Environmental Impact Assessment Report - Volume 2C

Chapter 25:
Noise (Airborne) and Vibration

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report
Chapter 25: Noise (Airborne) and Vibration

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EIAR – Chapter 25
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Contents

Figures

Tables

25 CHAPTER 25: NOISE (AIRBORNE) AND VIBRATION

25.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) provides an assessment of the potential noise and vibration impacts of the Oriel Wind Farm Project (hereafter referred to as 'the Project'). Specifically, this chapter considers the potential noise and vibration impacts on onshore sensitive receptors for both the onshore and offshore infrastructure of the Project during the construction, operational and maintenance, and decommissioning phases.

Potentially impacted onshore receptors (Noise Sensitive Locations, hereafter referred to as NSLs) may include:

- A dwelling, house, hotel or hostel;
- A health building (providing patient services), nursing/retirement home;
- An educational establishment, place of worship or entertainment;
- Another facility which may justifiably require for its proper use the absence of noise at levels likely to cause significant effects; or an
- An area of particular scenic quality or special recreational amenity importance including caravan and holiday parks, beaches, etc.

Potential disturbance impacts from the Project on ecological receptors are addressed in volume 2A, chapter 10: Marine Mammals and Megafauna, chapter 11: Offshore Ornithology and also in chapter 19: Biodiversity.

The assessment presented is informed by the following technical chapters:

- Chapter 18: Population and Human Health; and
- Chapter 28: Traffic and Transport.

This chapter summarises information contained within appendix 25-1: Baseline Noise Monitoring Results and appendix 25-2: Noise Modelling Methodology. For the avoidance of doubt, the term 'noise' includes vibration in this chapter, and certain sections deal with vibration specifically.

In this chapter dBA will mean the A-weighted decibel sound pressure level referenced to 20 micro-Pascals.

The details and competencies of the specialist who prepared this chapter can be found in volume 2A, chapter 1: Introduction.

25.2 Purpose of this chapter

The primary purpose of the EIAR chapter is to provide an assessment of the likely direct and indirect significant effects of the Project airborne noise sensitive receptors. In particular, this EIAR chapter:

- Presents the existing environmental baseline established from site-specific surveys and desktop studies (section 25.7);
- Identifies any assumptions and limitations encountered in compiling the environmental information (section 25.7.5);
- Presents an assessment of the potential likely significant effects of noise and vibration arising from the Project (section 25.10), based on the information gathered and the analysis and assessments undertaken. An assessment of potential cumulative impacts is provided in 25.12.2 and an assessment of transboundary effects is outlined in section 25.13; and

- Highlights any necessary monitoring (section 25.11.9) and/or measures (see section 25.11) which could prevent, minimise, reduce or offset the likely significant environmental effects identified in the assessment chapter (section 25.10).

25.3 Study area

Noise (including vibration) associated with the construction, operation and maintenance, and decommissioning phases of the Project has the potential for adverse effects on receptors (human beings), which can affect the use of their residential property, their enjoyment of outdoor recreation areas, or other activities for which noise might otherwise disturb. Noise and vibration can also have potential for adverse effects on protected wildlife. Locations that are likely to be significantly impacted by noise and vibration are collectively referred to as Noise Sensitive Locations (NSLs). Further detail on NSLs is provided in section 25.6.

There is no national government guidance or legislation on the control of noise from offshore wind farms. Similarly, there is no guideline on the extent/size of the Noise (Airborne) and Vibration Study Area to adopt for the assessment of noise and vibration effects from electrical infrastructure or the construction or operation of wind farms on NSLs.

To inform this assessment, it was required to define three study areas as described below and summarised in Table 25-1.

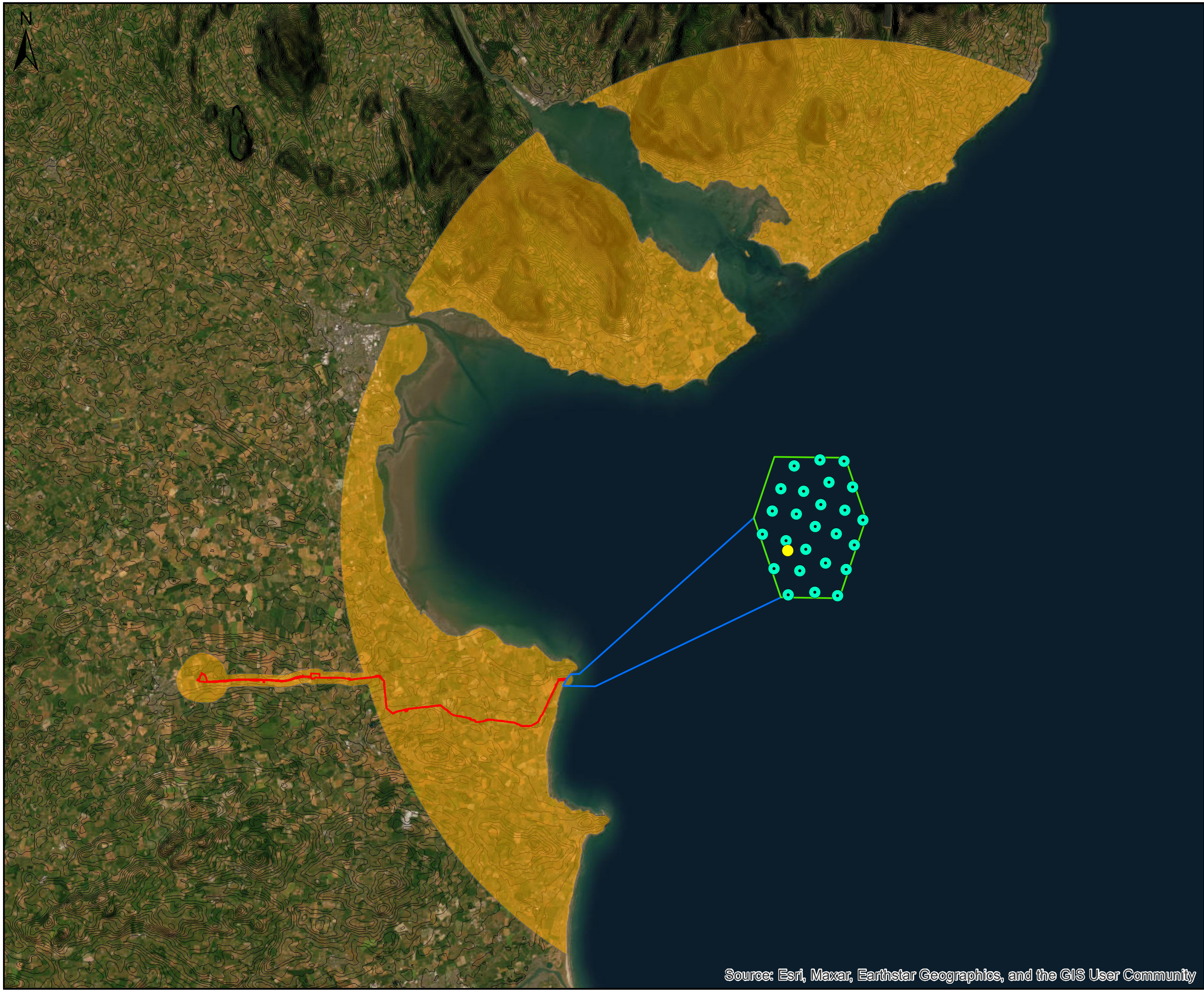
The Noise (Airborne) and Vibration Study Area for the construction and decommissioning phases in this assessment have been set with consideration of the guidance contained within EirGrid Evidence Based Environmental Studies - Study 8: Noise (May 2016), BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites Noise (+A1:2014) and BS 5228-2:2009 Vibration. Professional judgment has been used to determine the distances over which noise impacts may occur during construction along with consideration of the likely magnitude and duration of impact and the sensitivity of receptors. During the construction and decommissioning phases, the Noise (Airborne) and Vibration Study Area considers NSLs up to 300 m from the onshore elements of the Project (namely the landfall, the onshore cable route and the onshore substation) together with temporary construction compounds and access routes.

Electrical equipment in the onshore substation will be in constant operation with near constant noise emission levels and highly tonal low frequency noise. Low frequency noise attenuates more slowly than higher frequencies with distance from the source and equipment will operate at night when baseline levels are lower. The Noise (Airborne) and Vibration Study Area for the onshore substation is therefore larger than that for construction and is set to 1 km from the substation property boundary. This study area has been set with consideration of EPA NG4 and ISO 9613 environmental noise prediction methodology.

For operational Wind Turbine Noise (WTN) a Noise (Airborne) and Vibration Study Area of onshore locations within 20 km of the Wind Turbine Generators (WTG) planned as part of the Project is considered. The Noise (Airborne) and Vibration Study Area for operational WTN has been set using professional judgement and with consideration of current best practice offshore WTN modelling (Danish Executive Order BEK nr 135).

Table 25-1: Study areas for noise and vibration.

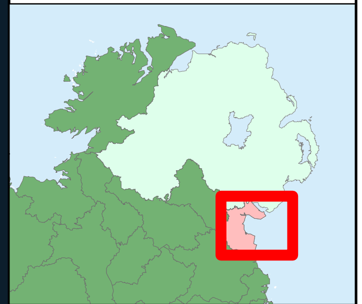
Phase/infrastructure	Extent of study area	Justification
Construction & decommissioning of onshore infrastructure	300 m from onshore infrastructure elements of the Project	Noise from construction plant will have attenuated to levels below 65 dBA at a distance of 300 m.
Operation & maintenance – onshore substation	1 km from substation boundary	An extended distance of 1 km is chosen due to low frequency tonal content of substation noise.
Operation & maintenance – WTGs	Onshore locations within 20 km of a proposed WTG	Largest estimated potential zone of influence for WTG noise



Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Wind Turbine Generator
- Offshore Substation
- Noise (Airborne) and Vibration Study Area
- 10m Elevation Contours

Data Sources: OWL, EPA, OSi



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Project

Oriel Wind Farm Project

Title

Figure 25-1:
Noise (Airborne) and Vibration Study Area

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: BC	**File Ref:** MDR1520bArc3063F02
Approved By: CC	
Scale: 1:240,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 13/02/2024	

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2. All levels are referred to Ordnance Datum, Malin Head.

25.4 Policy Context

Planning policy on renewable energy infrastructure is presented in volume 2A, chapter 2: Policy and Legislation. This section presents planning policy that specifically relates to airborne noise and vibration. which is contained in the Offshore Renewable Energy Development Plan I and II (OREDP) (DECC, 2022) (see Table 25-2). The National Marine Planning Framework (NMPF) (Department of Housing, Planning and Local Government,2021) contains no policies specific to airborne noise.

In February 2023, the 'OREDP II - National Spatial Strategy for the transition to the Enduring Regime' was published in draft and subject to consultation. The key objectives of OREDP II are:

- *"Assess the resource potential for ORE in Ireland's maritime area;*
- *Provide an evidence base to facilitate the future identification of Broad Areas most suitable for the sustainable deployment of ORE in Ireland's maritime area;* and
- *Identify critical gaps in marine data or knowledge and recommend prioritised actions to close these gaps."*

The OREDP II will provide an evidence base to facilitate the future identification of Broad Areas of Interest most suitable for the sustainable deployment of ORE in Ireland's maritime area, to be assessed in greater detail at regional scale. This assessment will subsequently inform the identification of more refined areas as part of the designation process for Designated Maritime Area Plans (DMAP).

When published, the OREDP II will update the original OREDP published in 2014.

Table 25-2: Summary of OREDP provisions relevant to airborne noise.

Summary of OREDP provision – project level mitigation measures	How and where considered in the EIAR
Recreation and Tourism	
Disturbance: noise from construction (piling and cable laying*)* and operation of the wind farm	The potential impacts of the construction, operational and maintenance and decommissioning phases of the Project have been assessed at a number of Nearest Sensitive Receptors, which include caravan and holiday parks and beaches (see section 25.10).

Specific policy, relevant to noise and vibration, is set out in the following sections with a summary provided in Table 25-3.

Table 25-3: Summary of policy provisions relevant to airborne noise and vibration.

Summary of relevant policy framework	How and where considered in the EIAR
Offshore Renewable Energy Development Plan, 2014	See Table 25-2.
Wind Energy Development Guidelines 2006	The WEDG 2006 provide the foundation for determination of appropriate noise limits (see section 25.9).
Environmental Protection Agency Act 1992	EPA NG4 guidance is considered in assessing noise emissions from the onshore substation (see section 25.9).
Environmental Noise Directive 2002/49/EC	Noise mapping is utilised in the desktop study (see section 25.2).
Draft Wind Energy Development Guidelines 2019	Guidance of the DRWEDG 2019 as it relates to special audible characteristics has been considered in the assessment (see section 25.8).

Available policy in Northern Ireland has also been reviewed. The Offshore Renewable Energy Strategic Plan (ORESAP) 2012-2020 is now expired and in 2022 the Department for Economy (DfE) led the development of the Draft Offshore Renewable Energy Action Plan (OREAP). Consultation on the Draft OREAP opened on 21 December 2022 and closed on 16 March 2023 and DfE stated “The Draft OREAP is the first step towards delivering on the ambition of deploying 1 Gigawatt (GW) of offshore wind from 2030 in NI waters.”

25.4.1 Wind Energy Development Guidelines 2006

There are no development guidelines or noise guidance for offshore wind farms in Ireland. The Wind Energy Development Guidelines, Guidelines for Planning Authorities, June 2006, Department of Environment, Heritage and Local Government (hereafter referred to as the WEDG 2006) are the current guidelines in force for onshore wind farms. The WEDG 2006 state that noise impact should be assessed by reference to the nature and character of NSLs. In the case of onshore wind energy development, an NSL includes any occupied dwelling house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational amenity importance. Noise limits should apply only to those areas frequently used for relaxation or activities for which a quiet environment is highly desirable. Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.

The WEDG 2006 recommend that where background noise is less than 30 dB(A), the daytime level of the $L_{A90,10min}$ of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A). During the night a fixed limit of 43 dB(A) is recommended. There is no distinction in the WEDG 2006 for evening or weekend amenity hours, such as exists under UK guidance.

The WEDG 2006 are based on provisions of the ETSU-R-97, which is the UK’s preferred method of assessing wind farm noise for planning purposes and has gained acceptance in other jurisdictions. The Institute of Acoustics (IoA) has published a Good Practice Guide (IoA 2013a) to the Application of ETSU-R97 which has relevance to the implementation of the WEDG 2006.

The WEDG 2006 have been the subject of a targeted review since 2013 to encompass detailed guidance in relation to noise and address other issues that have caused increasing concern in relation to wind turbine development. No change to the WEDG 2006 has been adopted to date.

25.4.2 Draft Wind Energy Development Guidelines 2019

In 2019, the Department of Housing, Planning and Local Government (DHPLG), in conjunction with the Department of Communications, Climate Action and Environment (DCCAE), published the Draft Revised Wind Energy Development Guidelines December 2019, (DRWEDG 2019) and accompanying Strategic Environmental Assessment. These draft guidelines are based on a ‘Preferred Draft Approach’, published in June 2017 and offer advice on planning for wind energy and in determining applications for planning permission. The DRWEDGs 2019, if adopted, will replace the WEDG 2006.

The DRWEDGs 2019 noise limits propose a relative rated noise limit of 5 dB(A) above existing background noise within the range of 35 to 43 dB(A), with 43 dB(A) being the maximum noise limit permitted, day or night. The noise limits would apply to outdoor locations at any residence or noise sensitive location.

Special audible characteristics specific to wind turbines (i.e. tonal noise, low frequency noise and amplitude modulation), where present in wind turbine noise (WTN), are frequently perceived to be more intrusive than normal broadband WTN. The rated limit would take account of these certain noise characteristics and, where identified, permitted noise limits would be further reduced to mitigate for these.

As the DRWEDGs 2019 are at consultation draft stage, it is not possible to anticipate the specific requirements at the time of preparation of this EIAR. The application of the proposed noise limits has, however, been considered in this assessment.

25.4.3 The Environmental Protection Agency Act, 1992

The Environmental Protection Agency Act, 1992 as amended (the 1992 Act), identifies noise as a form of environmental pollution. The 1992 Act contains provisions for dealing with noise “which is a nuisance or would endanger human health or damage property or harm the environment.” Section 106 of the 1992 Act relates to Regulations for Control of Noise; this section gives the relevant Minister the power to make regulations for the purpose of preventing or limiting noise. This may include imposing noise limits, either exceedance values or emission values, controlling sources of noise and the imposition of charges for noise pollution. Section 107 of the 1992 Act relates to the Power of Local Authority or Agency to Prevent or Limit Noise; this section gives powers to Local Authorities or the Environmental Protection Agency (EPA) to control and limit noise from any premises, process or work. Noise Regulations (S.I. No. 140 of 2006).

While not relating specifically to wind farm noise these regulations can be applied to industrial noise, which includes, substations and other infrastructure supporting windfarm operation. The EPA has also published guidance on noise monitoring, EPA, Office of Environmental Enforcement (OEE) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities* (EPA NG4). While an offshore windfarm is not a Scheduled Activity, the guidance is considered to have relevance with regard to identifying NSLs and baseline monitoring.

25.4.4 Environmental Noise Directive 2002/49/EC

The purpose of the Environmental Noise Directive (END) is to provide a basis for developing and completing the existing set of Community measures concerning noise emitted by the major sources, in particular road and rail vehicles and infrastructure, aircraft, outdoor and industrial equipment and mobile machinery, and for developing additional measures, in the short, medium and long term.

Existing Community measures include the use of a common noise indicator for transportation noise sources, mapping transportation noise and developing noise action plans based on noise-mapping results.

The EPA is the national authority for overseeing the implementation of S.I. No. 140/2006 - Environmental Noise Regulations, 2006 (the END Regulations). This role includes supervisory, advisory and coordination functions in relation to both noise mapping and action planning, as well as various reporting requirements for the purpose of the Environmental Noise Directive (Directive 2002/49/EC).

25.4.5 Louth County Development Plan, 2021-2027

The Louth County Development Plan 2021-2027 is the over-arching strategic framework document for the proper planning and sustainable development of the entire functional area of County Louth. The Development Plan refers to the WEDG 2006 regarding wind energy projects. The development plan includes Policy Objectives IU 56 to IU 63 which are specific to offshore wind including IU 60.

“To support the development of offshore windfarm developments subject to normal planning considerations, including in particular the impact on areas of environmental or landscape sensitivity”.

25.5 Consultation

This section summarises the issues raised relevant to airborne noise and vibration which have been identified during consultation activities undertaken to date, together with how these issues have been considered in the production of this EIAR chapter. Chapter 6: Consultation provides details on the types of consultation activities undertaken for the Project between 2019 and 2023 and the consultees that were contacted.

Table 25-4 summarises the issues identified during consultation activities undertaken to date, which are relevant to noise and vibration, together with how these issues have been considered in the preparation of this EIAR chapter. Volume 2A, chapter 6: Consultation provides details on the types of consultation activities undertaken for the Project between 2019 and 2024 and the consultees that were contacted.

