Partners in UK offshore wind

MONA OFFSHORE WIND PROJECT

Preliminary Environmental Information Report

Volume 3, chapter 22: Noise and vibration

Image of an offshore wind farm

April 2023
FINAL

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Prepared by:	Prepared for:
RPS	**Mona Offshore Wind Ltd.**

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Glossary

Term	Meaning
A-weighting	A frequency weighting devised to attempt to account for the fact that human response to sound is not equally sensitive to all frequencies. It consists of an electronic filter in a sound level meter which attempts to build this variability into the indicative sound level reading so that it will correlate, approximately, with the human response.
Ambient Sound Level, $L_{Aeq,T}$	The steady sound level which, over a period of time T, contains the same amount of A-weighted sound energy as the time varying sound over the same period. Also known as the equivalent continuous sound pressure level.
Background Sound Level, $L_{A90,T}$	The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using fast time-weighting, F, and quoted to the nearest whole number of decibels.
Best Practicable Means (BPM)	Adopting the best available methods to reasonably control noise and vibration.
Basic Noise Level (BNL)	A measure of traffic source noise prior to development. It is calculated from traffic flows, road speed, and Heavy Goods Vehicle (HGV) percentage.
Decibel (dB)	A unit used to measure or compare the intensity of a sound by comparing it with a given reference level on a logarithmic scale.
Free-field	A situation in which the radiation from a sound source is entirely unaffected by the presence of any reflective boundaries.
Intermittency	A measure of the 'on/off' nature of a sound source.
Impulsivity	A measure of the sharpness of sudden nature of a sound which is short in duration such as a gunshot or a blast.
Logarithmic averaging	A method by which sound levels in decibels (dB) can be averaged. This allows us to account for the fact that higher levels of sound will always dominate in the presence of lower sound levels.
Noise	An unwanted or unexpected sound.
Peak Particle Velocity (PPV)	An indicator of the magnitude of ground vibration which refers to the movement of molecular particles within the ground.
Residual Sound Level	The ambient sound level at a receptor in the absence of influence from the sound source under assessment.
Sound	Fluctuations of pressure within a medium (gas, solid or fluid) within the audible range of loudness and frequencies which excite the sensation of hearing.
Sound Power Level, *Lw*	The total sound energy emitted by a source per unit time.
Sound Pressure Level, *Lp*	The amount of force a sound wave exerts on a surface area perpendicular to the direction of travel. A measure of the variation of sound level over a distance.
Specific Sound Level	The equivalent continuous A-weighted sound pressure level produced by the specific noise source at the assessment location over a given reference time internal.
Temporal averaging	Averaging a dataset over a given time period.
Tonality	A measure of sound quality that correlates to how humans perceive certain frequencies of sound. A sound is considered tonal if the frequency spectrum contains a lot of sound energy at a single frequency.

Acronyms

Acronym	Description
BNL	Basic Noise Level
BPM	Best Practicable Means
BS	British Standard
CCBC	Conwy County Borough Council
CEA	Cumulative Effects Assessment
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act
DCC	Denbighshire County Council
DCO	Development Consent Order
DMRB	Design Manual Roads and Bridges
DRC	Dynamic Reactive Compensator
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
HVAC	High Voltage Alternating Current
LDP	Local Development Plan
LOAEL	Lowest Observed Adverse Effect Level
LT	Long-term
MDS	Maximum Design Scenario
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
NGET	National Grid Electricity Transmission
NRW	Natural Resources Wales
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project

Acronym	Description
OSP	Offshore Substation Platform
PEIR	Preliminary Environmental Information Report
PPV	Peak Particle Velocity
SOAEL	Significant Observed Adverse Effect Level
ST	Short-term
TAN	Technical Advice Note
TJB	Transition Joint Bay

Units

Unit	Description
%	Percentage
dB	Decibel
mm/s	Millimetres per second
km^2	Square kilometres
m	Metres
h	Hours
ms	Milliseconds

22 Noise and vibration

22.1 Introduction

22.1.1 Overview

22.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the assessment of the potential impact of the Mona Offshore Wind Project on noise and vibration. Specifically, this chapter considers the potential impact of the Mona Offshore Wind Project landward of Mean Low Water Springs (MLWS) during the construction, operations and maintenance, and decommissioning phases. The area assessed includes noise and vibration due to construction works in the intertidal region

22.1.1.2 Consideration is also given to the impacts of construction noise and vibration due to offshore construction works.

