proposed Development receives planning permission, further data will be obtained from the supplier for the final choice of wind turbine model to demonstrate compliance with the derived Guidelines noise limits and/or noise limits determined and contained within any planning permission condition imposed. In the event that mitigation is required, turbine control systems allow for turbines to operate in a reduced noise mode.

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