Table 25-4: Summary of key consultation issues raised during consultation activities undertaken for the Project relevant to noise and vibration.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
January 2021 and January 2023	Public consultation	Concerns regarding noise impacts from the Project on land.	Noise impacts identified on land primarily relate to construction and the operation of the onshore substation and these impacts can be appropriately mitigated to ensure there will be no significant effects. The offshore wind turbines will produce operational noise that is unlikely to be audible onshore but might occasionally be audible at

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
			certain quiet locations inland on the Cooley Peninsula when wind directions favour noise propagation. These issues are addressed in sections 25.10 and 25.11.
January 2023	Public consultation	Questions regarding decibel level from WTG noise.	The decibel level that could be measured from turbines at any given location depends upon the distance from the turbines and the propagation conditions (i.e. wind direction, wind speed and other atmospheric conditions, topography, etc.). Noise from the turbines has been predicted according to industry best practice and predictions for all locations on land up to a standardised 10 m wind speed of 10 m/s are below both the lowest limit generally imposed (35 dB $L_{A90,10min}$), and the average background $L_{A90,10min}$ levels recorded during baseline surveys. This is addressed in section 25.10.

25.6 Methodology to inform the baseline

The airborne noise (airborne) and vibration assessment has followed EPA Guidelines (2022) on the information to be contained in Environmental Impact Assessment Reports. The following guidance documents, which are specific to noise and vibration, have also been considered for assessment of the baseline environment:

- Wind Energy Development Guidelines, Guidelines for Planning Authorities, June 2006, Department of Environment, Heritage and Local Government (WEDG 2006);
- Institute of Acoustics Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IoA 2013a);
- ETSU-R-97 The Assessment and Rating of Noise from Wind Farms, The Working Group on Noise from Wind Turbines - Final Report ETSU-R-97, UK Department of Trade and Industry;
- BS 5228-1:2009 +A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise;
- EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4);
- BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound;
- BS 5228-1:2009 +A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration; and
- ISO 1996-2:2017 Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels.

25.6.1 Desktop study

Noise sensitive locations (NSLs) are defined as any location in which the inhabitants may be disturbed by noise from the wind energy development. This includes a dwelling, house, hotel or hostel, health building (providing patient services), nursing/retirement home, educational establishment, place of worship or entertainment, or other facility which may justifiably require for its proper use the absence of noise at levels likely to cause significant effects and may also include areas of particular scenic quality or special recreational amenity importance (see WEDG2006 and IoA GPG).

The key sources (i.e. data and reports) used to inform the baseline characterisation of the Noise (Airborne) and Vibration Study Area are summarised in Table 25-5 below. These sources provide the most up to date data for this assessment.

Table 25-5: Summary of key desktop data.

Title	Source	Year	Author(s)
Louth County Council Noise Action Plan 2018-2023 and Round 3 mapping	Louth County Council	2018	O'Gorman, E., O'Hagan, J., and Gallagher, B.
Northern Ireland END Noise Data (Round 3)	DAERA NI	2018	N/A
OSI	Ordnance Survey Ireland	Online database	N/A
Google Earth Imagery	Google Earth	1984-2022	Google LLC
GeoDirectory	An Post	2022	An Post and Ordnance Survey Ireland

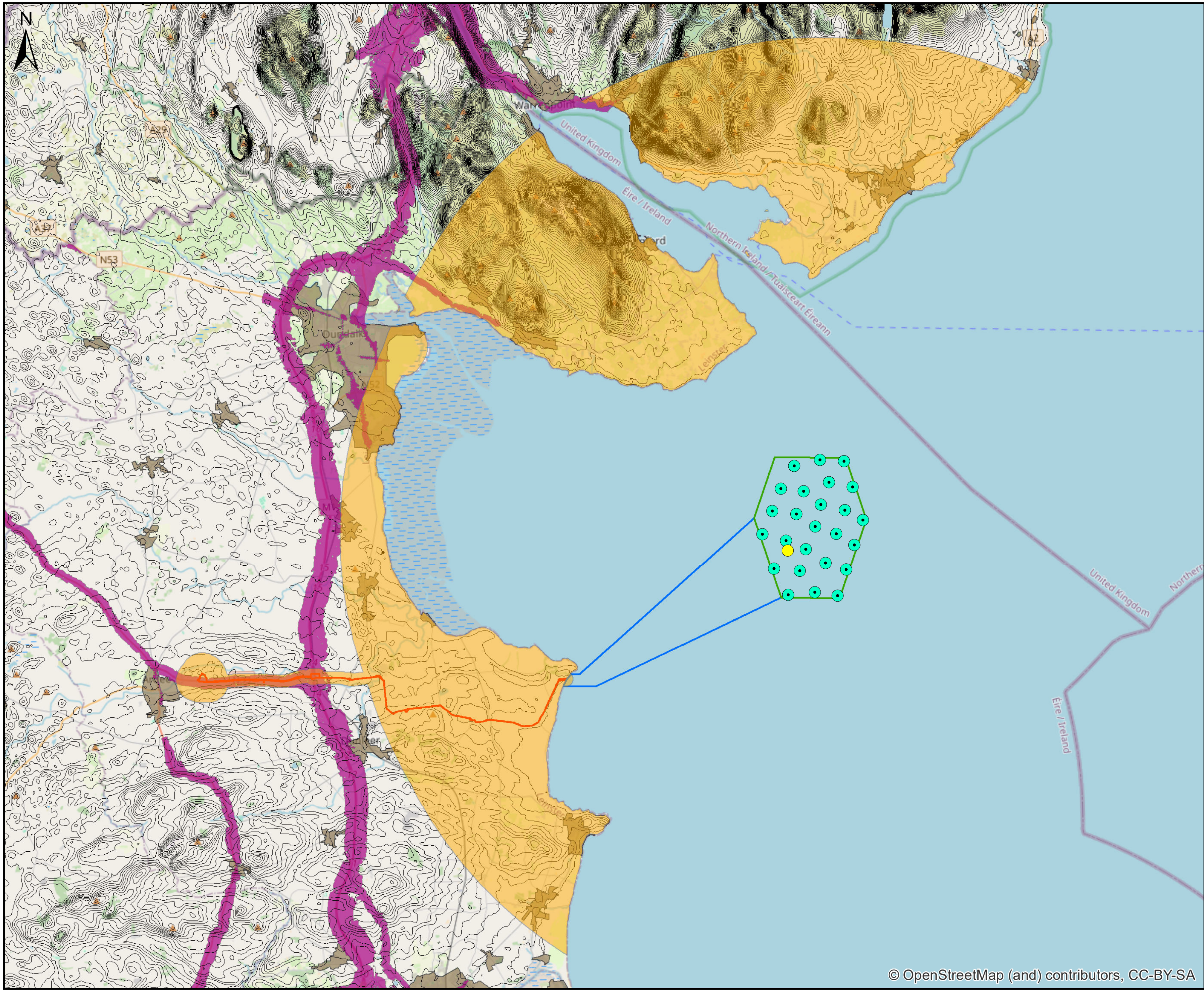
NSLs within the Noise (Airborne) and Vibration Study Areas have been identified from the An Post GeoDirectory, Ordnance Survey Ireland mapping, aerial photographs, site inspections and consultations with other specialist disciplines. NSLs have been catalogued and GIS mapped for analysis purposes including selection of monitoring sites, noise predictions, calculation of separation distances from construction works etc.

GIS mapping of NSLs with topography and known existing noise sources of noise allows consideration of receiver sensitivity and an assessment of expected existing baseline noise levels using professional judgement. In addition, mapping of anthropogenic noise sources overlaid with details of the Project provides a resource to inform baseline monitoring and characterisation of the wider baseline noise environment. A GIS desktop study rendering for the Project is displayed in Figure 25-2. Existing sources of noise such as roads, population centres and coastal water action influence the selection of noise monitoring locations in addition to consideration of topography and other factors influencing sheltering of sites from wind induced noise etc. The figure shows the END Round 3 road traffic noise L_{den} > 55dB contour, cities and towns, and ground elevation contours all of which are considered in selection of monitoring sites and assessment of potential noise impacts.

Examination of the figure indicates expected noise sources in the Noise (Airborne) and Vibration Study Area include:

- Anthropogenic noise sources such as road and rail noise and urban noise from towns; and
- Coastal noise from the sea in areas near the high-water mark.

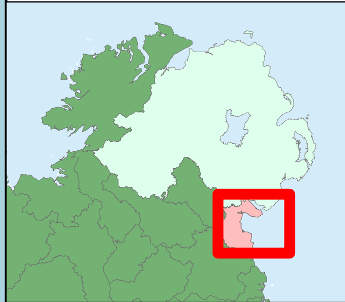
The GIS exercise indicates that the NSLs with highest sensitivity which are likely to be exposed to higher operational noise levels from the WTGs are located toward the tip of the Cooley Peninsula east of the Cooley Mountains.



Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Wind Turbine Generator
- Offshore Substation
- Noise (Airborne) and Vibration Study Area
- END Round 3 L_{den} > 55dB
- Cities and Towns NI and ROI
- 10m Elevation Contours

Data Sources: OWL, NPWS, EPA, Northern Ireland Department of Agriculture, Environment and Rural Affairs, OSi, Northern Ireland Research & Statistics Agency



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Title

**Figure 25-2:
GIS map desktop
study for the Project**

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
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3.

25.6.2 Site specific surveys

In order to inform the EIAR, site-specific surveys were undertaken. A summary of the surveys undertaken to inform the airborne noise and vibration impact assessment are outlined in Table 25-6.

Table 25-6: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Long term continuous baseline noise monitoring	WTG Operational Noise (Airborne) and Vibration Study Area.	Ten sites (NML1 – NML10)	Enfonic	10/10/2022 to 25/11/2022	Appendix 25-1
Attended daytime and night-time monitoring	Construction Noise (Airborne) and Vibration Study Area, Onshore Substation Operational Noise (Airborne) and Vibration Study Area.	Four sites daytime (AML1 – AML4) and one site night-time (AML5)	RPS	28/2/2023 to 1/3/2023	Appendix 25-1

Long term baseline monitoring was undertaken in October-November 2022 to establish background noise levels for the operational wind turbine noise (WTN) assessment. Results of the long-term monitoring have also been utilised in the assessment of noise from offshore piling.

As a consequence of the BS 5228 65dBA lower cut-off, where existing noise levels are low, construction criteria are independent of the precise noise levels (i.e. unless daytime average ambient noise levels at façades of NSLs are in excess of 62.5dBA, the lower daytime noise threshold will default to 65dBA). Where existing noise levels are generally low, construction criteria are independent of the precise noise levels, and this was determined to be the case for most locations during the desktop study. In addition, baseline noise surveys were conducted for the BS 5228 assessment at four positions in the Construction Noise (Airborne) and Vibration Study Area.

Baseline survey data required for the Project relates to three different types of noise assessment. The types of assessment and data requirements are generally as follows:

1. Construction/decommissioning assessment in accordance with BS 5228:
   - Attended daytime noise survey data is used to determine noise thresholds, subject to the 65dBA lower cut-off value; and
   - Surveys are conducted in accordance with ISO 1996-2:2017.
2. Industrial noise assessment of the onshore substation in accordance with EPA NG4:
   - Attended or unattended survey data is used to determine noise limits;
   - Comparison with night-time background noise level (L_{A90}) is used for prediction and assessment of objective tonal noise audibility; and
   - Surveys are conducted in accordance with ISO 1996-2:2017, EPA NG4, and, where appropriate, BS4142.
3. WTN assessment in accordance with WEDG 2006, IoA GPG and ETSU-R-97:
   - Long duration unattended noise monitoring under a range of wind conditions to determine prevailing background ($L_{A90,10min}$) noise curves;
   - Prevailing background noise curves are used to set relative noise limits at integer wind speeds;

- Detailed weather monitoring data is required including wind speed monitored at hub height, wind direction close to hub height, and rain monitoring at survey positions; and
- Surveys are conducted in accordance with the IoA GPG.

The WEDG 2006 are the current guidelines for onshore wind energy development in Ireland. The Institute of Acoustics Good Practice Guide to The Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (2013) (IoA GPG) represents current best practice in the application of the ETSU-R-97 and by extension the WEDG 2006 for onshore wind turbines and was used in the formation of a baseline methodology. The assessment methodology consists of the following steps:

- Determine a study area;
- Identify potentially affected properties;
- Undertake a measurement survey consisting of measurement of baseline noise levels at representative properties with wind speed and direction at the proposed turbine site; and
- Analyse the data to remove rain affected and atypical data and derive the noise limits for the scheme in accordance with ETSU-R-97.

Information gathered in the desktop study enables selection of appropriate baseline noise monitoring sites for each assessment exercise using professional judgement. In all cases, there is effort to achieve the twin objectives of:

1. Further understand and characterise variations in baseline noise across the Noise and Vibration Study Area both generally and specifically to each assessment; and
2. Gather baseline noise data which is representative for the most sensitive NSLs within the Noise and Vibration Study Area which could potentially experience noise impacts from the Project.

Specifically, the following baseline noise information requirements are identified, by phase, for the Project:

- Construction: sites on the coastline which may be impacted by offshore piling noise and sites close to the onshore cable corridor and onshore substation which may be impacted by construction noise;
- Operation and maintenance: sites on the coastline which may be impacted by CTV noise, sites in the Noise (Airborne) and Vibration Study Area which may be impacted by WTN, and sites near the Onshore Substation which may be impacted by operational noise; and
- Decommissioning: requirements are similar to those for construction.

25.7 Baseline environment

A summary of the airborne noise and vibration baseline environment is provided below.

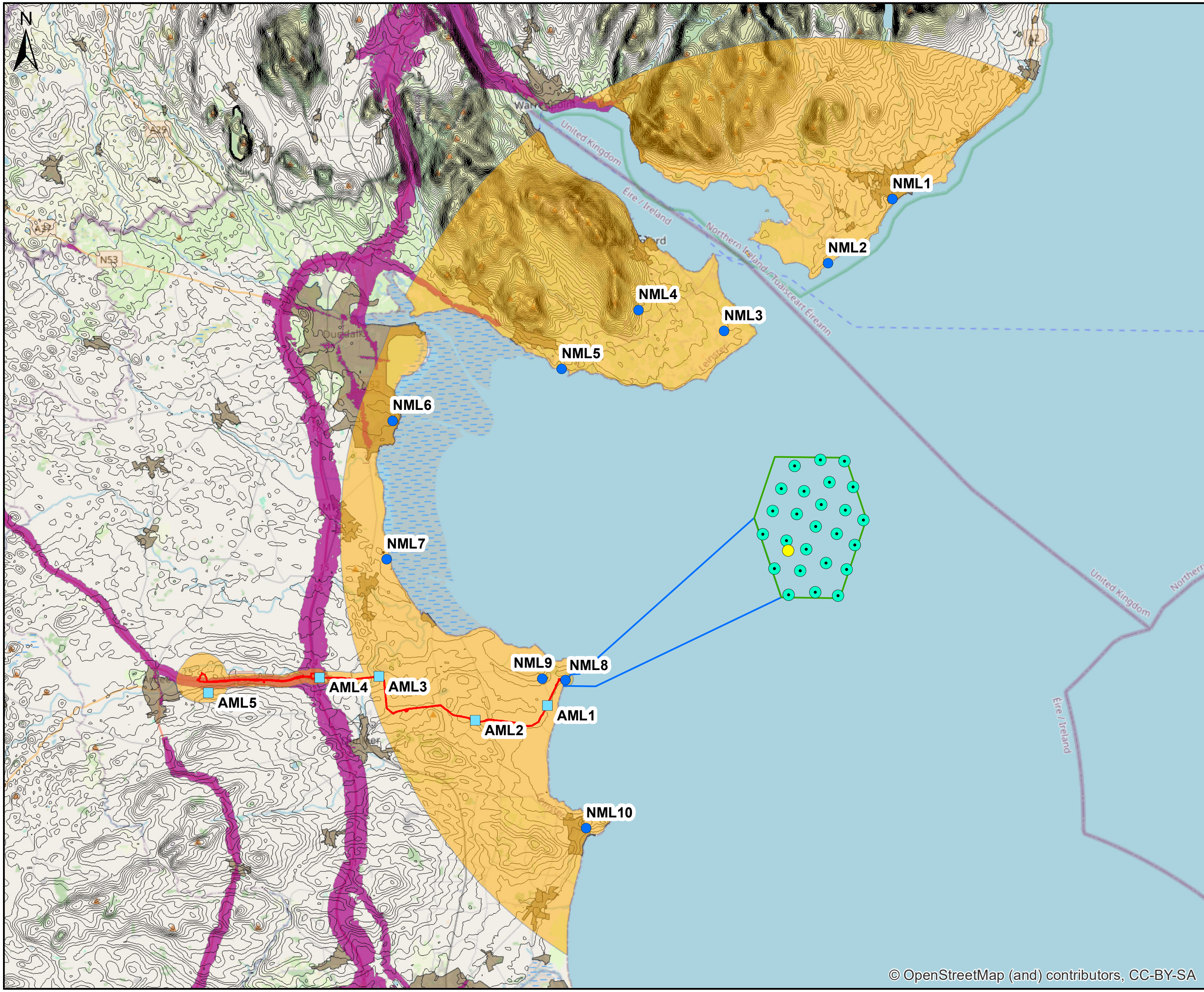
25.7.1 Baseline survey locations

A long-term baseline monitoring campaign was conducted at ten sites (NML1 – NML10) from 10 October 2022 to 25 November 2022. The scope, methodology, results of the surveys, and survey locations (shown in Figure 25-3) are set out in appendix 25-1: Baseline Noise Monitoring Results. Wind speed and direction was monitored adjacent to NML8 and rain gauges were deployed to record precipitation at NML3, NML7 and NML10.

The long-term monitoring sites include three sites on the coastline within 200 m of the high-water mark, six sites within approximately 1 km of the high-water mark, and one elevated site approximately 4 km inland on the Cooley Peninsula. The sites are spatially distributed along the coastline within the Noise and Vibration Noise (Airborne) and Vibration Study Area and allow characterisation of the baseline environment for NSLs which may be impacted by WTN from the Project. The Cooley Peninsula was identified to be of particular sensitivity in the desktop study and therefore monitoring has been conducted at three sites, located on the coast, approximately 1 km and approximately 4 km inland respectively.

To inform the construction noise assessment, four attended monitoring locations (AML1 – AML4) were selected along the onshore cable route. For the assessment of operational noise emissions from the onshore substation, a site representative of baseline noise conditions at the nearest NSL (AML5) was chosen for attended night-time noise monitoring.

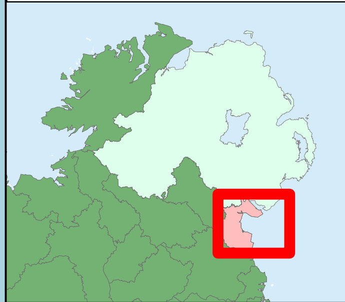
The ten long-term monitoring sites and the five attended monitoring sites are shown in Figure 25-3.



Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Wind Turbine Generator
- Offshore Substation
- Noise (Airborne) and Vibration Study Area
- Long-term Noise Monitoring Locations
- Attended Monitoring Locations
- END Round 3 L_{den} >
- Cities and Towns NI and ROI
- 10m Elevation Contours

Data Sources: OWL, OSi, EPA, Northern Ireland Department of Agriculture, Environment and Rural Affairs, Northern Ireland Research & Statistics Agency



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 25-3: Baseline Noise Monitoring Locations

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: BC	**File Ref:** MDR1520bArc3060F02
Approved By: CC	
Scale: 1:240,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 13/02/2024	

NOTE:
1. This drawing is the property of RPS Group Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels are referred to Ordnance Datum, Malin Head.
3.