22.1.2 Purpose of chapter

22.1.2.1 The primary purpose of the PEIR is outlined in volume 1, chapter 1: Introduction of the PEIR. In summary, the primary purpose of an Environmental Statement is to support the Development Consent Order (DCO) application for Mona Offshore Wind Project under the Planning Act 2008 (the 2008 Act). The PEIR constitutes the Preliminary Environmental Information for the Mona Offshore Wind Project and sets out the findings of the Environmental Impact Assessment (EIA) to date to support the pre-application consultation activities required under the 2008 Act. The EIA will be finalised following completion of pre-application consultation and the Environmental Statement will accompany the application to the Secretary of State for Development Consent.

22.1.2.2 The PEIR forms the basis for statutory consultation which will last for 47 days and conclude on 04 June 2023 as outlined in volume 1, chapter 2: Policy and legislation of the PEIR. At this point, comments received on the PEIR will be reviewed and incorporated (where appropriate) into the Environmental Statement, which will be submitted in support of the application for Development Consent scheduled for quarter one of 2024.

22.1.2.3 In particular, this PEIR chapter:

- Presents the existing environmental baseline established from desk studies, site-specific surveys and consultation
- Identifies any assumptions and limitations encountered in compiling the environmental information
- Presents the potential environmental effects on noise and vibration arising from the Mona Offshore Wind Project, based on the information gathered and the analysis and assessments undertaken
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Mona Offshore Wind Project on noise and vibration.

22.1.2.4 The assessment presented is informed by the following technical chapters:

- Volume 1, chapter 3: Project description of the PEIR
- Volume 3, chapter 21: Traffic and transport of the PEIR.

22.1.2.5 The baseline traffic flows and proposed construction traffic flows presented in this chapter have informed the assessment of noise impacts due to construction traffic.

22.1.2.6 This chapter also draws upon information contained within volume 5, annex 3.1: Underwater sound technical report of the PEIR on offshore piling noise.

22.1.2.7 This chapter focuses on the impacts of airborne noise only. The impacts of underwater noise on marine life are based on information contained within volume 5, annex 3.1: Underwater sound technical report of the PEIR and assessed in:

- Volume 2, chapter 8: Fish and shellfish ecology of the PEIR
- Volume 2, chapter 9: Marine mammals of the PEIR
- Volume 2, chapter 11: Commercial fisheries of the PEIR.

22.1.2.8 The impacts of airborne noise based on information contained within this chapter and associated annexes are presented in:

- Volume 3, chapter 18: Onshore ecology of the PEIR
- Volume 3, chapter 24: Onshore and intertidal ornithology of the PEIR.

22.1.3 Study area

22.1.3.1 The noise and vibration study area focuses on noise and vibration sensitive receptors landward of MLWS where potential impacts are more likely to occur on receptors sensitive to noise and vibration.

22.1.3.2 The noise and vibration study area has been defined as:

- Noise and vibration sensitive receptors landward of Mean High Water Springs (MHWS) within the area of land to be temporarily or permanently occupied during the construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project (hereafter referred to as the Mona Proposed Onshore Development Area)
- Noise sensitive receptors located within 1km of the Mona Landfall (approximately 1648 receptors) and Mona Onshore Substation (approximately 46 and 803 receptors for Options 2 and 7, respectively) as presented in Figure 22.2
- Noise sensitive receptors located within 250m of the Mona Proposed Onshore Development Area (excluding the Mona Landfall and Onshore Substation options) (approximately 1,903 receptors) as presented in Figure 22.1. This area includes the locations of the construction compounds and the potential Horizontal Directional Drilling (HDD) (or other trenchless crossing technique) compounds
- Noise sensitive receptors located within 2km of the Mona Offshore Cable Corridor (approximately 7,370 receptors)
- Noise sensitive receptors located within 50km of the Mona Array Area where construction piling is required (receptor count not available due to limited address data) as presented in Figure 22.3

- Vibration sensitive receptors located within 100m of the construction of the Mona Landfall (approximately 47 receptors) as presented in Figure 22.4.

22.1.3.3 The noise and vibration study area is shown on Figure 22.1 to Figure 22.4 below. The location of the receptors sensitive to noise and vibration are shown in volume 7, annex 22.2: Construction noise and vibration of the PEIR.