25.7.1.1 Data collection issues

A summary of issues encountered with equipment during the survey period is provided in Table 25-7. Issues encountered included insufficient charge current from solar panels due to shading, SD card failure, damage to one monitor, and a lightning strike to the Lidar meteorological monitoring unit.

Table 25-7: Noise monitoring locations and issues encountered during survey (weather and lidar stations highlighted in grey).

Site	Location	Start Date	End Date	Overview of Survey / Issues
NML1	Kilkeel	13/10/2022	18/11/2022	Tight back garden solar charge difficulties. Additional solar capacity added. Offline from 19/10/22 to 21/10/22
NML2	Cranfield	13/10/2022	18/11/2022	Continuous noise monitoring – no issues
NML3	Ballagan	10/10/2022	18/11/2022	Continuous noise monitoring – no issues
	Rain Gauge	10/10/2022	18/11/2022	Continuous rain monitoring – no issues
NML4	The Grange	10/10/2022	18/11/2022	Continuous noise monitoring – no issues
NML5	Gyles Quay	14/10/2022	18/11/2022	Continuous noise monitoring – no issues
NML6	Blackrock	13/10/2022	18/11/2022	SD card failure. Data from 21/10/22 to 28/10/22 missing. Replaced card on 28/10/22
NML7	Castlebellingham	10/10/2022	18/11/2022	Continuous noise monitoring – no issues
	Rain Gauge	10/10/2022	18/11/2022	Continuous rain monitoring – no issues
NML8	Dunany (Landfall)	10/10/2022	25/11/2022	Solar panel issues. Offline from 15/10/22 to 24/10/22 Worked following replacement on 24/10/22
	Lidar	10/10/2022	25/11/2022	Monitoring of wind speed and direction. Lidar unit was offline from 10/10/22 to 25/10/22 following lightning strike.
NML9	Dunany (~1 km inland)	28/10/2022	25/11/2022	Equipment damaged, removed on 21/10/22. Reinstalled on 28/10/22
	Rain Gauge	18/11/2022	25/11/2022	Continuous rain monitoring – no issues
NML10	Clogherhead	10/10/2022	18/11/2022	Continuous noise monitoring – no issues
	Rain Gauge	10/10/2022	18/11/2022	Continuous rain monitoring – no issues

25.7.1.2 Instrumentation

Sound level measurements were carried out using Brüel and Kjær instruments with Class 1 measurement accuracy in compliance with both national and international standards. All instrumentation was within the manufacturers' periods of calibration. The instrumentation was checked both prior to and immediately following the surveys to measure any drift that had occurred over the survey period. The maximum drift recorded was within the 0.5 dB(A) permitted under ISO 1996-2[1]. A full list of monitoring equipment, with associated calibration certificates, is provided in Appendix 25-1: Baseline Noise Monitoring Results.

Weather conditions affect noise measurements. Good practice suggests that standard measurement equipment can be used with caution for wind speeds up to 5 m/s. For wind farm baseline measurements it is necessary to carry out baseline measurements at higher wind speeds. In order to carry out baseline measurements at higher windspeeds all microphones were mounted in double skin wind shields, in accordance with the IoA GPG. Type approved double windscreens were used, which provide a higher level of protection from wind induced noise.

[1] International Standard ISO 1996-2, Third edition 2017, Acoustics - Description, measurement and assessment of environmental noise - Part2: Determination of sound pressure levels

25.7.1.3 Prevailing wind direction

Long-term wind monitoring data from a floating LiDAR unit deployed in the centre of the offshore wind farm area was analysed and a wind rose was created, as shown in Figure 25-4. It can be seen from the figure that the prevailing wind direction is west-southwest, placing NSLs in either upwind or cross wind positions relative to WTGs proposed for the Project for most of the year.

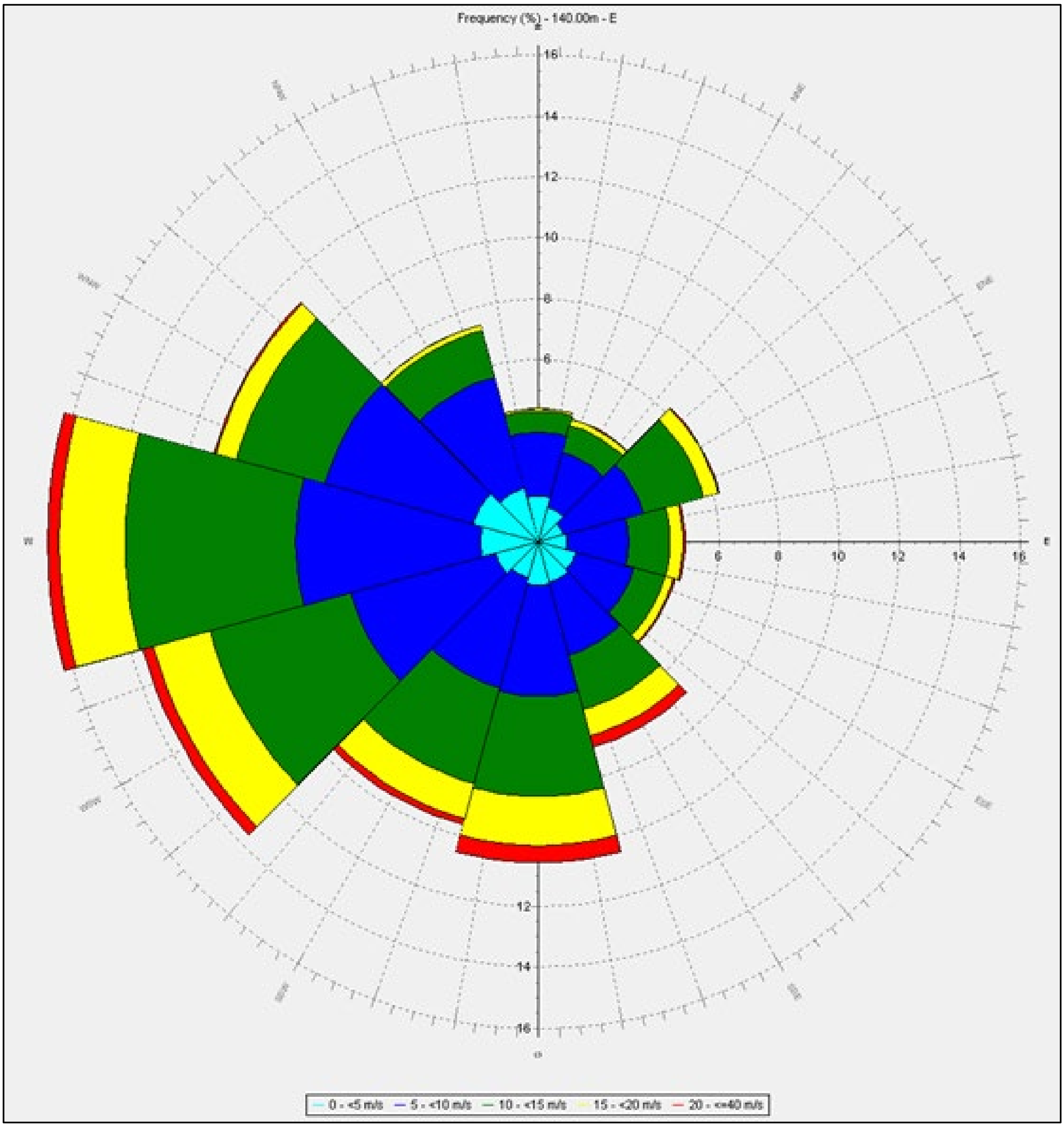


Figure 25-4: Wind Rose based on floating LiDAR long-term data.

25.7.2 Wind Conditions during baseline monitoring

Meteorological data for the survey was supplied from a Lidar unit deployed near to NML8. The hub heights of proposed WTGs range from 145 – 152 m and the Lidar data included measurement of wind speed and direction at 123 m and 163 m. For conservative derivation of prevailing background noise curves, the 152 m hub height is assumed and the average hub height 10-minute windspeeds (VHH) have been calculated from the 123 m and 163 m measurements using equations 2 and 3 from the IoA GPG Supplementary Guidance Note 4. As recommended by the IoA GPG, average wind direction from the nearest measurement height, 163 m, has been used directly. Finally, in order to reference background noise curves to standardised 10 m wind speed (V10), V10 wind speed have been calculated using a roughness length of 0.05 m as specified by the IoA GPG.

Measurements from the onshore Lidar unit located close to NML8 have been analysed and compared with measurements from a floating Lidar which was deployed within the offshore wind farm area, with excellent correlation shown (i.e. the results from the two different Lidar units at any given time agree). The floating Lidar was no longer in position at the time of the baseline monitoring in October/November 2022 and therefore measurements from the onshore Lidar have been used for baseline analysis.

10-minute average hub height windspeeds during the survey period from 10th October to 25th November 2022 are plotted in Figure 25-5 with corresponding measured wind directions. The wind direction measurement height used for the assessment is the Lidar measurement height closest to hub height as specified by the IoA GPG.

As can be seen from the plot, a wide range of windspeeds and directions were recorded during the survey. A good distribution of windspeeds is seen from the prevailing wind direction (210° to 290°).

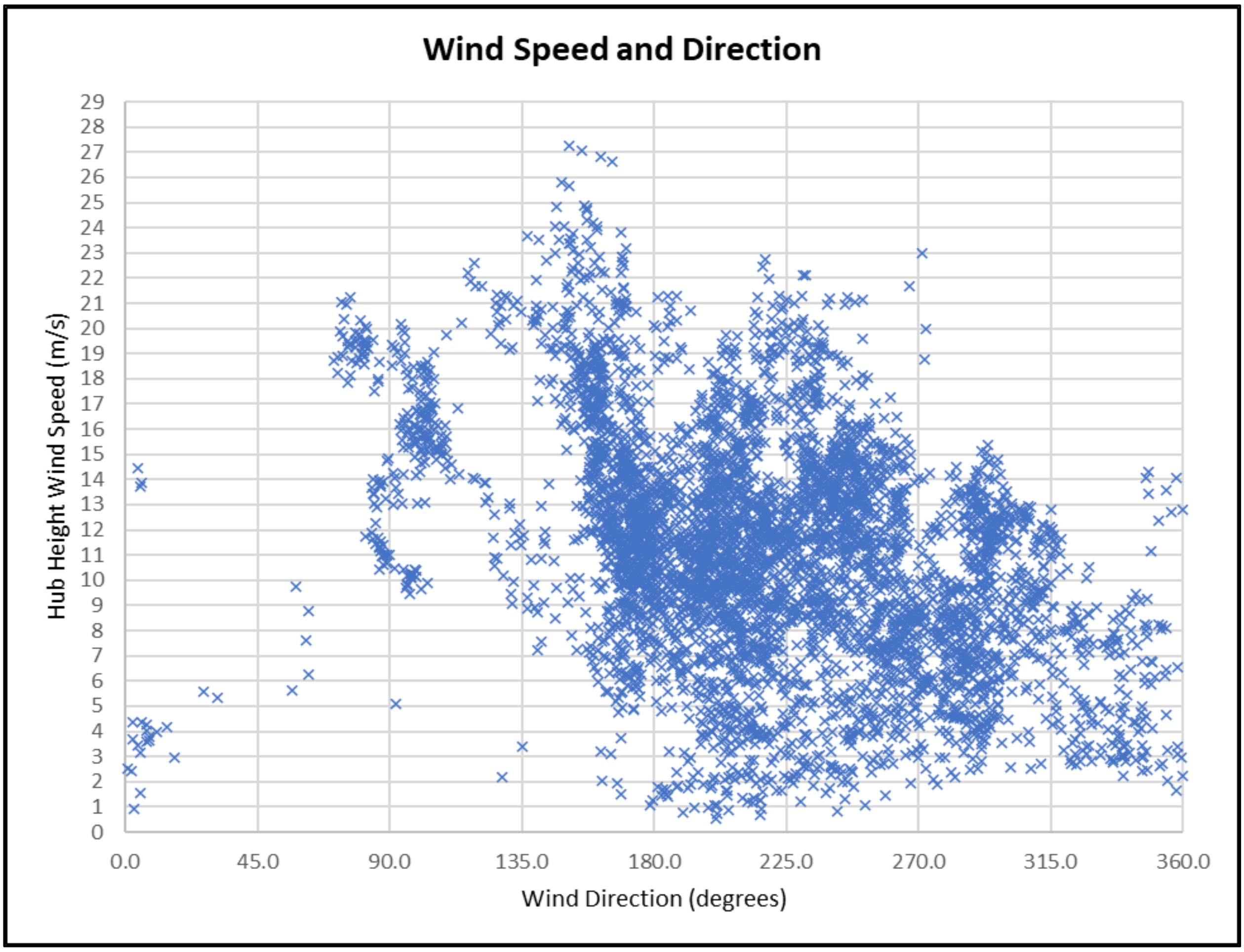


Figure 25-5: Distribution of 10-min average wind speed for corresponding wind directions.

25.7.3 Baseline noise survey results

The baseline noise survey results are detailed in Appendix 25-1: Baseline Noise Monitoring Results and summarised in Table 25-8.

Table 25-8: Background curves and ETSU-R-97 limits for NML1 – NML10.

Site	V10 (m/s)	2	3	4	5	6	7	8	9	10
NML1	Daytime Amenity Curve (dB L_{A90})	32.0	33.0	34.2	35.4	36.7	38.1	39.6	41.2	42.9
	Daytime Limit (dB L_{A90})	37.0	38.0	39.2	40.4	41.7	43.1	44.6	46.2	47.9
	Night-time Curve (dB L_{A90})	31.6	32.1	32.6	33.4	34.2	35.3	36.5	37.9	39.5
	Night-time Limit (dB L_{A90})	36.6	37.1	37.6	38.4	39.2	40.3	41.5	42.9	44.5
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML2	Daytime Amenity Curve (dB L_{A90})	41.4	43.4	45.3	47.1	48.8	50.4	51.9	53.2	54.5
	Daytime Limit (dB L_{A90})	46.4	48.4	50.3	52.1	53.8	55.4	56.9	58.2	59.5
	Night-time Curve (dB L_{A90})	41.7	43.6	45.3	47.0	48.7	50.3	51.8	53.3	54.7
	Night-time Limit (dB L_{A90})	46.7	48.6	50.3	52.0	53.7	55.3	56.8	58.3	59.7
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML3	Daytime Amenity Curve (dB L_{A90})	27.1	27.9	28.9	30.0	31.3	32.7	34.3	36.1	38.0
	Daytime Limit (dB L_{A90})	35.0	35.0	35.0	35.0	36.3	37.7	39.3	41.1	43.0
	Night-time Curve (dB L_{A90})	26.5	27.3	28.3	29.4	30.6	32.0	33.6	35.3	37.2
	Night-time Limit (dB L_{A90})	35.0	35.0	35.0	35.0	35.6	37.0	38.6	40.3	42.2
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML4	Daytime Amenity Curve (dB L_{A90})	33.0	33.6	34.3	35.2	36.1	37.2	38.3	39.6	40.9
	Daytime Limit (dB L_{A90})	38.0	38.6	39.3	40.2	41.1	42.2	43.3	44.6	45.9
	Night-time Curve (dB L_{A90})	28.0	28.2	28.6	29.2	30.0	31.0	32.3	33.8	35.5
	Night-time Limit (dB L_{A90})	35.0	35.0	35.0	35.0	35.0	36.0	37.3	38.8	40.5
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML5	Daytime Amenity Curve (dB L_{A90})	47.4	49.2	50.9	52.6	54.2	55.8	57.2	58.6	59.8
	Daytime Limit (dB L_{A90})	52.4	54.2	55.9	57.6	59.2	60.8	62.2	63.6	64.8
	Night-time Curve (dB L_{A90})	49.0	50.4	51.8	53.2	54.5	55.9	57.2	58.5	59.8
	Night-time Limit (dB L_{A90})	54.0	55.4	56.8	58.2	59.5	60.9	62.2	63.5	64.8
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML6	Daytime Amenity Curve (dB L_{A90})	35.6	35.6	35.6	35.5	35.7	36.2	37.0	38.1	39.4
	Daytime Limit (dB L_{A90})	40.5	40.5	40.5	40.5	40.7	41.2	42.0	43.1	44.4
	Night-time Curve (dB L_{A90})	32.2	31.8	31.7	31.9	32.4	33.1	34.1	35.4	36.9
	Night-time Limit (dB L_{A90})	37.2	36.8	36.7	36.9	37.4	38.1	39.1	40.4	41.9
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML7	Daytime Amenity Curve (dB L_{A90})	34.5	34.9	35.3	35.9	36.6	37.5	38.6	40.0	41.6
	Daytime Limit (dB L_{A90})	39.5	39.9	40.3	40.9	41.6	42.5	43.6	45.0	46.6
	Night-time Curve (dB L_{A90})	27.7	28.6	29.8	31.1	32.5	34.1	35.9	37.8	39.9
	Night-time Limit (dB L_{A90})	35.0	35.0	35.0	36.1	37.5	39.1	40.9	42.8	44.9
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Site	V10 (m/s)	2	3	4	5	6	7	8	9	10
NML8	Daytime Amenity Curve (dB L_{A90})	44.0	44.3	44.8	45.5	46.4	47.4	48.7	50.1	51.8
	Daytime Limit (dB L_{A90})	49.0	49.3	49.8	50.5	51.4	52.4	53.7	55.1	56.8
	Night-time Curve (dB L_{A90})	43.3	43.6	44.2	44.9	45.7	46.8	48.0	49.4	51.0
	Night-time Limit (dB L_{A90})	48.3	48.6	49.2	49.9	50.7	51.8	53.0	54.4	56.0
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML9	Daytime Amenity Curve (dB L_{A90})	28.7	29.2	30.0	31.1	32.4	34.1	36.0	38.1	40.5
	Daytime Limit (dB L_{A90})	35.0	35.0	35.0	36.1	37.4	39.1	41.0	43.1	45.5
	Night-time Curve (dB L_{A90})	28.2	28.2	28.6	29.4	30.5	32.0	33.8	36.0	38.5
	Night-time Limit (dB L_{A90})	35.0	35.0	35.0	35.0	35.5	37.0	38.8	41.0	43.5
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML10	Daytime Amenity Curve (dB L_{A90})	36.1	36.8	37.7	38.6	39.6	40.7	41.9	43.2	44.7
	Daytime Limit (dB L_{A90})	41.1	41.8	42.7	43.6	44.6	45.7	46.9	48.2	49.7
	Night-time Curve (dB L_{A90})	35.9	36.5	37.2	38.0	39.0	40.1	41.3	42.7	44.2
	Night-time Limit (dB L_{A90})	40.9	41.5	42.2	43.0	44.0	45.1	46.3	47.7	49.2

25.7.4 Future baseline noise scenario

The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (hereafter the EIA Regulations 2018) require that "*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge*" is included within the EIAR.

In the event that the Project does not proceed, an assessment of the future baseline noise conditions indicates that there will be no changes to the noise baseline that can be specifically identified at this time. Changes that may arise in the future include:

- Changes in road traffic patterns on roads resulting in changes to road traffic noise levels;
- Changes in industrial activity or zoning resulting in changes to urban noise levels;
- Changes in agricultural practice resulting in changes to rural noise levels; and
- Changes in rail and air traffic patterns resulting in changes to transportation noise levels.

25.7.5 Data validity and limitations

Limitations in data available for the desktop study primarily relate to END noise mapping for roads since roads that fall below the threshold of 3 million passengers per year are not mapped. This means that road traffic noise for most roads is not mapped, a limitation that is overcome with site-specific noise surveys.