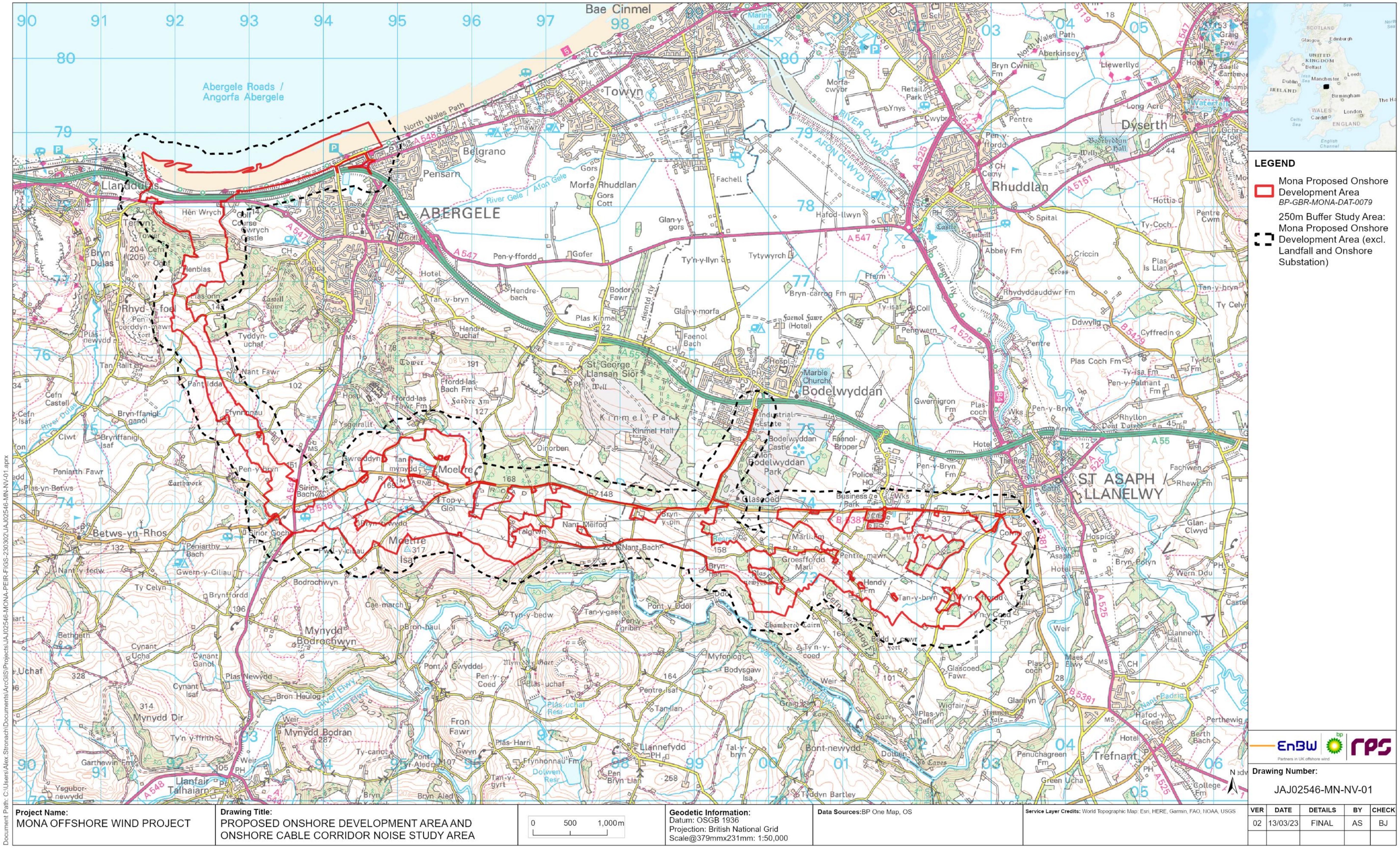

Figure 22.1: Noise and vibration study area - Mona Proposed Onshore Development Area .