Clearly, it is not possible to monitor baseline noise at all NSLs within the WTG Operational Noise (Airborne) and Vibration Study Area and therefore the baseline monitoring locations have been selected in order to be maximally representative of the various environments within the Noise (Airborne) and Vibration Study Area. The high number (10) of monitoring sites also assists in minimising effects of this limitation on the assessment.

Ambient and background sound levels are subject to seasonal variation due to a number of factors (e.g. rain, surf noise and wind from sheltered sectors). Background noise levels were taken from October to November 2022. Baseline noise levels are generally lower in Autumn/Winter due to reduced agricultural and wildlife activity. Therefore, limitations in the baseline monitoring data due to the time of year have minimal impact on the assessment as the results would tend to be conservative in favour of NSLs.

25.8 Key parameters for assessment

25.8.1 Project design parameters

The project description is provided in volume 2A, Chapter 5: Project Description. Table 25-9 outlines the project design parameters that have been used to inform the assessment of potential impacts of the construction, operation and maintenance and decommissioning phases of the Project on noise sensitive locations (NSLs).

The final height of each wind turbine will be confirmed following detailed geotechnical investigations and analysis of ground conditions (see design flexibility details in section 2 - Project Description). In respect of noise impacts to NSLs from operation of offshore WTGs, the assessment (section 25.11.5) considers the lower hub height of 145 m, as this would result in the maximum potential for impacts arising from WTN. Should the final height of the wind turbine result in a hub height of > 145 -152 m, this would result in a lesser noise impact.

The final location and layout of the Transition Joint Bay (TJB) will be confirmed post consent on examination of the electrical and thermal properties of the selected offshore export cable and the ground conditions at the landfall (see chapter 5: Project Description). For the purposes of the assessment presented in section 25.10.2 the assessment of adverse effects considers the construction of the TJB option closest to NSL.

Table 25-9: Project design parameters used for the assessment of potential impacts on NSLs.

Potential Impact	Phase			Project design parameters	Justification
	C	O	D		
Noise impacts to onshore NSLs from offshore piling	✓	✗	✗	**Monopiles for WTGs and offshore substation** • 26 impact piled base foundations with 35 m (max) pile penetration depth. – Hammer piling will be used to achieve 5 – 15 m penetration depth after which drilling will be required; – Pile drilling results in airborne noise levels which are not significant in comparison to the engine noise levels of the installation vessel; and – Full penetration depth of the piles will not be reached solely by piling at any of the foundation locations. • Pile diameter of 9.6 m. • Maximum hammer energy of 3500 kJ. • Total number of days when piling may occur expected to be 26 days.	The maximum hammer energy is used as this will allow prediction of worst-case noise levels from impact piling.
Noise impacts to NSLs from construction at cable landfall	✓	✗	✗	**Offshore export cable landfall** • Open trench installation of the *export* cable in the Project intertidal zone; • Construction of the TJB connecting the marine cable to the three onshore export cables is sited as close to the High-Water Mark as feasible; and • The offshore export cable laying vessel will approach landfall to closest proximity of approximately 750 m from the shore, beyond which point the seabed is too shallow for the vessel draft.	The offshore export cable laying vessel will be required to approach the landfall and therefore noise emissions from the vessel are assessed cumulatively with the onshore construction activities.
Noise impacts to NSLs from	✓	✗	✗	**Onshore cable route** • Approximately 20.1 km of onshore underground cable installation under roadway	Likely tonnage of equipment is used to select reference noise levels from BS5228 in order to

Potential Impact	Phase C	O	D	Project design parameters	Justification
construction of onshore cable				using open trench method including pre-construction activities such as site investigations, enabling works; • Construction of 29 joint bays; • Horizontal Directional Drilling (HDD) at river crossing and motorway/railway crossing (5 sites) and other sites for potential duration of 90 days; • Open trench crossings (two GNI crossings; and streams).	predict likely noise emissions from construction of the onshore cable.
Vibration impacts to NSLs from onshore cable construction	✓	×	×	**Onshore cable route** • Site-specific conditions may call for use of a rock breaker in close proximity to residences.	The vibration levels within 10 m of rock breaking activity are likely to result in vibration impacts. The shortest separation distance of NSLs along the onshore cable route is 6 m.
Noise impacts to NSLs from construction of onshore substation	✓	×	×	**Hybrid GIS/AIS onshore substation** • Site preparation, levelling, hardcore surface; • Substructure and hard standings excavation; • Foundations, hard standings and bunds; and • Superstructures and plant installation.	Construction equipment lists have been provided and include noisy equipment which may be used onsite. Likely tonnage of equipment is used to select reference noise levels from BS5228 in order to predict likely noise emissions from construction of the onshore substation.
Noise impacts to NSLs from operation of onshore substation	×	✓	×	**Hybrid GIS/AIS onshore substation** • Compound 1 will include a building to house Gas Insulated Switchgear (GIS) equipment (building height 17 m); • GIS equipment will be fully enclosed and will not give rise to significant noise emissions; • Compound 2 will accommodate Air Insulated Switchgear (AIS) including: – Power Transformer with L_{wA} 90 – 96 dB, – Harmonic filter with L_{wA} 87 – 101 dB, and – Reactor with L_{wA} 86 – 96 dB.	Sound power levels for the noisiest items of AIS equipment have been supplied as ranges and further detail will not be available until detail design stage. The upper range noise levels will be modelled using an example spectrum from high voltage station measurements to determine worst-case noise predictions. The lower range noise levels will also be modelled to inform benefits of low noise equipment selection.
Noise impacts to NSLs from operation of offshore WTGs	×	✓	×	**Offshore WTGs** • 25 WTGs with layout as described in Chapter 5: Project Description; • Maximum blade tip height of 270 m above Lowest Astronomical Tide (LAT); • Hub heights above LAT ranging from 145 – 152 m depending on local seabed conditions. – All WTGs will be modelled with hub height 145 m; • Maximum rotor diameter of 236 m; • Maximum WTG sound power level for assessment of 118 dBA; • WTG cut-in (lowest operational windspeed) at 2.6 m/s standardised 10 m windspeed (V10); and • Maximum WTG sound power reached at approximately 7 m/s V10.	Key wind turbine design parameters for the Project have been defined and allow assessment of WTG noise from the Project. The worst-case noise levels at longer distances would result from lower hub heights due to certain propagation effects. For this reason, WTG noise predictions will be undertaken for the lower range hub height of 145 m.
Noise impacts to NSLs from operation of maintenance CTVs	×	✓	×	**Maintenance Crew Transfer Vessels** • 300 CTV return trips per year;	Assessment of noise from the CTVs is based on measurement of noise on board a typical vessel.

Potential Impact	Phase C	O	D	Project design parameters	Justification
				• Prediction of CTV noise levels based on measurements of similar vessels. – Idling 83dBA @ 1 m. – Cruising 92dBA @ 1 m. – Accelerating 98dBA @ 1 m. • CTVs will operate from and existing harbour in County Louth or County Down with consent for the proposed activities.	
Noise impacts to NSLs from decommissioning of cable landfall	×	×	✓	***Removal of onshore cable*** • Complete decommissioning would require break out of TJB concrete structure.	As outlined for construction of cable landfall.
Noise impacts to NSLs from decommissioning of onshore substation	×	×	✓	***Removal of onshore substation*** • Complete decommissioning would require removal of all electrical infrastructure with removal of all waste; and • Foundations would be broken up and the site reinstated to its original condition.	As outlined for construction of onshore substation.

25.8.2 Measures included in the Project

There are no specific project design measures relating to airborne noise or vibration which have been the subject of a targeted design process as part of the Project. Noise predictions have not considered noise control measures and, where appropriate, mitigation measures are proposed (see section 25.11).

25.8.3 Impacts scoped out of the assessment

On the basis of the baseline environment and the project description outlined in volume 2A, chapter 5: Project Description, a number of impacts are proposed to be scoped out of the assessment for noise and vibration. These impacts are outlined, together with a justification for the scoping out decision, in Table 25-10.

Table 25-10: Impacts scoped out of the assessment for noise and vibration.

Potential impact	Justification
Noise impacts to onshore NSLs from special audible characteristics of WTN (see text below table for further details)	The very large separation distances from onshore NSLs of 6 km or greater make impacts from special audible characteristics of WTN extremely unlikely.
Vibration impacts to onshore NSLs from offshore piling	Significant ground vibration from piledriving occurs close to the source (i.e. within tens of metres) (Smith, 1988). Dowding (1996) has data indicating that pile driving in sand at an energy level of 3,250 kJ, the peak particle velocity reduces to 10 mm/s within 50 m. Onshore vibration impacts from the offshore construction and decommissioning phases of the Project will therefore not give rise to any vibration impacts onshore and have been scoped out due to the separation distance (6 km or greater) between the source and the receivers. The potential impacts from noise and vibration to offshore receptors is addressed in chapter 10: Marine Mammals and Megafauna (including subsea noise) and chapter 9: Fish and Shellfish Ecology.
Noise impacts to onshore NSLs from WTG construction	While noise attenuates far more slowly with distance over water than over land, the very large separation distances (greater than 6 km from shoreline NSLs) mean that levels from even the noisiest items of equipment that may be used during WTG assembly and commissioning will be well below the BS5228 lower threshold onshore. In addition, downwind conditions from the offshore source to the onshore receiver would naturally generate wave action and surf noise which would serve to mask any construction noise present.

Potential impact	Justification
Noise impacts to onshore NSLs from WTG decommissioning	Noise levels from WTG decommissioning are expected to be similar to those for construction and commissioning and are therefore similarly scoped out.
Noise impacts to onshore NSLs from construction vessels	Construction vessels will operate from a marshalling port and will utilise shipping lanes. When not operating in existing shipping lanes, vessels will be at large separation distances from onshore receivers (>6 km). Vessel movements in an out of potential marshalling harbours will be a small fraction of the total annual vessels. As an example, the Belfast Harbour Annual Report 2021 states an annual total of 5,536 arrivals with vessel traffic including commercial shipping, passenger/vehicle ferries and cruise liners. Were the maximum number of return trips for the construction phase (see chapter 5: Project Description) to be operated solely from Belfast Harbour, the increase to annual port traffic would be less than 10% and would therefore represent a negligible noise impact.
Noise impacts to onshore NSLs from offshore export cable laying	Offshore export cable laying will take place at separation distances from shore sufficient for attenuation of noise levels to well below thresholds. The only exception to this is at landfall which is assessed in Section 25.10.2.
Vibration impacts to NSLs from onshore substation construction	The nearest vibration sensitive locations to the onshore substation property boundary are more than 500 m distant. Ground-borne vibration attenuates rapidly with distance and vibration impacts from onshore substation construction are expected to be negligible at distances greater than 50 m.
Vibration impacts to NSLs from onshore substation decommissioning	See above, vibration impacts from onshore substation decommissioning, including breakup of concrete foundations, are expected to be negligible given the separation distances to receivers.
Noise impacts to NSLs from construction traffic	Anticipated construction traffic numbers in chapter 28: Traffic and Transport have been reviewed. In all cases, the predicted increase in traffic flows due to construction traffic on the receiving road network is well below 25%, implying a negligible noise level increase of less than 1dB. The noise impact of construction related traffic has therefore been scoped out, including for specific abnormal loads for the transport of substation equipment that may arise during the night-time periods. This is estimated at five loads.
Noise impacts to NSLs from operation of onshore cable	There are no modes of noise generation of the onshore cable which could produce noise levels sufficient to penetrate the covering soil or road materials.
Noise impacts to NSLs from operation of offshore substation	Noise from the offshore substation will be neither perceptible nor detectible onshore due to the large separation distance (greater than 8 km).
Noise impacts to NSLs from decommissioning of onshore cable	On decommissioning of the onshore cable, it is proposed to seal the cable ends and leave the cable in the ground. As such, decommissioning of the onshore cable will not give rise to noise impacts.

Special audible characteristics of WTN

Wind turbines have the potential to emit noise with special audible characteristics which generate greater nuisance to nearby residents than would otherwise be expected for a given noise level. The characteristics of concern for noise from wind turbines are tonal noise, amplitude modulation, and low frequency noise.

The Draft Revised Wind Energy Development Guidelines 2019 (DRWEDG2019) has not been adopted but is commonly referred to when considering special audible characteristics of wind turbine noise. The extent of effort devoted to special audible characteristics of WTN reflects the attention drawn to these in recent times.

The following sections provide additional discussion of the special audible characteristics and context for the decision to scope out impacts of same from the assessment given the very large separation distances from the WTGs to receivers.

Tonal noise

Tonal noise from wind turbines arises primarily from mechanical hub components such as bearings or gearing. Improvements in modern wind turbine designs have resulted in significant reductions of tonal noise emissions and tones would generally be expected to be audible only at shorter distances.

DRWEDG2019 states:

> *"the methodology to be applied in relation to quantifying tonal emissions from wind energy developments is in accordance with ISO 1996-2 2017 Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels Annex J and ISO/PAS 20065 on an objective method for assessing the audibility of tones in noise".*

The method described in ISO 1996-2 Annex J is also recommended in BS4142 for the objective assessment of tonal noise.

Long distance propagation over water includes effects such as multiple reflections and scattering due to wave action. These propagation effects would tend to reduce tonal characteristics. Detectible tonal components of WTN are not expected at the Project separation distances of 6 km and greater.

Amplitude Modulation

Amplitude Modulation (AM) characteristics in noise from wind energy developments have generated sufficient complaints to justify several studies as well as the establishment of the Institute of Acoustics Amplitude Modulation Working Group (IoA AMNWG), which has since determined a method for the rating of AM from wind turbines, the method adopted by DRWEDG2019.

The UK Department of Energy and Climate Change (DECC) report "Wind Turbine AM Review Phase 2 Report" suggests a rating penalty scheme for AM, the scheme adopted by DRWED2019. It should be noted that the recommendations of the report have not been implemented in the UK and that there is no consensus view among acousticians that the scheme should be adopted.

"Blade swish" is observable at short distances from turbines and is termed "Normal amplitude modulation", rarely constituting an issue at typical separation distances from NSLs. "Other" or "Excessive" amplitude modulation (AM) may occur on certain sites and is thought to be due to transient stall conditions.

"Excessive" AM may be described as a "thumping" characteristic at frequencies related to the blade pass frequency of the wind turbines, and may be heard at much greater distances, though often only intermittently and under specific weather conditions.

The Defra NANR233 Report (2007) surveyed 133 operational wind farm sites in the UK, finding that 27 of the sites had attracted complaints at some point. The report stated the following:

> *"AM was considered to be a factor in four of the sites, and a possible factor in another eight. Regarding the four sites, analysis of meteorological data suggests that the conditions for AM would prevail between about 7% and 15% of the time. AM would not therefore be present most days, although it could occur for several days running over some periods. Complaints have subsided for three out of these four sites, in one case as a result of remedial treatment in the form of a wind turbine control system. In the remaining case, which is a recent installation, investigations are ongoing."*

The Defra report goes on to state that AM is not fully predictable due to the extremely complex nature of aerodynamic noise and it is also a rare phenomenon.

To summarise:

- "Excessive" AM is known to occur at some wind farms some of the time;
- Large scale studies of industry-wide prevalence of AM have not been undertaken and it's therefore not possible to draw conclusions as to prevalence or probability of occurrence;
- Not all occurrences of "excessive" AM lead to complaints;
- There is broad agreement that AM occurrence cannot be predicted at the planning stage;

- AM has, in some instances, has been successfully controlled at certain sites through the use of engineering methods;
- The IoA AMNWG AM rating method is widely regarded as robust and to produce a robust rating metric for individual sample of wind turbine noise; and
- There is currently no widely accepted definition of what constitutes “unacceptable” AM.

There is currently a proposal for an international standard relating to AM to be included within the International Electrotechnical Commission (IEC) 61400 series of standards that deal with wind turbines. An international standard for the analysis of AM would be a welcome development as it would enable more focussed human perception research which would then enable development of suitable penalty schemes, definition of “unacceptable” levels of AM and so on.

Long distance propagation over water includes effects such as multiple reflections and scattering due to wave action. These propagation effects would tend to reduce amplitude modulation characteristics and AM is not expected at the Project separation distances of 6 km and greater.

Low Frequency Noise

Low frequency noise (LFN) has historically been associated with downwind rotor turbines and is less characteristic of modern upwind rotor designs. Extensive survey and analysis conducted by the South Australia Environment Protection Authority (SAEPA) compared low frequency noise at several rural and urban sites, with the rural locations including sites in the vicinity of wind farms (surveyed both with turbines operating and shut down) and also some with no wind turbines nearby. At typical separation distances, no association of low frequency noise with wind turbines was found. The study also measured infrasound levels at the rural sites close to windfarms, finding infrasound levels similar to those found in surveyed urban sites.

A study of wind turbine infrasound, and human responses to same, was commissioned by the Finnish Government’s Analysis, Assessment and Research Activities. The study was conducted by VTT (the project lead, a Finnish state-owned research institution), the Finnish Institute for Health and Welfare, the Finnish Institute of Occupational Health, and the University of Helsinki. The project commenced on 16 August 2018 with publication of the report in June 2020.

The Finnish study included questionnaire surveys of residents in the vicinity of wind farm developments, long term noise measurements (total of 308 days full-spectrum indoor and outdoor measurements), and double-blind listening tests. Self-reported symptoms which questionnaire respondents intuitively associated with wind turbine infrasound were relatively common among residents within 2.5 km of a wind turbine. The indoor noise recordings obtained during the measurements which had the highest levels of infrasound and amplitude modulation were used in the double-blind listening tests, which included a control group and a group of participants who had self-reported symptoms which they intuitively attributed to wind turbine infrasound. Important findings of the study included the following:

- Participants who had previously reported wind turbine infrasound related symptoms were not able to perceive infrasound in the noise samples; and
- Participants who had previously reported wind turbine infrasound related symptoms did not find samples with infrasound more annoying than those without previously reported wind turbine infrasound related symptoms; and
- Wind turbine infrasound exposure did not cause physiological responses in either participant group.

Clearly, wind turbines do produce low frequency noise, as shown by the octave band data published by manufacturers. Modelling work conducted by Aagaard Madsen at the Technical University of Denmark suggests that:

> *“Important turbine design parameters with strong influence on LFN are the blade tip speed and the distance between rotor and tower”* but that *“For an upwind rotor the LFN levels are so low that it should not cause annoyance of neighbouring people”.*

In summary, low frequency noise and infrasound are not expected to be significant issues for sensitive receptors at usual separation distance from wind turbines. At the Project separation distances of 6 km and greater the likelihood of LFN and infrasound is extremely low.

25.9 Impact assessment methodology

25.9.1 Overview

The noise (airborne) and vibration assessment has followed the guidance set out in EPA (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports*. All language describing sensitivities, impacts, durations, effects etc. is as described in the EIAR guidelines unless otherwise noted. The following guidance documents, which are specific to noise and vibration, have also been considered:

- Wind Energy Development Guidelines, Guidelines for Planning Authorities, June 2006, Department of Environment, Heritage and Local Government (WEDG 2006);
- Institute of Acoustics Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IoA 2013a);
- ETSU-R-97 The Assessment and Rating of Noise from Wind Farms;
- BEK nr 135 af 07/02/2019, Executive Order 135, Executive Order on noise from wind turbines, Denmark;
- Miljoministeriet (2021) Miljostyrelsen, Støj fra vindmøller. Vejledning fra Miljøstyrelsen[2], ISBN: 978-87-7038-275-5;
- Design Manual for Roads and Bridges (2020), LA 111 Noise and Vibration;
- ISO 9613-2:1996 Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation;
- BS 5228-1:2009 +A1 2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise;
- BS 5228-1:2009 +A1 2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration;
- EPA Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4);
- BS 4142:2014 Methods for rating and assessing industrial and commercial sound; and
- Transport Infrastructure Ireland, Code of engineering practice for works on, near, or adjacent the Luas light rail system (2016).