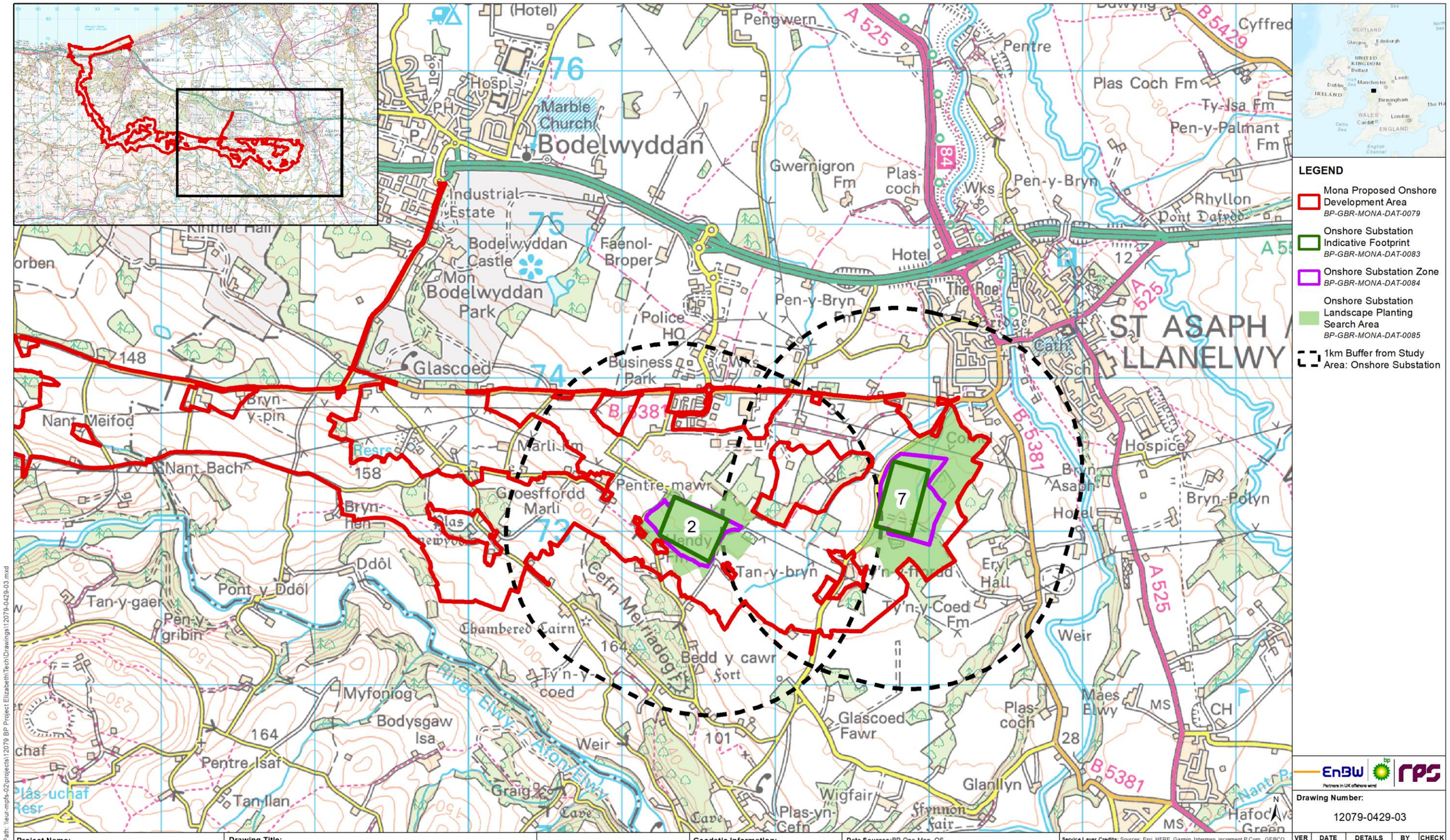

Figure 22.2: Noise and vibration study area – Onshore substations.

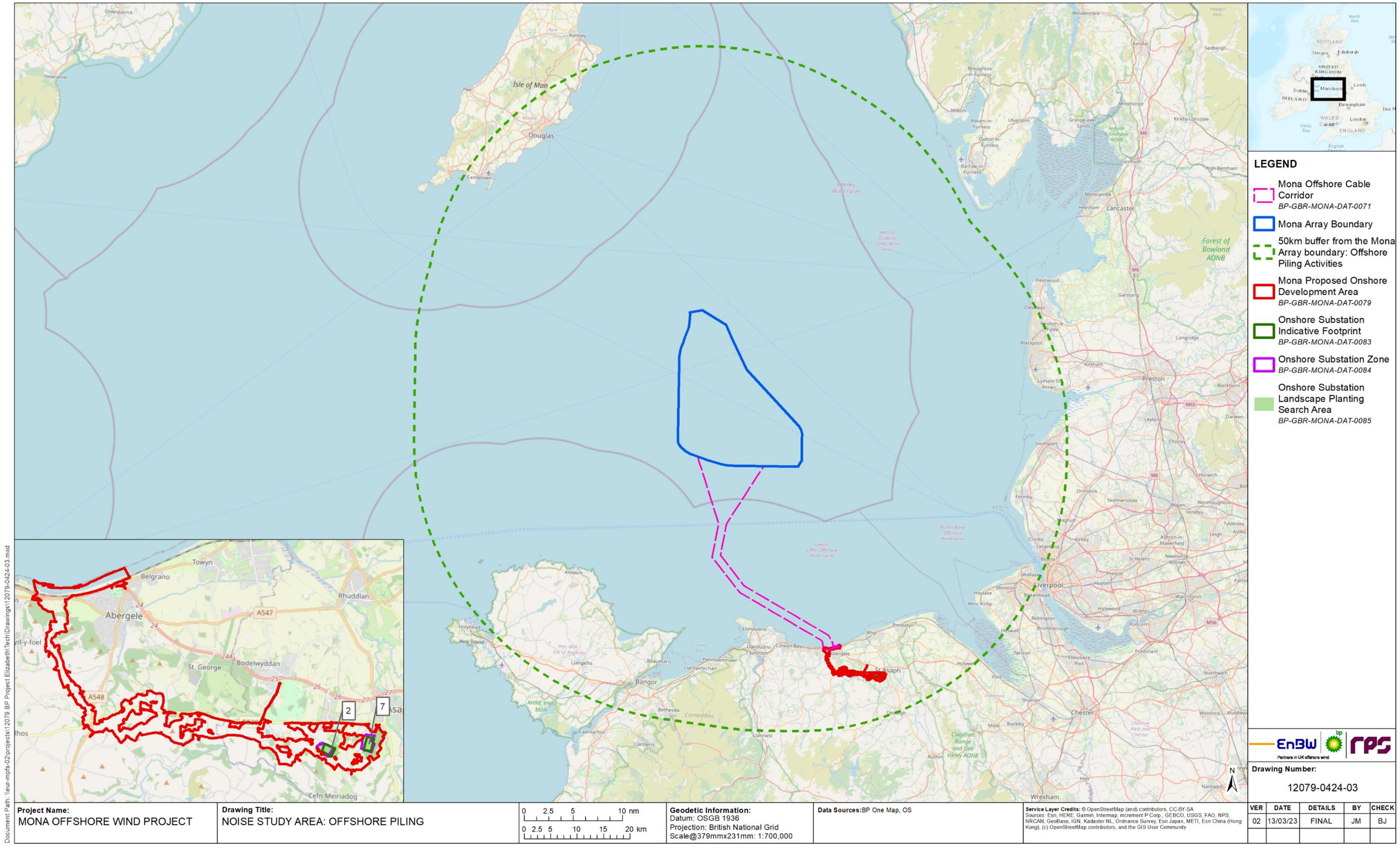

Figure 22.3: Noise and vibration study area – Offshore piling activities.