In addition, the noise and vibration assessment has considered the legislative framework as defined by:

- Environmental Noise Directive (2002/49/EC).

25.9.2 Impact assessment criteria

The significance of the effect of noise and vibration is determined by considering the magnitude of the impact and the sensitivity of the receptor in accordance with EPA 2022 EIAR guidance. Figure 25-6 is taken from the EPA guidance and illustrates the process for classification of effects as Imperceptible, Not Significant,

[2] Translated as: Ministry of the Environment (2021) Danish Environmental Protection Agency, Noise from wind turbines. Guidance from the Danish Environmental Protection Agency.

Slight, Moderate, Significant, Very Significant and Profound. A generalised formula for significance of effect is:

Magnitude of Impact + Sensitivity of Receptor = Significance of Effect

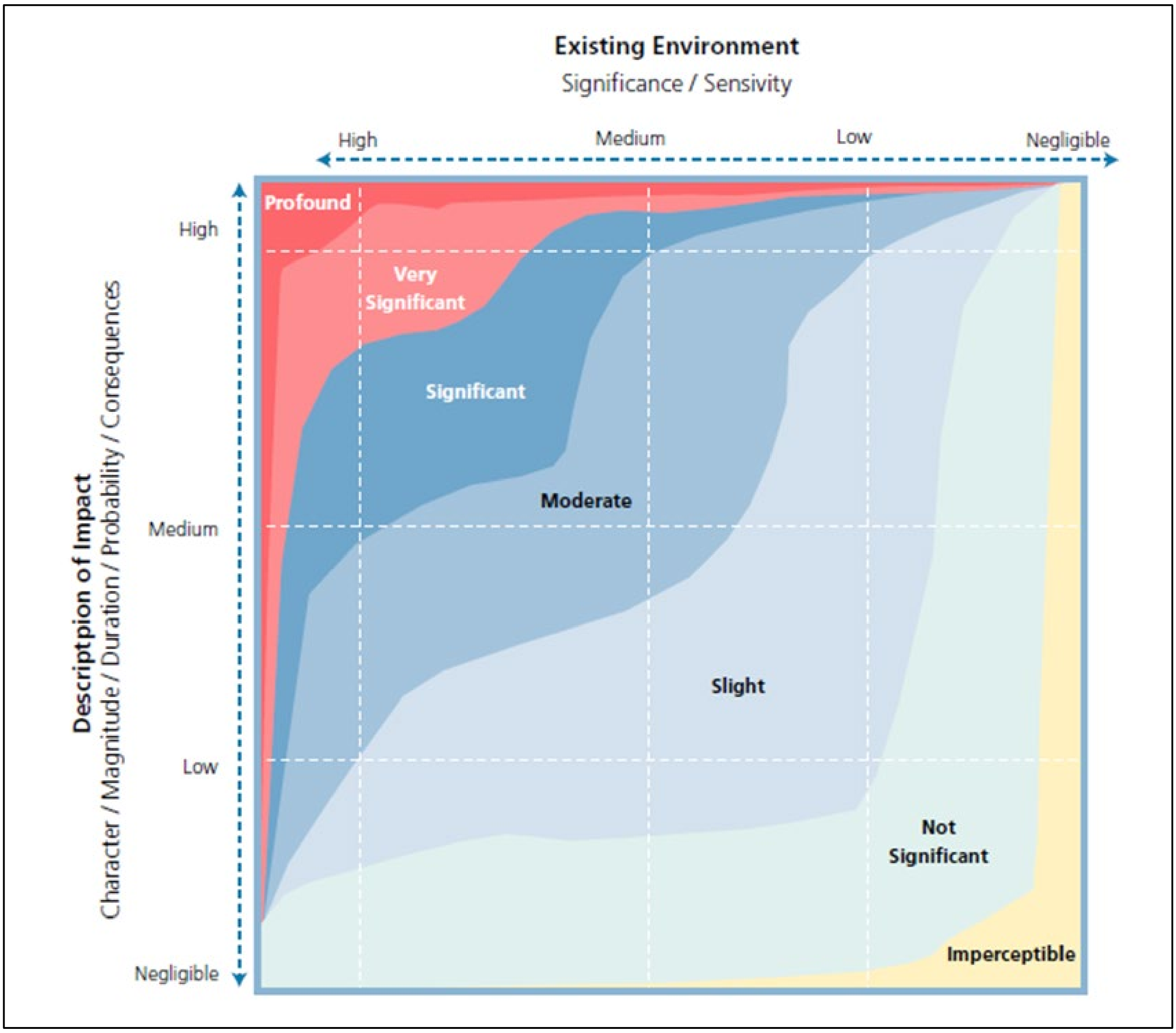


Figure 25-6: Classification of the Significance of Effects (from EPA, 2022).

Table 25-11 presents a generalised matrix which is used for assessment of significance.

Table 25-11: Matrix for general assessment of significance of effects.

		Magnitude of impact			
		Negligible	**Low**	**Medium**	**High**
Sensitivity of receiver	**Negligible**	Imperceptible	Imperceptible - Not Significant	Imperceptible - Not Significant	Imperceptible - Slight
	Low	Imperceptible - Not Significant	Not Significant - Slight	Not Significant – Moderate	Slight - Profound
	Medium	Imperceptible - Not Significant	Not Significant - Slight	Slight – Significant	Moderate - Profound
	High	Not Significant - Slight	Not Significant – Significant	Moderate - Very Significant	Significant - Profound

Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and other noise sensitive locations. Site and project specific considerations play a part in determining the sensitivity of a receptor, and noise assessment standards in general include implicit considerations of sensitivity (e.g. through consideration of background noise levels).

Table 25-12 presents general categorisations of receiver sensitivities for use in Ireland. The table has been developed based on professional judgement and experience in completing noise assessments.

Table 25-12: General categorisation of receiver sensitivity.

Sensitivity	Description	Examples of Receptors	Modifiers
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate Hospitals/residential care homes Schools during the daytime Quiet outdoor areas used for recreation Places of worship	Modifiers are factors that can change the sensitivity categorisation of receivers. These include magnitude and character of baseline noise, period of occupancy, and noise insulation of buildings.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive Community facilities and amenity areas Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, fishing and golf) Wildlife refuges Recording studios and concert halls are also included in this category	
Low	Receptors where distraction or disturbance from noise is low	Buildings not occupied during the daytime Sports grounds when spectator noise is a normal part of the event Night Clubs	
Negligible	Receptors where distraction or disturbance from noise is negligible.	All other areas such as those used primarily for industrial or agricultural purposes	

While the above tables are useful generally, the specific categorisations of magnitudes and sensitivities are determined using applicable standards, which are detailed in the following sections, and professional judgement. For noise and vibration, consideration of magnitudes and sensitivities are inherent to the assessment process for most categories of emissions.

25.9.2.1 Construction vibration

There is no statutory Irish guidance relating to the maximum permissible vibration level that may be generated during the construction phase of a project. In the absence of specific vibration limits, appropriate vibration emission criteria relating to permissible construction vibration levels for a development of this scale may be found in BS5228-2:2009+A1:2014 Code of Practice of Noise and Vibration Control on Construction and Open Sites Part 2: Vibration.

Human beings are known to be sensitive to vibration, the threshold of perception being typically in the Peak Particle Velocity (PPV) range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher PPV levels (>15 mm/s) vibrations can lead to concerns about possible (not probable) structural damage. Guidance regarding effects of vibration levels is set out in Table 25-13 and Table 25-14.

Table 25-13: Guidance on Human Perception of Vibration Levels.

Vibration Level	Effect
0.14 mm/s	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	Vibration might be just perceptible in residential environments.
1.0 mm/s	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	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Limits of transient vibration, above which cosmetic damage to property could occur, are given numerically in Table 25-14 (Ref: BS5228-2:2009+A1:2014). Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 25-14 and major damage to a building structure can occur at values greater than four times the tabulated values.

Table 25-14: Transient vibration guide values for cosmetic damage.

Type of Building	Peak Particle Velocity (PPV) (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Transport Infrastructure Ireland (TII) has specific threshold levels for works near rail lines as shown in Table 25-15. Their preference is that Level 1 thresholds are not exceeded to avoid the need for mitigation measures. HDD vibration levels will not exceed Level 1 criteria.

Table 25-15: Limits on vibrations required by TII.

Frequency Range	Peak Particle Velocity (PPV) (mm/s)		
	Level 1	Level 2	Level 3
Greater than 50 Hz	10 mm/s	12 mm/s	15 mm/s
Up to 50 Hz	10 mm/s	10 mm/s	10 mm/s

Sensitivity

Sensitivity of receptors is assessed in line with Table 25-12.

Magnitude

Magnitudes of impacts are assessed in line with the guidance stated in Table 25-13 and Table 25-14 and the impact magnitude levels are stated in Table 25-16.

Significance of effects

Guidance has been listed above on effects of vibration levels on humans and limits of transient vibration, above which cosmetic damage could occur. For assessing the significance of effect, reference is made to the EPA Guidelines (2022) and specifically the DMRB which states:

"Construction vibration shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1. 10 or more days or nights in any 15 consecutive days or nights; and
2. A total number of days exceeding 40 in any six consecutive months."

Table 25-16 presents the construction vibration significance rating.

Table 25-16: Construction vibration – Significance of the impact.

Vibration Level	EPA Initial Magnitude of Impact	Initial Significance Rating	Modifiers
Less than 0.3 mm/s	Negligible	Imperceptible/ Not Significant	Modifiers are factors that can change the magnitude of impact or significance rating. These include: Duration, occurrence, and frequency.
Greater than or equal to 0.3 mm/s and less than 1.0 mm/s	Low	Slight/ Moderate	
Greater than or equal to 1.0 mm/s and less than 10 mm/s	Medium	Moderate/ Significant	
Greater than or equal to 10 mm/s	High	Very Significant / Profound	

25.9.2.2 Construction noise (offshore and onshore)

The ABC method outlined in section E3.2 of BS 5228-1:2009+A1:2014 has been used for the purposes of controlling noise. The approach adopted calls for the designation of a noise sensitive receptor into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact is associated with the construction activities.

Table 25-17 outlines the applicable noise threshold of potential significant effect (TPSE) at the nearest noise sensitive locations. The determination of what category to apply is dependent on the existing ambient (L_{Aeq}) noise level (rounded to the nearest 5 dB) at the nearest noise sensitive property. For weekday daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e. 65 dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e. 70 dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e. 75 dB) applies.

Table 25-17: Threshold of potential significant effect at NSLs.

Assessment Category and Threshold Value Period (L_{Aeq})	Noise Threshold Value, in decibels (dB)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23.00 – 07.00)	45	50	55
Evenings and weekends[D]	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Sensitivity

Sensitivity of receptors is assessed in line with Table 25-12.

Magnitude

As a consequence of the 65dBA lower cut-off, where existing noise levels are low, construction criteria are independent of the precise noise levels (i.e. unless daytime average ambient noise levels at façades of NSLs are in excess of 62.5dBA, the lower daytime noise threshold will default to 65dBA). The desktop study indicates that, with the exception of façades immediately adjacent to roads, all NSLs within the construction Noise (Airborne) and Vibration Study Area fall into this category and therefore the threshold values in Table 25-18 apply.

Table 25-18: ABC method construction noise lower threshold value.

Location	Category	Day Limit (dB L_{Aeq})	Evening Limit (dB L_{Aeq})	Night Limit (dB L_{Aeq})
All sites	A	65	55	45

Significance of effects

Table 25-19 presents the construction noise initial significance rating of effects. The table provides an initial indication of the significance of effect which is then modified based upon the duration and frequency of the construction activity.

Table 25-19: Construction Noise - initial significance rating of effects.

Noise Levels	EPA Initial Magnitude of Impact	Initial Significance Rating	Modifiers
≤ Baseline noise level or ≤ BS 5228 threshold – 10dB	Negligible	Imperceptible / Not Significant	Modifiers are factors that can change the magnitude of impact or significance rating. These include: Baseline noise levels, duration, frequency and likelihood of occurrence.
> Baseline noise level and ≤ BS 5228 threshold	Low	Slight/ Moderate	
> BS 5228 threshold to ≤ BS 5228 threshold + 5 dB	Medium	Moderate/ Significant	
> BS 5228 threshold +5 to + 10 dB	High	Significant/ Very Significant	
> BS 5228 threshold + 10 dB		Very Significant / Profound	

25.9.2.3 Operational noise onshore substation

While not strictly applicable to substations or electrical infrastructure, EPA NG4 is commonly applied to planning assessments for new substations in Ireland. The limits for the rating noise level from industrial sites present at noise sensitive receivers specified by NG4 are shown in Table 25-20 below. The rating noise limits applicable depend on the categorisation of the site as being in a ‘quiet area’, an ‘area of low background noise’ or ‘all other areas’.

Table 25-20: NG4 Noise Limits for licensed sites based on area type classification.

Area Classification	Daytime Noise Level, $L_{Ar,T}$ (07:00 to 19:00 hours)	Evening Noise Level, $L_{Ar,T}$ (19:00 to 23:00 hours)	Night-time Noise Level, $L_{Aeq,T}$ (23:00 to 07:00 hours)
Quiet Area	Noise from site at least 10dB below average daytime noise measured during baseline survey	Noise from site at least 10dB below average evening noise measured during baseline survey	Noise from site at least 10dB below average night-time noise measured during baseline survey
Area of Low Background Noise	45 dB	40 dB	35 dB
All Other Areas	55 dB	50 dB	45 dB

Note 1 Daytime and evening noise limits include any rating limit which is applied (5dB for presence of objectively detectible tonal or impulsive noise components).

Note 2 Night-time noise limits are given as $L_{Aeq,T}$ values as objectively detectible tonal or impulsive noise components are prohibited by NG4 at any NSL during the night-time.

NG4 states that there should be no objectively detectible tonal noise present at any NSL during the night-time and this prohibition is commonly stated in local authority noise limits in Ireland. For electrical substations in rural areas, the prohibition of tonal noise at NSLs is often of more importance than the absolute noise limit. This is because electrical transformers are highly tonal noise sources that operate 24hrs at almost constant noise emission levels. Detection of tonality depends on the magnitude of the tonal noise compared with background noise levels.

Sensitivity

EPA NG4 Guidance note for noise categorises sensitivity of NSLs as “Quiet Areas”, “Areas of low background noise” and “All other areas”. To be classified as a “Quiet Area” the location must meet all of the minimum distance criteria listed below in Table 25-21.

Table 25-21: 'Quiet Area' classification criteria.

Minimum separation distance criteria for classification as ‘Quiet Area’
At least 3 km from urban areas with a population >1,000 people
At least 10 km from any urban areas with a population >5,000 people
At least 15 km from any urban areas with a population >10,000 people
At least 3 km from any local industry
At least 10 km from any major industry centre
At least 5 km from any National Primary Route
At least 7.5 km from any Motorway or Dual Carriageway

Areas of low background noise are areas with background noise (L_{A90}) levels below the following values:

- ≤40 dB L_{A90} Daytime;
- ≤35 dB L_{A90} Evening; and
- ≤30 dB L_{A90} Night-time.

Note: The average background noise level for a specific period is the arithmetic average of the measured L_{A90} noise levels during the relevant period.

Notably, where there are significant sources of natural noise present, quiet area NSLs can have higher noise limits than the other areas.

Magnitude

For electrical substations, daytime and evening noise limits are in often rendered superfluous as there is little variation in daytime and night-time noise emissions, and night-time background noise levels are lower. It is therefore appropriate to assess the substation using the night-time noise limit. Magnitudes of noise above the limit are expected to result in significant effects.

In addition, where existing background noise levels are low, it is possible for substation noise levels well below the limit to result in breach of the prohibition of tonality during the night-time. Predictions of objectively detectible tonality will therefore also be expected to result in significant effects.

Significance of effects

Table 25-22 presents the initial significance rating of effects for operational noise from the onshore substation.

Table 25-22: Electrical substation noise - initial significance rating of effects.

Noise Levels	EPA Initial Magnitude of Impact	Initial Significance Rating	Modifiers
≤ Background noise level and no objectively detectible tonality at night	Negligible	Imperceptible / Not Significant	Modifiers are factors that can change the magnitude of impact or significance rating. These include: Baseline noise levels, duration, frequency and likelihood of occurrence.
> Background noise level and ≤ NG4 limit and no objectively detectible tonality at night	Low	Slight / Moderate	
≤ NG4 limit with objectively detectible tonality at night	Medium	Significant	
> NG4 limit to ≤ NG4 limit + 5 dB	Medium	Significant / Very Significant	
> NG4 limit +5 to + 10 dB	High	Very Significant / Profound	

25.9.2.4 Operational Wind Turbine Noise (WTN)

While not applicable to offshore wind farms, the WEDG 2006 is the only guidance document currently adopted in Ireland for wind turbine noise (WTN). The WEDG 2006 WTN limits are summarised in Table 25-23.

Table 25-23: Summary of WEDG 2006 WTN limits.

Time of Day	WEDG 2006 Noise Limit
Daytime 07:00 – 23:00 every day	Where the prevailing background noise level is less than 30dBA, the greater of the lower fixed limit[(1)] (35 - 40dBA) or background + 5dB Or Where the prevailing background noise level is greater than 30dB, the greater of 45dBA or background + 5dB
Night-time 23:00 – 07:00 every day	A fixed limit of 43dBA

(1) WEDG 2006 does not offer any guidance for setting the lower fixed limit.

Given that the WEDG 2006 have been the subject of targeted review since 2013, and the new Wind Energy Development Guidelines wre due for publication in 2023, and that the WEDGs do not apply to offshore wind farms, it is appropriate to consider international best practice for assessment of the Project. The WEDG 2006 contents regarding WTG noise and limits are based on an interpretation of ETSU-R-97. The IoA GPG (2013), which interprets and expands upon ETSU-R-97, does not cover noise propagation calculations for offshore wind farms but is widely regarded as international best practice for WTG baseline and operational noise monitoring and analysis. The ETSU-R-97 WTN limits are summarised in Table 25-24.

Table 25-24: Summary of ETSU-R-97 WTN limits.

Time of Day	ETSU-R-97 Noise Limit
Daytime 18:00 - 23:00 every day 13:00 - 18:00 Saturday 07:00 – 18:00 Sunday	The greater of the lower fixed limit(2) (35 - 40dBA) or background + 5dB
Night-time 23:00 – 07:00 every day	The greater of 43dBA or background + 5dB Or The greater of the lower fixed limit (35 - 40dBA) or background + 5dB

(2) ETSU-R-97 specifies three criteria which should be used to determine the lower fixed limit and the IoA GPG provides additional guidance for same.

Both fixed and relative limits arrived at using ETSU-R-97/IoA GPG tend to be lower than those resulting from WEDG 2006, therefore providing additional protection to receivers from any potential effects of WTN. This conclusion arises from the following observations:

- The main difference in noise limits resulting from application of WEDG 2006 vs ETSU-R-97 is that, for areas not deemed to be WEDG 2006 “very quiet areas” (background noise less than 30dBA),
  - The WEDG 2006 lower fixed limit is 45dB $L_{A90,10min}$, and
  - The ETSU-R-97 lower fixed limit is always set to a value in the range 35 – 40dB $L_{A90,10min}$.
- An additional divergence of the two standards is that for ETSU-R-97, daytime limits are set using baseline levels measured during “daytime amenity hours” which may have lower baseline levels than the full 16hr day.

Because ETSU-R-97/IoA GPG WTN limits tend to be lower, any wind energy development deemed acceptable when assessed using ETSU-R-97/IoA GPG will also satisfy the requirements of WEDG 2006.

Given the above, the following approach has been adopted:

- Baseline surveys, data processing and analysis conducted in accordance with the IoA GPG; and
- Determination of noise limits in accordance with ETSU-R-97 as interpreted by the IoA GPG.

Use of ETSU-R-97/IoA GPG will tend to produce results which are more conservative in favour of sensitive receivers and these standards are widely regarded as international best practice.

Relative noise limits have been derived from prevailing background noise curves in accordance with the guidance of the IoA GPG and ETSU-R-97 as detailed in Appendix 25-1: Baseline Noise Monitoring Results. The recommended fixed lower limit of 37.5dB has been determined, as detailed in Appendix 25-1: Baseline Noise Monitoring Results, with consideration of the three criteria outlined in ETSU-R-97 and the IoA GPG.

Sensitivity

Sensitivity of NSLs is inherently assessed within the IoA GPG/ETSU-R-97 methodology. In essence, NSLs are assumed to be of high initial sensitivity with subsequent modification using levels from long duration baseline noise surveys. High baseline noise levels reduce the assessed sensitivity of NSLs and therefore result in higher relative noise limits.

In addition, IoA GPG/ETSU-R-97 allow for a reduction in assessed sensitivity of receivers where they are financially involved with the wind energy development. The determination of reduced sensitivity for financially involved NSLs is expressed through the application of fixed lower limits which are higher than for other NSLs (45dB fixed lower limit for financially involved NSLs and 35 – 40dB fixed lower limit for other NSLs).

Magnitude

Magnitudes of WTN impacts are considered through the use of both lower fixed limits and relative limits. ETSU-R-97 concludes that for WTN below 35dBA $L_{A90,10min}$ up to windspeeds of 10 m/s at 10 m height, impacts to NSLs are negligible or low irrespective of location or baseline noise levels.

Magnitude is further considered using the relative limit of 5dB above the prevailing background noise curve. Impacts of magnitudes below the prevailing background curve are considered to be negligible or low, magnitudes between background and the relative limit are generally low.

25.9.2.4.1 Significance of effects

Table 25-26 presents the WTN initial significance rating of effects.

Table 25-25: WTN - initial significance rating of effects.

<table>
<tr><th>Noise Levels</th><th>EPA Initial Magnitude of Impact</th><th>Initial Significance Rating</th><th>Modifiers</th></tr>
<tr><td>≤ Prevailing background noise level</td><td>Negligible</td><td>Imperceptible / Not Significant</td><td rowspan="4">Modifiers are factors that can change the magnitude of impact or significance rating.

These include:

Baseline noise levels, duration, frequency and likelihood of occurrence.</td></tr>
<tr><td>> Prevailing background noise level and
≤ ETSU-R-97 limit</td><td>Low</td><td>Slight / Moderate</td></tr>
<tr><td>> ETSU-R-97 limit to
≤ ETSU-R-97 limit + 5 dB</td><td>Medium</td><td>Significant / Very Significant</td></tr>
<tr><td>> ETSU-R-97 limit +5 to + 10 dB</td><td>High</td><td>Very Significant / Profound</td></tr>
</table>

25.9.3 Noise predictions

25.9.3.1 Construction noise

Predictions of construction noise have been conducted using ISO 9613, BS 5228 or BEK135 methodology as deemed appropriate to circumstance. Further detail can be found in Appendix 25-2: Noise Modelling.

25.9.3.2 Operational noise onshore substation

Noise emissions from the onshore substation have been modelled using Softnoise Predictor as detailed in Appendix 25-2: Noise Modelling.

25.9.3.3 Operational WTN

Danish Executive Order BEK nr 135 describes a calculation method for sound propagation for offshore wind turbine generators (WTGs). This is the only methodology which is approved for noise modelling of offshore WTGs and has therefore been utilised to predict WTN from the Project. The method includes a correction for multiple reflections which accounts for increased received downwind noise levels at long distances over water. Further details regarding the modelling methodology can be found in Appendix 25-2: Noise Modelling.

25.10 Assessment of significance

The potential impacts arising from the construction, operational and maintenance and decommissioning phases of the Project are listed in Table 25-9, along with the project design parameters against which each impact has been assessed. The assessment was supported by numerical modelling, details of which are provided in Appendix 25-2: Noise Modelling Methodology.

A description of the potential effects caused by each identified impact is given below.

25.10.1 Noise impacts to onshore NSLs from offshore piling

Construction of the WTGs calls for the installation of 9.6 m diameter monopile foundations offshore. This will require the use of an impact piling rig capable of an energy output of 3,500 kJ. The piling operation will begin with a 20-minute soft start at 15% hammer energy followed by ramp up to full power. While the maximum hammer energy is 3,500 kJ, the average maximum hammer energy employed will be 2,500 kJ. The noise from this operation is impulsive with the potential to be audible onshore. When the piling rig meets refusal (no further seabed penetration possible with hammer piling), final depth will be achieved using the drill drive method. Hammer piling will begin during the daytime as early as practicable following cetacean spotting etc., and the duration of hammer piling is expected to be 5 – 8hrs for each pile making it unlikely that night-time hammer piling will occur and implying that any occurrence of night-time hammer piling will be of brief duration. Magnitude of drilling noise emissions will be very low in comparison to hammer piling emissions.

Noise levels at the nearest NSL (GeoDirectory code 38649758) have been predicted as detailed in appendix 25-2: Noise Modelling and are shown in Table 25-26.

Table 25-26: Noise predictions for offshore piling at the nearest NSL.

Noise Source/Receiver	Calm conditions	3 m/s* (11 km/h) downwind conditions	Initial Magnitude of impact (daytime)
L_{Aeq} offshore piling noise for shortest separation distance (NSL 38649758)	41 dBA	52 dBA	Negligible

* This wind speed is chosen because at higher windspeeds, the rougher sea surface due to wave action would result in transmission losses due to scattering.

It is important to emphasise that the predictions in Table 25-26 are for the average maximum hammer energy, the closest piling position to shore which will only be active for one day, and favourable noise propagation conditions (i.e. moderate downwind from source to receiver). Wind from the prevailing direction would result in substantially lower levels. Also, while hammer piling noise is impulsive in character, propagation effects over long distances will tend to reduce impulsivity.

Magnitude of impact

Noise impacts will be direct, spatially distributed, brief and constant with low likelihood of occurrence. The duration of hammer piling is expected to be 5 – 8 hrs for each pile making it unlikely that night-time hammer piling will occur and implying that any occurrence of night-time hammer piling will be of brief duration. The assessed magnitude of impacts is negligible for daytime/evening occurrence, and low for the night-time given the brief duration and low likelihood.

Sensitivity of the receptor

The receptors are determined to be of Category A sensitivity in BS 5228 terms which equates to high sensitivity in EIA terms.

Significance of the effect

Overall, the magnitude of the impact is deemed to be negligible to low and the sensitivity of the receptor is considered to be high. The effects of construction noise from offshore piling are predicted to be of **not significant adverse effect** due to the low likelihood, negligible to low magnitude and brief duration, which is not significant in EIA terms.

25.10.2 Noise impacts to NSLs from construction at cable landfall

Construction at the landfall will comprise open trench installation of the offshore export cable as far as the TJB. Two options for the location of the cable trench are under consideration, one at the end of the beach access road (option 1) and the other slightly further north in the adjacent field (option 2). Since the trench location at the end of the road (option 1) is closer to the nearest NSL (a holiday home), this option has been assessed since impacts of the other option would be less due to the additional separation distance.

Table 25-27: Predicted construction noise levels for NSLs within 350 m of Landfall excavation.

NSL Geodirectory ID	Distance to centre of activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
80957386	75	65	64	Low
80957626	335	65	44	Negligible

Magnitude of Impact

The construction activities at the landfall will cause a direct noise impact and result in potentially audible noise at a small (<5) number of nearby properties. The predicted noise level at the nearest NSL of 64 dBA is for TJB sheet piling works and noise levels at the nearest NSL will be lower for other activities.

Sensitivity of the receptor

The receptors are determined to be of high sensitivity.

Significance of the effect

The magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The predicted significance of effect is **moderate adverse significance** at the nearest NSL and less at all other NSLs, which is not significant in EIA terms.

25.10.3 Noise impacts to NSLs from construction of onshore cable

Activity along the onshore cable route will be linear construction of cable ducts with static construction works at the joint bays. These works are to be carried out using conventional excavate and fill trenching methods with temporary duration at any one location. Subsequent activity will involve pulling in the cable lengths which will require a number of vehicles to move the cable winch and cable drums to the appropriate location and limited activity during the cable jointing phase. Further detail regarding predictions is available in appendix 25-2: Noise Modelling Methodology.

Predicted noise levels at stated distances from linear trenching are presented in Table 25-28. The predicted noise levels indicate a medium initial magnitude of impact for NSLs within 20 m of the cable trench (GIS analysis indicates there are less than 50 NSLs within 20 m of the cable trench). However, the higher noise levels are associated with use of road planers, rock breakers and pavers and the use of these is expected to be limited to two days at any one location on the cable trench. Given that use of these noisy items of plant will be brief, the predicted magnitude of impact is reduced to low for trenching along the onshore cable route. Table 25-19: Construction Noise - initial significance rating of effects. details the initial magnitude and significance ratings for construction noise.

Table 25-28: Predicted noise levels at listed distances for trenching on onshore cable route.

Distance from activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
10	65	68	Medium
20	65	65	Medium

Distance from activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
30	65	64	Low
40	65	63	Low
50	65	61	Low
60	65	61	Low
70	65	60	Low
80	65	59	Low
90	65	58	Low
100	65	57	Low

Onshore cable construction calls for static construction of 29 joint bays with dimensions typically in the order of 8 m long, approximately 2.5 m wide and approximately 2.5 m deep and designed to be covered over following reinstatement. The joint bay chambers may be cast in-situ or installed pre-cast and excavation of the pits is predicted to be the noisiest phase of joint bay construction activity, noise level predictions for which are shown at listed distances in Table 25-29.

The predicted noise levels indicate a high initial magnitude of impact and are dominated by use of the road planer and rock breaker in the same day. Excavation of the joint bays is unlikely to last more than two or three days, thereby reducing the impacts of the related construction noise. Taking into account the short duration of excavation works at any given location, and the low likelihood of rock breaking, the predicted magnitude of impact on NSLs for joint bay construction is medium.

Table 25-29: Predicted noise levels at stated distances for joint bay excavation.

Distance from activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
10	65	79	High
20	65	73	High
30	65	70	High
40	65	67	Medium
50	65	65	Medium
60	65	64	Low
70	65	62	Low
80	65	61	Low
90	65	60	Low
100	65	59	Low

Horizontal directional drilling (HDD) will be required at seven cable crossing locations. Table 25-30 shows the predicted noise level at the nearest NSL for each HDD location. High and medium initial magnitudes of impact are predicted at three locations and there are no modifying factors that reduce the magnitudes of impact. The minimum separation distance between respective HDD locations is greater than 1.2 km and therefore while there may be HDD at two locations simultaneously, the large separation distances between HDD sites ensure that no cumulative noise impacts from simultaneous HDD will arise.

Table 25-30: Predicted HDD construction noise levels at nearest NSLs.

No	Cable Crossing	Preferred Method	Duration	Nearest NSL	Distance (m)	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
1	River Dee @ Richardstown, N33	HDD	2 months	80956696	168	58	Low
2	M1 Motorway and Dublin Belfast Rail Line @ Charleville	HDD	3 months	35472921	167	58	Low
3	River Dee @ Drumcar	HDD	1 month	80957595	125	60	Low
4	Port Stream @ Togher	HDD	1 month	37955452	62	67	Medium
5	Salterstown Stream @ Salterstown	HDD	1 month	80957637	40	70	High

Pulling and jointing of cables will have much lower magnitudes and shorter duration than the construction of the ducts and joint bays.

Magnitude of impact

Noise impacts will be direct, local, temporary and intermittent. High and medium impacts are predicted at a small number of NSLs in close proximity to works. The short duration and low likelihood of some noisy activities reduces the magnitude of impact for the onshore cable trenching and joint bay excavation.

Sensitivity of the receptor

The receptors are determined to be high sensitivity.

Significance of the effect

The magnitude of the impact is deemed to be high to medium (at a small number of NSLs) and the sensitivity of the receptor is considered to be high. **Significant adverse effects** due to construction noise from the onshore cable are therefore predicted for a small number (less than 30) of NSLs in close proximity to works. Mitigation to reduce these effects are specified in section 25.11 with lists of locations of NSLs in close proximity to works. The effect will therefore be significant in EIA terms.

25.10.4 Vibration impacts to NSLs from onshore cable construction

Site-specific conditions may call for use of a rock breaker at positions along the onshore cable trench. The vibration PPV for a typical excavator mounted rock breaker has been sourced from FTA (2018) Transit Noise and Vibration Impact Assessment Manual[3] and is stated in Table 25-31.

Table 25-31: Vibration from excavator mounted rock breaker (hoe ram).

Equipment	Peak Particle Velocity (PPV) (mm/s)
Excavator mounted rock breaker	2.3 @ 7.6 m

The PPV for rock breaking is 2.3 mm/s at 7.6 m distance and the shortest separation distance for NSLs along the onshore cable route is 6 m. This indicates that for the closest receptors a PPV of 2 – 3 mm/s is

[3] FTA Report No. 0123 September 2018 Transit Noise and Vibration Impact Assessment Manual

predicted for rock breaking if required adjacent to these NSLs. A PPV of 2 – 3 mm/s, while well below levels which could cause structural damage, would be perceptible to humans and likely to cause complaints.

Magnitude of impact

Vibration impacts will be direct, local, brief or temporary and intermittent. Impacts are predicted to be medium magnitude where rock breaking takes place in proximity to NSLs. There are less than 20 NSLs within 10 m of the redline boundary.

Sensitivity of the receptor

The receptors are determined to be of high sensitivity.

Significance of the effect

The magnitude of the impact is deemed to be medium and the sensitivity of the receptor is considered to be high. Effects of construction vibration from construction of the onshore cable are predicted to be **moderate adverse significance** (i.e. not significant in EIA terms), since, while there is potential for annoyance due to vibration, the brief durations and low likelihood make significant effects unlikely.

25.10.5 Noise impacts to NSLs from construction of onshore substation

There are no NSLs located within the substation construction Noise (Airborne) and Vibration Study Area, i.e. no NSLs within 300 m of the substation property boundary. Predictions of noise from construction of the onshore substation have, nonetheless, been conducted as detailed in appendix 25-2: Noise modelling and the predicted noise levels are more than 10 dB below the daytime noise threshold value at all NSLs.

Magnitude of impact

Noise impacts will be direct, local, temporary and intermittent. Impacts are predicted to be of negligible magnitude at all nearby NSLs.

Sensitivity of the receptor

The receptors are determined to be of high sensitivity.

Significance of the effect

The magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be high. Effects of construction noise from the onshore substation are predicted to be **not adverse significance** due to the negligible magnitude and large separation distances, which is not significant in EIA terms).

25.10.6 Noise impacts to NSLs from operation of onshore substation

The substation operational noise has been modelled as detailed in appendix 25-2: Noise Modelling using the Softnoise Predictor implementation of ISO 9613 and the results are as shown in Table 25-32 below. The source noise levels have been provided by the client as estimated ranges of L_{wA} for the noisiest AIS components of the substation as detailed in Appendix 25-2: Noise Modelling.

Table 25-32: Measured baseline and predicted substation noise levels at the nearest NSL.

Description	Measured/Predicted L_{Aeq} (dB)				Comment
	Total	100Hz	200Hz	315Hz	
Measured baseline noise for nearest NSL	45	12	16	23	Elevated baseline L_{Aeq} levels due to road traffic noise from the N33. The background L_{A90} was 31dB during the attended survey.
Predicted noise at nearest NSL for highest estimated L_{wA} for all equipment	36	30	20	32	Detectible tonality is predicted for these source levels.

Description	Measured/Predicted L_{Aeq} (dB)				Comment
	Total	100Hz	200Hz	315Hz	
Predicted noise at nearest NSL for lowest estimated L_{wA} for all equipment	23	19	8	20	There may be occasional detectible tonality during the night-time at the nearest NSLs at 100Hz for these source levels. The predicted noise level is 8dB below the background L_{A90} of 31dB.

For the lowest estimated L_{wA} for all items of onshore substation equipment:

- The predicted broadband noise level is 8dB below background, which would indicate a low magnitude of impact.
- Predicted 200Hz and 315Hz 1/3 octave band levels are below the measured ambient levels.
- The predicted 100Hz 1/3 octave band level is 7dB above the measured ambient, indicating that there may be occasional detectible tonality at the nearest NSLs at 100Hz.

Magnitude of impact

The operation of the onshore substation will cause a direct noise impact and the predicted noise level, under downwind conditions, from the substation alone is 23 – 36dBA depending upon the final design and implementation. The impact is predicted to be of local spatial extent, long term duration and intermittent depending upon wind direction and atmospheric conditions. At the highest estimated L_{wA} for all equipment, impacts will be high magnitude. At the lowest estimated L_{wA} for all equipment, impacts will be negligible magnitude provided that there is no detectible tonality present at any NSL during the night-time.

Sensitivity of the receptor

The receptors are considered to be high sensitivity.