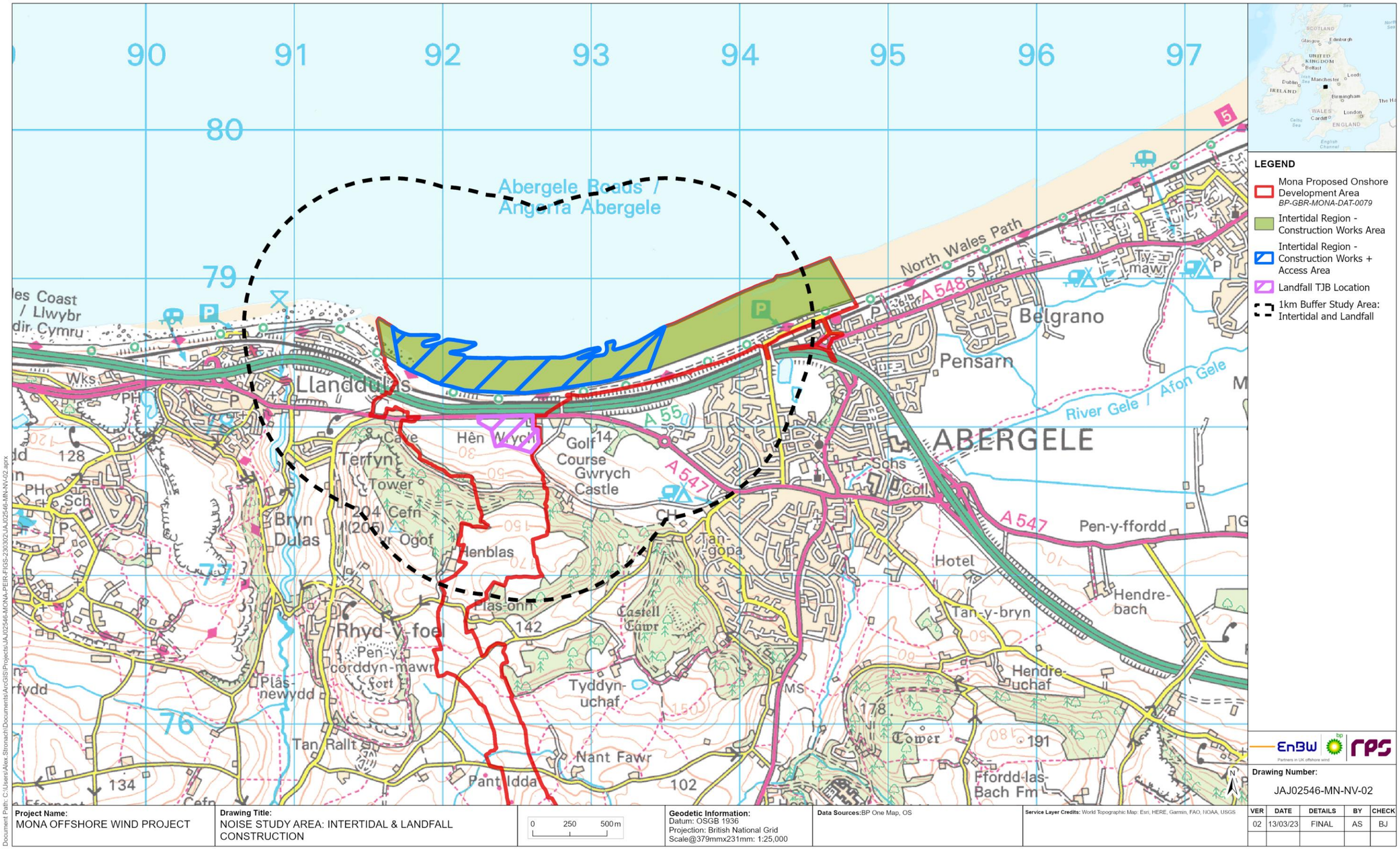

Figure 22.4: Noise and vibration study area – Intertidal construction.

22.2 Policy context

22.2.1 Control of Pollution Act (CoPA) 1974

22.2.1.1 Section 60, Part III of the CoPA refers to the control of noise on construction sites. It outlines legislation by which Local Authorities can control noise from construction sites and prevent noise disturbance.

22.2.1.2 British Standards (BS) 5228-1:2009+A1:2014 and BS 5228 2:2009+A1:2014 were approved within The Control of Noise (Code of Practice for Construction and Open Sites) Order 2015 as suitable guidance on appropriate methods for the control of noise from construction and open sites in exercise of the powers conferred on the Secretary of State by sections 71(1)(b), (2) and (3) of the CoPA.

22.2.1.3 The CoPA provides a Local Authority the power to serve a notice imposing requirements for the way in which construction works are to be carried out in their jurisdiction. This notice can specify the following:

- The plant or machinery permitted for use
- The hours during which construction work may be undertaken
- Limits for the emission levels of noise and vibration due to the works at any time or spatial position on site
- Any other change in circumstance.

22.2.1.4 Section 61, Part III of the CoPA refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. Providing consent is granted, and compliance is maintained with the stated method and hours of work, no action may be taken by the Local Authority under Section 60.

22.2.1.5 Section 71, Part III of the CoPA refers to the preparation and approval of codes of practice for minimising noise.

22.2.1.6 Section 72, Part III of the CoPA refers to BPM, which is defined as:

'In that expression, 'practicable' means reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'. Whilst 'Means' includes 'the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures.'