Significance of the effect

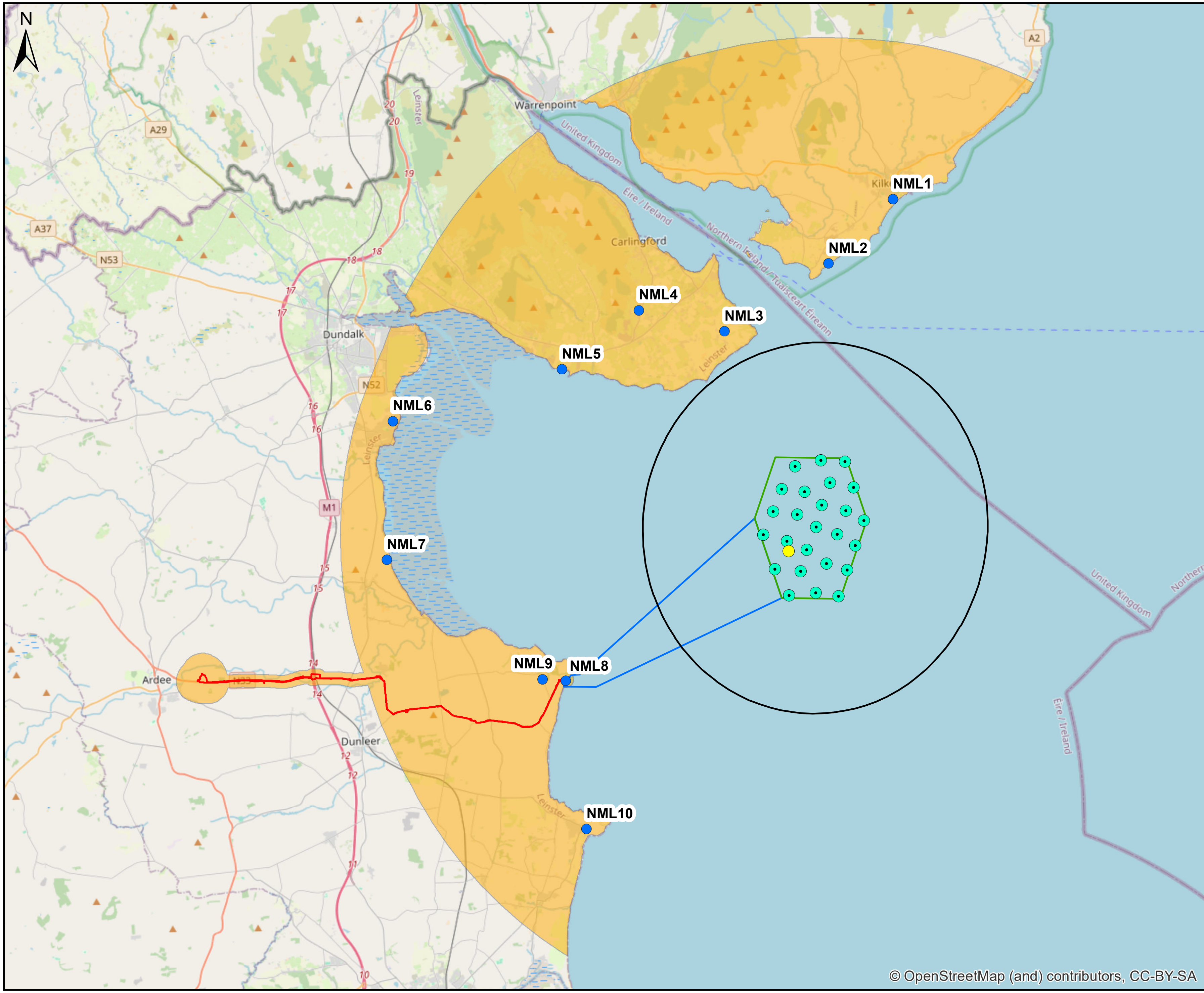
Due to detectible tonality during the night-time, effects for noise from the onshore substation are predicted to be **significant adverse significance** if the final design results in noise emissions at the maximum of the estimated ranges. For the minimum of the estimated range of noise levels for the harmonic filter bays, reactor bay and power transformer, the effects are predicted to be **slight adverse significance**, due to the low magnitude and intermittent frequency, provided that the total 100 Hz, 200 Hz and 315 Hz 1/3 octave band sound power levels are below the measured ambient levels of 12 dBA, 16 dBA and 23 dBA respectively. The effect will therefore be significant in EIA terms.

25.10.7 Noise impacts to NSLs from operation of offshore WTGs

The WTG assessed for the Project reaches maximum sound power levels at approximately 8 m/s standardised 10 m wind speed (V10). Noise levels from the WTGs have been predicted in an omnidirectional noise model using the Danish standard BEK135 as detailed in appendix 25-2: Noise Modelling Methodology.

ETU-R-97 states *“if the noise is limited to an $L_{A90,10min}$ of 35dB(A) up to wind speeds of 10 m/s at 10 m height, then this condition alone would offer sufficient protection of amenity”*.

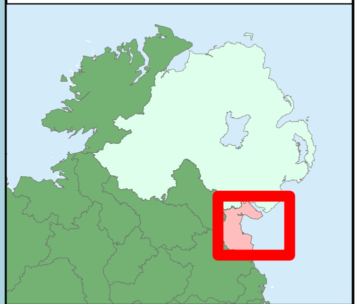
Figure 25-7 shows the predicted 35 dB $L_{A90,10min}$ contour at 10 m/s wind speed standardised to 10 m height. It can be seen from the figure that the 35dB contour does not reach the shoreline and therefore the 35 dB condition is satisfied. Nonetheless, a full assessment including baseline surveys and derivation of ETSU-R-97 limits has been conducted.



Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Wind Turbine Generator
- Offshore Substation
- Noise (Airborne) and Vibration Study Area
- Long-term Noise Monitoring Locations
- WTN > 35dB

Data Sources: OWL



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 25-7:
35dB predicted noise contour @ 10m/s windspeed standardised to 10m height

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Issue Details

Drawn By: NR	Project No. MDR1520b
Checked By: BC	File Ref:
Approved By: CC	MDR1520bArc3059F02
Scale: 1:240,000 @ A4	Projection: ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 13/02/2024	

Table 25-33 shows background curves, limits and predicted WTN up to 10 m/s V10 for the nearest NSL and the 10 monitoring locations. NML10 has been selected as the most representative location for the nearest NSL. It can be seen from the table that compliance with noise limits is predicted at all NSLs for all windspeeds. The critical wind speed (minimum difference between baseline levels and predicted WTN) has been determined to be 7 m/s V10. Predicted WTN is below the prevailing background curve at all of the sites listed and the smallest difference between background and predicted WTN at the critical wind speed is seen at NML3 and NML9. The results indicate that, while WTN from the Project may occasionally be subjectively audible at some locations inland, it will not in general be perceptible.

Table 25-33: Background curves, limits and predicted WTN noise.

Site	V10 (m/s)	2	3	4	5	6	7	8	9	10
Nearest NSL	Daytime Amenity Curve (dB L_{A90})	36.1	36.8	37.7	38.6	39.6	40.7	41.9	43.2	44.7
	Daytime Limit (dB L_{A90})	41.1	41.8	42.7	43.6	44.6	45.7	46.9	48.2	49.7
	Night-time Curve (dB L_{A90})	35.9	36.5	37.2	38.0	39.0	40.1	41.3	42.7	44.2
	Night-time Limit (dB L_{A90})	40.9	41.5	42.2	43.0	44.0	45.1	46.3	47.7	49.2
	Predicted WTN (dB L_{A90})	18.3	18.9	21.6	27.2	32.0	33.7	34.0	34.2	34.4
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML1	Daytime Amenity Curve (dB L_{A90})	32.6	33.2	34.0	35.1	36.5	38.0	39.6	41.4	43.2
	Daytime Limit (dB L_{A90})	37.6	38.2	39.0	40.1	41.5	43.0	44.6	46.4	48.2
	Night-time Curve (dB L_{A90})	31.6	32.1	32.6	33.4	34.2	35.3	36.5	37.9	39.5
	Night-time Limit (dB L_{A90})	37.5	37.5	37.6	38.4	39.2	40.3	41.5	42.9	44.5
	Predicted WTN (dB L_{A90})	8.8	9.6	12.9	19.0	24.1	26.1	26.6	27.0	27.4
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML2	Daytime Amenity Curve (dB L_{A90})	42.1	43.7	45.4	47.1	48.7	50.3	51.9	53.3	54.7
	Daytime Limit (dB L_{A90})	47.1	48.7	50.4	52.1	53.7	55.3	56.9	58.3	59.7
	Night-time Curve (dB L_{A90})	41.7	43.6	45.3	47.0	48.7	50.3	51.8	53.3	54.7
	Night-time Limit (dB L_{A90})	46.7	48.6	50.3	52.0	53.7	55.3	56.8	58.3	59.7
	Predicted WTN (dB L_{A90})	16.0	16.6	19.3	25.0	29.9	31.6	32.0	32.3	32.6
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML3	Daytime Amenity Curve (dB L_{A90})	27.5	27.9	28.7	29.8	31.1	32.6	34.3	36.2	38.2
	Daytime Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	37.6	39.3	41.2	43.2
	Night-time Curve (dB L_{A90})	26.5	27.3	28.3	29.4	30.6	32.0	33.6	35.3	37.2
	Night-time Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	37.5	38.6	40.3	42.2
	Predicted WTN (dB L_{A90})	14.5	15.1	17.8	23.5	28.4	30.1	30.5	30.8	31.1
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML4	Daytime Amenity Curve (dB L_{A90})	31.8	33.1	34.3	35.4	36.3	37.3	38.3	39.4	40.6
	Daytime Limit (dB L_{A90})	37.5	38.1	39.3	40.4	41.3	42.3	43.3	44.4	45.6
	Night-time Curve (dB L_{A90})	28.0	28.2	28.6	29.2	30.0	31.0	32.3	33.8	35.5
	Night-time Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	37.5	37.5	38.8	40.5

Site	V10 (m/s)	2	3	4	5	6	7	8	9	10
	Predicted WTN (dB L_{A90})	11.5	12.1	15.1	21.1	26.3	28.2	28.7	29.1	29.5
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML5	Daytime Amenity Curve (dB L_{A90})	47.4	49.2	50.9	52.6	54.2	55.7	57.2	58.6	59.9
	Daytime Limit (dB L_{A90})	52.4	54.2	55.9	57.6	59.2	60.7	62.2	63.6	64.9
	Night-time Curve (dB L_{A90})	49.0	50.4	51.8	53.2	54.5	55.9	57.2	58.5	59.8
	Night-time Limit (dB L_{A90})	54.0	55.4	56.8	58.2	59.5	60.9	62.2	63.5	64.8
	Predicted WTN (dB L_{A90})	10.3	11.0	14.1	20.2	25.4	27.3	27.8	28.2	28.6
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML6	Daytime Amenity Curve (dB L_{A90})	35.6	35.6	35.6	35.5	35.7	36.2	37.0	38.1	39.4
	Daytime Limit (dB L_{A90})	40.6	40.6	40.6	40.5	40.7	41.2	42.0	43.1	44.4
	Night-time Curve (dB L_{A90})	32.2	31.8	31.7	31.9	32.4	33.1	34.1	35.4	36.9
	Night-time Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	38.1	39.1	40.4	41.9
	Predicted WTN (dB L_{A90})	3.9	4.8	8.2	14.3	19.4	21.4	21.9	22.5	23.0
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML7	Daytime Amenity Curve (dB L_{A90})	34.5	34.9	35.3	35.9	36.6	37.5	38.6	40.0	41.6
	Daytime Limit (dB L_{A90})	39.5	39.9	40.3	40.9	41.6	42.5	43.6	45.0	46.6
	Night-time Curve (dB L_{A90})	27.7	28.6	29.8	31.1	32.5	34.1	35.9	37.8	39.9
	Night-time Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	39.1	40.9	42.8	44.9
	Predicted WTN (dB L_{A90})	5.6	6.5	9.8	15.9	21.1	23.0	23.6	24.1	24.6
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML8	Daytime Amenity Curve (dB L_{A90})	44.0	44.3	44.8	45.5	46.4	47.4	48.7	50.1	51.8
	Daytime Limit (dB L_{A90})	49.0	49.3	49.8	50.5	51.4	52.4	53.7	55.1	56.8
	Night-time Curve (dB L_{A90})	43.3	43.6	44.2	44.9	45.7	46.8	48.0	49.4	51.0
	Night-time Limit (dB L_{A90})	48.3	48.6	49.2	49.9	50.7	51.8	53.0	54.4	56.0
	Predicted WTN (dB L_{A90})	10.7	11.4	14.5	20.5	25.7	27.6	28.1	28.5	28.9
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML9	Daytime Amenity Curve (dB L_{A90})	28.7	29.2	30.0	31.1	32.4	34.1	36.0	38.1	40.5
	Daytime Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	39.1	41.0	43.1	45.5
	Night-time Curve (dB L_{A90})	28.2	28.2	28.6	29.4	30.5	32.0	33.8	36.0	38.5
	Night-time Limit (dB L_{A90})	37.5	37.5	37.5	37.5	37.5	37.5	38.8	41.0	43.5
	Predicted WTN (dB L_{A90})	8.2	8.9	12.2	18.3	23.4	25.4	25.9	26.3	26.6
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y
Site	**V10 (m/s)**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
NML10	Daytime Amenity Curve (dB L_{A90})	36.1	36.8	37.7	38.6	39.6	40.7	41.9	43.2	44.7

Site	V10 (m/s)	2	3	4	5	6	7	8	9	10
	Daytime Limit (dB L_{A90})	41.1	41.8	42.7	43.6	44.6	45.7	46.9	48.2	49.7
	Night-time Curve (dB L_{A90})	35.9	36.5	37.2	38.0	39.0	40.1	41.3	42.7	44.2
	Night-time Limit (dB L_{A90})	40.9	41.5	42.2	43.0	44.0	45.1	46.3	47.7	49.2
	Predicted WTN (dB L_{A90})	5.7	6.6	9.9	16.1	21.2	23.2	23.6	24.1	24.5
	Compliance	Y	Y	Y	Y	Y	Y	Y	Y	Y

Magnitude of impact

Impacts of operational WTN from the Project are predicted to be of regional spatial extent, long term duration, direct, and intermittent. As the predicted WTN levels from the Project are below the ETSU-R-97 noise limits and below the prevailing background noise curve at all sites during both daytime amenity hours and night-time, impacts are considered to be of negligible magnitude at any single location.

Sensitivity of the receptor

NSLs are generally considered to be of high sensitivity to WTN, modified by high baseline noise levels on the coast.

Significance of the effect

Effects of WTN are predicted to range from **imperceptible** to **not significant adverse significance** which is not significant in EIA terms).

25.10.8 Noise impacts to NSLs from operation of maintenance CTVs

Noise from CTVs operating has been modelled as detailed in appendix 25-2: Noise modelling. For the purposes of modelling, the Greenore Port approach route has been selected to examine the potential impacts of CTV noise on the nearest NSLs. The predicted levels are shown in Table 25-34 below.

Table 25-34: Predicted noise level for CTV.

Description	Predictions (dB)	
	Nearest south shore NSL	Nearest north shore NSL
L_{Aeq} during route traverse	38	34
Contribution to daytime L_{Aeq} for both trips completed daytime	25	21
Contribution to night-time L_{Aeq} for both trips completed night-time	14	10

The representative noise monitoring location for coastal NSLs which may be exposed to CTV noise is NML2 with background noise of approximately 42dB $L_{A90,10min}$ at low wind speeds of 2 m/s. The predicted levels in Table 25-34 are well below measured background indicating a negligible impact for CTV noise.

Magnitude of impact

Noise impacts will be direct, local, temporary and intermittent. Impacts are predicted to be of negligible magnitude at all nearby NSLs.

Sensitivity of the receptor

The receptors are determined to be of medium sensitivity due to the relatively high existing baseline noise levels.

Significance of the effect

Effects of noise from operation of maintenance CTVs are predicted to be **not significant adverse significance** which is not significant in EIA terms).

25.10.9 Noise impacts to NSLs from decommissioning of cable landfall

Noise impacts from decommissioning of cable landfall will be similar to those for construction.

Magnitude of impact

The decommissioning of the landfall will cause a direct noise impact and result in potentially audible noise at a small number of nearby properties. The predicted noise levels at the nearest NSL is 66 dBA which represents a medium initial impact magnitude which is reduced to low magnitude following consideration of the short duration of noisy activity. Impacts will be local, temporary and intermittent.

Sensitivity of the receptor

The receptors are determined to be of Category A sensitivity in BS 5228 terms which equates to high sensitivity in EIA terms.

Significance of the effect

The magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be high. The predicted significance of effect is **slight adverse significance** at the nearest NSL and less at all other NSLs (i.e. not significant in EIA terms).

25.10.10 Noise impacts to NSLs from decommissioning of onshore substation

Decommissioning of the onshore substation would result in noise levels generated similar in magnitude to those for construction. Magnitude, sensitivity and significance are, therefore, the same as for construction as listed below.

Magnitude of impact

Noise impacts will be direct, local, temporary and intermittent. Impacts are predicted to be of negligible magnitude at all nearby NSLs.

Sensitivity of the receptor

The receptors are determined to be of Category A sensitivity in BS 5228 terms which equates to high sensitivity in EIA terms.

Significance of the effect

Effects of noise from removal of the onshore substation are predicted to be **not significant adverse significance**, which is not significant in EIA terms).

25.11 Mitigation and residual effects

25.11.1 Offshore piling

There are no significant effects predicted for noise from offshore piling and therefore no mitigation measures are necessary.

Residual effects

Residual effects predicted for offshore piling noise are **not significant adverse**.

25.11.2 Construction at the landfall; onshore cable; and onshore substation

No construction at the onshore substation site or the onshore cable route will be carried out at night, with the possible exception of abnormal load deliveries to the substation site. Where necessary, mitigation measures will be employed to limit noise within the BS 5228 thresholds. As a minimum the following measures will be adopted and included in the CEMP:

- The contractor will employ a competent acoustician to:
  - Review the operation of the CEMP, and
  - Advise on appropriate noise and vibration monitoring arrangements as required by the local authority.
- The CEMP and any associated documentation will form part of the project detail design documentation during construction. The contractor will be responsible for maintaining a copy of the documentation on site for inspection by the planning authority at all times.
- The CEMP will specify the use of low noise equipment where practicable;
- Where noise barriers are required for specific activities to limit noise emissions, barriers will be specified by a competent professional who will provide drawings showing the location and a specification of minimum performance for the barriers:
  - Flexible absorptive noise barriers designed for control of construction noise are readily available and can be mounted on heras fencing or similar. Commercially available examples include EchoBarrier, NoiseBreak and Outdoor Sound Curtains; and
  - Standard construction site hoarding functions as an effective noise barrier where it blocks line of site to noisy activity.
- The use of particularly noisy handheld tools such as pneumatic drills may require the use of a site enclosure such as outlined in BS 5228 (2009);

Noise control measures will be employed in each of the construction phases during operations. Standard operating procedures will include many general measures that can reduce noise levels at source such as:

- Avoid unnecessary revving of engines and switch off equipment when not required;
- Keep internal haul routes well maintained and avoid steep gradients;
- Use rubber linings in, for example, chutes and dumpers to reduce impact noise;
- Minimize drop height of materials;
- Start-up plant and vehicles sequentially rather than all together. The movement of plant onto and around the sites should have regard to the normal operating hours of the sites and the location of any NSLs as far as is reasonably practicable; and
- The use of conventional tonal audible reversing alarms has caused problems on some sites and alternatives are available such as white noise reversing alarms. Audible reversing warning systems on mobile plant and vehicles should be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact on persons outside sites.

Cable landfall

No significant effects have been predicted for construction noise at cable landfall, there may however be requirements to locate heavy loads or work to tidal constraints at the cable landfall site which necessitate night-time works for limited periods. Where such work is required, it will be the subject of an approval process and controls to keep construction noise within thresholds will be adopted.

There are a small number of NSLs in the vicinity of cable landfall and keeping residents well informed of works is of importance. The nearest NSL to the cable landfall excavation is a holiday home and it should be ensured that regular correspondence with the owner is maintained, and notice given of any disruption or noisy activities so that they can plan accordingly if appropriate.

If use of a rock breaker is required for durations of an hour or more, a temporary acoustic enclosure will be erected around the breaker head.

Onshore cable route

The assessment indicates that noise levels from linear trench construction will not result in significant effects. If site conditions make the use of a rock breaker necessary at fixed positions within 40 m of a residential façade, a temporary acoustic enclosure will be erected around the breaker head.

Noise control measures will be employed where necessary along the route to ensure that there are no significant effects due to noise from trenching activities.

The assessment indicates that noise levels at facades more distant than 40 m from joint bay construction activity will not result in significant effects. If site conditions make use of a rock breaker necessary at the following joint bays, a temporary acoustic enclosure will be erected around the breaker head:

- Joint Bay 12 – NSL façade within 20 m;
- Joint Bay 13 – NSL façade within 30 m;
- Joint Bay 14 – NSL façade within 20 m;
- Joint Bay 15 – NSL façade within 40 m;
- Joint Bay 16 – NSL façade within 30 m;
- Joint Bay 18 – NSL façade within 40 m;
- Joint Bay 19 – NSL façade within 40 m;
- Joint Bay 20 – NSL façade within 40 m;
- Joint Bay 21 – NSL façade within 20 m;
- Joint Bay 22 – NSL façade within 20 m;
- Joint Bay 23 – NSL façade within 30 m;
- Joint Bay 24 – NSL façade within 40 m;
- Joint Bay 25 – NSL façade within 40 m; and
- Joint Bay 28 – NSL façade within 20 m.

Noise control measures will be employed where necessary to ensure that there are no significant effects due to noise from joint bay construction.

Three HDD sites have been identified where proximity of NSLs may result in significant effects due to HDD noise, these are:

- Port Stream tributary at Clonmore (open trench preferred);

- Port Stream at Togher; and
- Salterstown Stream.

Temporary noise barriers will be employed at these sites to avoid significant effects. If open trench construction is used as planned at Port Stream tributary Clonmore, no mitigation will be necessary. The barriers should be placed as close as practicable to the noisiest equipment and must block line of sight to the nearest NSLs.

Onshore substation

There are no significant effect predicted for construction noise from the Onshore Substation and no mitigation measures are necessary.

Residual effects

Following implementation of construction noise mitigation measures some effects will remain. The significance of the residual effects will be '**not significant adverse'** in EIA terms.

25.11.3 Vibration impacts to NSLs from onshore cable construction

Vibration PPVs of 2 – 3 mm/s are predicted for rock breaking if required on the onshore cable route adjacent to the nearest NSLs. BS 5228-2 indicates that these levels will cause complaints in residential environments but can be tolerated if prior warning and explanation is given to residents.

A 1 – 1 stakeholder engagement process will be put in place for the duration of the construction phase, including the provision of information to local residents regarding works likely to cause significant noise or vibration and/or works planned to take place outside of core working hours and also establish a process for handling all enquires including complaints. Responsibility for communicating details of construction activities will be assigned to a community liaison officer who will act as a single point of contact with secondary responsibility assigned appropriately to account for any absences.

Residual effects

Following implementation of vibration mitigation measures some effects will remain. The significance of the residual effects will be **slight adverse** (i.e. not significant in EIA terms).

25.11.4 Operation of onshore substation

For the upper range of potential sound power levels of the harmonic filters, reactor and power transformer, the predicted effects of operational noise from the onshore substation without mitigation measures are significant. Noise barriers short of full equipment enclosure are ineffective at the separation distance to NSLs and the noise frequencies of importance (100Hz, 200Hz and 300Hz).

Mitigation of operational noise from the onshore substation must therefore take the form of careful system design with selection of the lowest noise equipment available. Predicted effects for the lower end of the range of potential sound power levels of the harmonic filters, reactor and power transformer are slight, indicating that this approach will be sufficient provided that the noise levels from AIS equipment at the nearest NSL do not exceed the values given in Table 25-35 below.

Table 25-35: Maximum noise levels from onshore substation AIS equipment at nearest NSL.

Description	Broadband and 1/3 octave L_{Aeq} (dB)				Comment
	Total	100Hz	200Hz	315Hz	
Maximum allowable combined noise levels for AIS onshore substation equipment	23	12	16	23	These are the maximum levels allowable at the nearest NSL

Equipment specifications will be reviewed by a competent acoustician and noise surveys will be conducted following commissioning of equipment to ensure noise levels are within the required range. The combined sound power level of the onshore substation AIS equipment will not exceed 93 dBA.

Residual effects

Residual effects predicted for operational noise from the onshore substation will be **not significant adverse** in EIA terms.

25.11.5 Operation of offshore WTGs

There are no significant effects predicted for operational noise of the offshore WTGs and therefore there are no mitigation measures proposed.

Residual effects

Residual effects predicted for noise from operation of WTGs are **not significant adverse** in EIA terms.

25.11.6 Operation of Crew Transfer Vessels

There are no significant effects predicted for operational noise from CTVs and therefore there are no mitigation measures proposed.

Residual effects

Residual effects predicted for operational noise from CTVs are **not significant adverse** in EIA terms.

25.11.7 Decommissioning of cable landfall

There are no significant effects predicted for decommissioning of cable landfall, however, should any unexpected noise issues occur due to specific site conditions, BS 5228 noise control measures listed above can be employed to reduce impacts.

Residual effects

Residual effects predicted for decommissioning of the cable landfall are **not significant adverse** in EIA terms.

25.11.8 Decommissioning of onshore substation

There are no significant effects predicted for removal of the onshore substation and therefore there are no mitigation measures proposed.

Residual effects

Residual effect predicted for operational noise from the onshore substation are **not significant adverse** in EIA terms.

25.11.9 Mitigation and residual effects

The assessment of impacts has concluded that there are no significant effects with the implementation of the measures included in the Project. Therefore, no measures over those outlined in section 25.8.2 are required.

Residual effects

With the implementation of the measures included in the Project (section 25.8.2), the residual effects are as outlined in the assessment provided in section 25.10.

25.11.10 Future monitoring

Noise monitoring during onshore construction should be conducted in line with Louth County Council guidance and requirements.

The predicted WTG operational noise levels at locations onshore indicate that noise from the WTGs will not be measurable since the predicted levels are below the measured background noise levels at all locations. Post completion and compliance measurements of operational wind turbine noise from the Project are therefore not recommended. Noise monitoring proposed for the Project is as follows:

1. Prior to the commencement of construction, the contractor will set out and agree a schedule of noise monitoring with the planning authority to include the number and locations at which noise monitoring will be carried out, the frequency and duration of the monitoring and the reporting of results;

2. One post-construction survey for operational noise will be carried out within three months of handover of the onshore substation to the Applicant; and

3. No monitoring is proposed for the operational WTGs.

25.12 Cumulative Impact Assessment

25.12.1 Methodology

The Cumulative Impact Assessment (CIA) takes into account the impact associated with the Project together with other projects. The projects and plans selected as relevant to the CIA presented within this chapter are based upon the results of a screening exercise (see volume 2A, appendix 3-1: CIA Screening Annex). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

The 25 dB predicted operational noise contour is the distance at which noise from the Project is predicted to be 10 dB lower than the minimum ETSU-R-97 lower fixed limit. The IoA GPG states *"If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary. Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary."* Other offshore wind energy developments would also be distant from the shore with associated distance attenuation of operational noise levels reaching the shoreline.

Given the above, the Zone of Interest (ZoI) for cumulative operational wind turbine noise has been set to the predicted 25dB operational noise contour, which extends approximately 20km from the centre point of the Project WTGs. This ZoI has also been applied to the construction phase for offshore piling.

Onshore projects on the Cooley Peninsula and in County Down, Northern Ireland, have been screened out of the CIA based upon the low predicted noise levels from offshore piling. As the predicted noise levels from offshore piling are more than 10dB below the lower noise threshold, they cannot contribute to an exceedance of the threshold (logarithmic summation of two dB levels where one level is more than 10dB below the other gives a result equivalent to the higher level).

There are no onshore wind projects located in the Northern Ireland portion of the Noise (Airborne) and Vibration Study Area. Onshore wind energy developments located onshore in ROI are sufficiently distant that there cannot be cumulative noise impacts.

The approach to assessment examines the cumulative effects of the Project alongside the following projects if they fall within the ZoI for the CIA for Noise (Airborne) and Vibration:

- Other projects with consent but not yet constructed/construction not completed;

- Other projects in a consent application process but not yet determined (including planning applications, foreshore lease/licence applications, Dumping at Sea Permit applications;

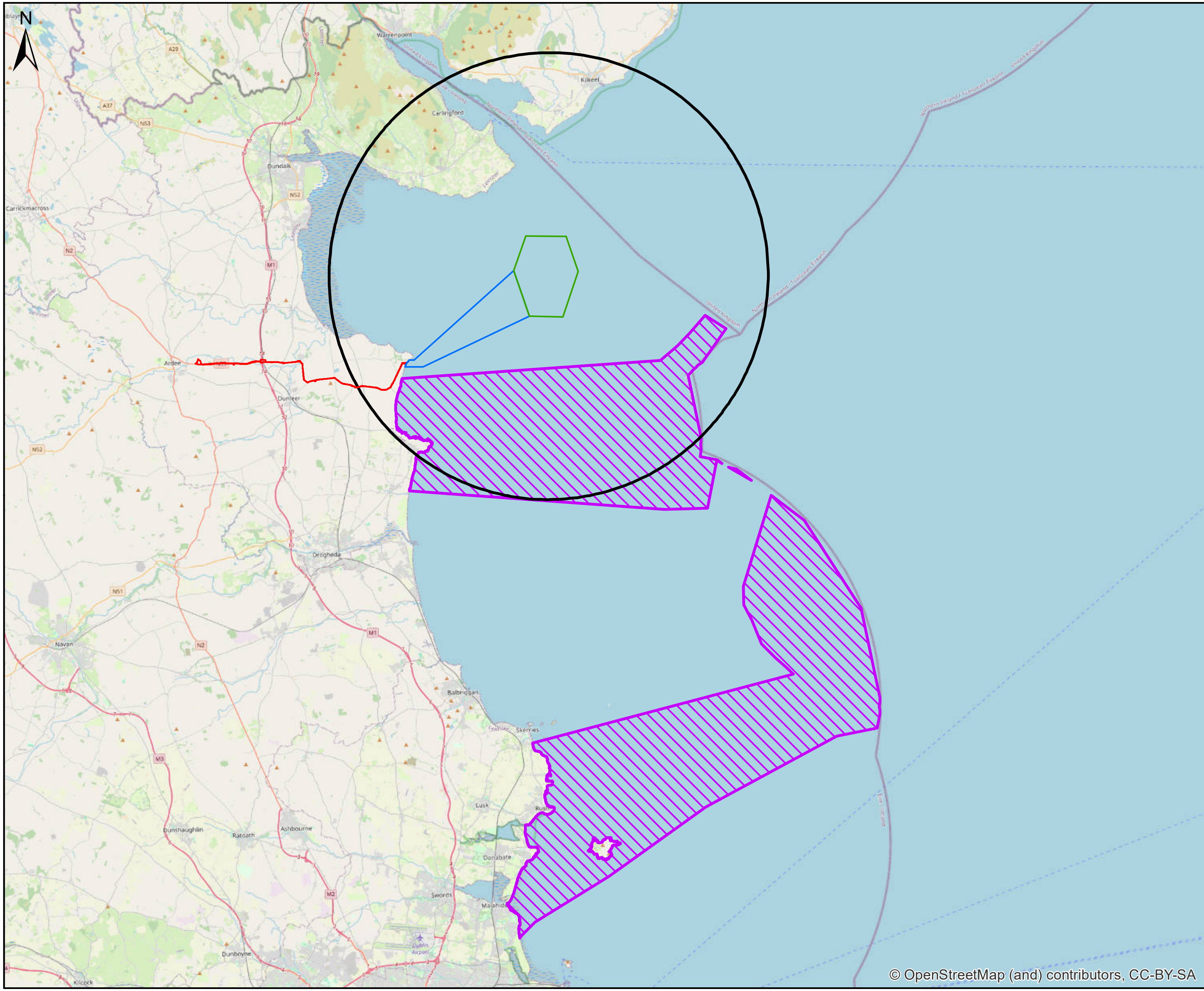
- Other projects currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact;

- Projects, which satisfy the definition of ‘relevant maritime usage’ under the Maritime Area Planning Act (2021) (i.e. wind farm projects designated as ‘Relevant Projects’ or ‘Phase 1 Projects’) including Arklow Bank II, Bray Bank and Kish Bank; North Irish Sea Array, Codling Wind Park (I and II).

The specific projects screened into this CIA, are outlined in Table 25-36 (see Figure Figure 25-8).

Table 25-36: List of other projects considered within the CIA.

Project	Status	Distance from Oriel Proposed Landfall (km)	Distance from Oriel Proposed Onshore Grid Infrastructure (km)	Description of Project	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Project
Foreshore Licenses							
Mainstream Renewable Power (North East Wind) (Mainstream Renewable Power Ltd)	Planning	4.2	0.8	Foreshore Licence application for site investigation works off County Dublin. Surveys include Geophysical, Geotechnical, Metocean and Ecological site investigations.	N/A	Unknown (subject to award of licence).	Screened in due to potential for the construction phase of the Project to overlap with the proposed surveys resulting in potential for cumulative noise impacts



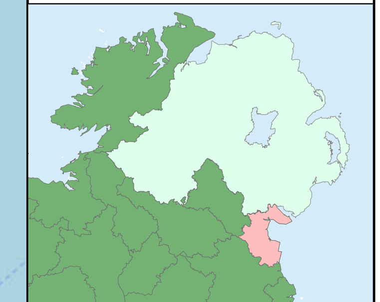
Legend

- Planning Application Boundary
- Offshore Cable Corridor
- Offshore Wind Farm Area
- Cumulative Noise (airborne) and Vibration Study Area

Foreshore licence applications for Site Investigations

- FS007373

Data Sources: OWL, OSi, Gov.ie.



Client

ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

Project

Oriel Wind Farm Project

Title

Figure 25-8: Other projects screened into the Cumulative Impact Assessment

A TETRA TECH COMPANY

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Issue Details

Drawn By: NR	**Project No.** MDR1520b
Checked By: CC	**File Ref:**
Approved By: CC	MDR1520bArc3089F02
Scale: 1:420,000 @ A4	**Projection:** ITM (IRENET95) Geographic Co-ordinates: ETRS89
Date: 25/03/2024	

NOTE:
1. This drawing is the property of RPS Group Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels are referred to Ordnance Datum, Malin Head.
3.

Table 25-37 presents the relevant project design parameters from Table 25-9, which are used to assess the potential cumulative impact of the Project with the other projects identified in Table 25-36 (where information is available).

Table 25-37: Project design parameters considered for the assessment of potential cumulative noise impacts.

Potential Impact	Phase C	O	D	Project design parameters	Justification
Noise impacts to NSLs from construction at cable landfall	✓	×	×	Project design parameters as described for the Project (see Table 25-9) assessed cumulatively with the following other projects: • Mainstream, Renewable Power	Potential overlap of Project construction phase (offshore export cable laying vessel) with other project activities (i.e. survey activities).

25.12.2 Assessment of significance

A description of the significance of cumulative effects upon noise sensitive receptors arising from the identified impact is given below.

Noise impacts to NSLs from construction at cable landfall

Geotechnical surveys for Mainstream will include boreholes at approximately 0.8 km distance from the landfall. This separation distance is sufficient that noise from the geotechnical survey vessels and activities will not be of sufficient magnitude to result in cumulative impacts and additionally have a low likelihood of temporal overlap.

Magnitude of impact

Noise impacts will be direct, local, temporary and intermittent. Impacts are predicted to be of **negligible magnitude** at all nearby NSLs given the low likelihood and short durations.

Sensitivity of the receptor

The receptors are determined to be of Category A sensitivity in BS 5228 terms which equates to **high sensitivity** in EIA terms.

Significance of the effect

Effects of noise from cumulative of concurrent activity with the Project are predicted to be **not significant adverse** in EIA terms.

25.13 Transboundary effects

The border between Ireland and Northern Ireland (UK) traverses the Noise (Airborne) and Vibration Study Area. NML1 and NML2 are located in Cranfield and Kilkeel, Co. Down, Northern Ireland. An assessment of the operation of the of the WTGs on NML1 and NML2 concluded imperceptible to not significant adverse significance (see section 25.10.7). An assessment of noise from CTVs on NML2 concluded a negligible impact. Overall, no significant transboundary effects have been identified in the noise and vibration assessment. Therefore, there is minimal potential for significant airborne noise or vibration transboundary effects from the Project upon the interests of the UK or other EEA States.

25.14 Interactions

A description of the likely inter-related effects arising from the Project on noise and vibration is provided in chapter 32: Interactions.

25.15 Summary of impacts, mitigation measures and residual effects

Information on Noise (Airborne) and Vibration was established from desk studies, site-specific surveys and a comprehensive numerical modelling study.

Table 25-38 presents a summary of the potential impacts, mitigation measures and residual effects in respect to Noise (Airborne) and Vibration. Table 25-39 presents a summary of the potential cumulative impacts, mitigation measures and residual effects.

The cumulative impacts assessed include: Noise impacts to NSLs from construction of onshore cable. The predicted significance of the cumulative effect is slight adverse in EIA terms.

The potential effects due to noise impacts from the Project have been described and, where significant effects have been identified, mitigation measures have been specified to ensure that residual effects will not be significant.

No potential transboundary impacts have been identified in regard to effects of the Project.

Table 25-38: Summary of potential environment effects, mitigation and monitoring.

Potential Impact	Phase C	O	D	Measures included in the Project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Further measures	Residual effect	Proposed Monitoring
Noise impacts to onshore NSLs from offshore piling	✓	×	×	n/a	C: Negligible	High	C: Not Significant	None	C: Not Significant	None
Noise impacts to NSLs from construction at cable landfall	✓	×	×	n/a	C: Low	High	C: Moderate	Approvals for any night work, CEMP BS 5228 noise controls, Rock breaker temporary enclosure if required	C: Slight	Standard noise monitoring for construction sites
Noise impacts to NSLs from construction of onshore cable	✓	×	×	n/a	C: High to medium	High	C: Significant/Very Significant	CEMP BS 5228 noise controls, rock breaker temporary enclosure at specified joint bays, temporary barriers at specified HDD sites	C: Slight	Standard noise monitoring for construction sites
Vibration impacts to NSLs from construction of onshore cable	✓	×	×	n/a	C: Medium	High	C: Moderate	Formal stakeholder engagement, Inform residents in advance of any rock breaking activity taking place within 20 m of a dwelling.	C: Slight	None
Noise impacts to NSLs from construction of onshore substation	✓	×	×	n/a	C: Negligible	High	C: Not Significant	None	C: Not Significant	None
Noise impacts to NSLs from operation of onshore substation	×	✓	×	n/a	O: High	High	O: Significant	Low noise equipment, noise optimised design	O: Not Significant	Commissioning noise survey
Noise impacts to NSLs from operation of offshore WTGs	×	✓	×	n/a	O: Negligible	Low - High	O: Imperceptible - Not Significant	None	O: Not Significant	None
Noise impacts to NSLs from operation of maintenance CTVs	×	✓	×	n/a	O: Negligible	Medium	O: Not Significant	None	O: Not Significant	None
Noise impacts to NSLs from decommissioning of cable landfall	×	×	✓	n/a	D: Low	High	D: Slight	CEMP BS 5228 noise controls	D: Not Significant	Standard noise monitoring for construction sites
Noise impacts to NSLs from removal of onshore substation	×	×	✓	n/a	D: Negligible	High	D: Not Significant	None	D: Not Significant	None

Table 25-39: Summary of potential cumulative environment effects, mitigation and monitoring.

Potential Impact	Phase C	Phase O	Phase D	Measures included in the Project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Mitigation	Residual effect	Proposed Monitoring
Noise impacts to NSLs from construction at cable landfall	✓	×	×	n/a	C: Negligible	High	C: Not significant	None	C: Not significant	None

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