22.2.2 Environmental Protection Act (EPA) 1990

22.2.2.1 Section 79, Part III of the EPA contains a list of matters that amount to statutory nuisances and places a duty on Local Authorities to regularly inspect areas in their jurisdiction to determine where statutory nuisances may exist.

22.2.2.2 This section also considers and defines the concept of 'Best Practicable Means' (BPM) which originates from Section 72, Part III of the CoPA.

22.2.2.3 The Local Authority must serve an abatement notice where it is satisfied that a statutory nuisance does exist, or is likely to occur/recur. Section 80, Part III of the EPA provides Local Authorities with the power to serve an abatement to prohibit or restrict its occurrence or recurrence; and to carry out works or other action necessary to abate the nuisance.

22.2.2.4 Section 82, Part III of the EPA allows a Magistrates' court to act on a complaint made by any person on the grounds that they are aggrieved by a statutory nuisance, such as noise.

22.2.2.5 The procedures for appeals against abatement notices are detailed in the Statutory Nuisance (Appeals) Regulations 1995.

22.2.3 National Policy Statements

22.2.3.1 Planning policy on renewable energy infrastructure is presented in volume 1, chapter 2: Policy and legislation of the PEIR. Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to noise and vibration, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; DECC, 2011a), the NPS for Renewable Energy Infrastructure (EN-3, DECC, 2011b) and the NPS for Electricity Networks Infrastructure (EN-5, DECC, 2011c).

22.2.3.2 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment and also highlight a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 22.2 below and Table 22.3 refer to the current NPSs, specifically NPS EN-1 (DECC, 2011a), NPS EN-3 (DECC, 2011b) and NPS EN-5 (DECC, 2011c). If the NPSs are updated prior to the application for Development Consent, the revised NPSs will be fully considered in relation to noise and vibration within the Environmental Statement.

22.2.3.3 NPS EN-5 includes guidance on what matters are to be considered in the onshore assessment of electrical networks. These are summarised in Table 22.3 below.

Table 22.1: Summary of NPS EN-1 policy on decision making relevant to noise and vibration.

Summary of NPS EN-1 provision	How and where considered in the PEIR
The project should demonstrate good design through the selection of the quietest cost-effective plant available, containment of noise within buildings wherever possible, optimisation of plant layout to minimise noise emissions and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission. Paragraph 5.1.8 of NPS-EN-1	The design of the Mona Onshore Substation is discussed in volume 1, chapter 3: Project description of the PEIR. The full plant design including equipment selections, layouts, and mitigation measures will be discussed in detail in the Environmental Statement.
The Secretary of State should not grant development consent unless it is satisfied that the proposals will meet the following aims: • Avoid significant adverse impacts on health and quality of life from noise • Mitigate and minimise other adverse impacts on health and quality of life from noise • Where possible, contribute to improvements to health and quality of life through the effective management and control of noise. Paragraph 5.11.9 of NPS EN-1.	Potential noise mitigation measures are provided in section 22.8. The specification of mitigation for operational noise sources in the Mona Onshore Substation will be reported in the Environmental Statement following a review of the detailed plant design.

Summary of NPS EN-1 provision	How and where considered in the PEIR
When preparing the development consent order, the Secretary of State should consider including measurable requirements or specifying the mitigation measures to be put in place to ensure that noise levels do not exceed any limits specified in the development consent. Paragraph 5.11.10 of NPS EN-1	

Table 22.2: Summary of NPS EN-1 and NPS EN-3 provisions relevant to noise and vibration.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the PEIR
NPS EN-1	
The applicant should include the following elements in the noise assessment: • A description of the noise generating aspects of the development proposal, including any distinctive tonal, impulsive or low frequency characteristics of the noise • Identification of the noise sensitive premises/areas that may be affected • The characteristics of the existing noise environment • A prediction of how the noise environment will change with the proposed development during the construction and operation periods and particular times of day/night • An assessment of the predicted noise changes at sensitive receptors • Measures employed in mitigating noise Paragraph 5.11.4 of NPS EN-1	The construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed using the principles in the relevant BS and nationally accepted guidance. Construction, operations and maintenance, and decommissioning noise and vibration impacts are assessed in section 22.9.
Operational and construction noise impacts should be assessed using the relevant BS Paragraph 5.11.6 of NPS EN-1	The construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed using the principles in the relevant BS and nationally accepted guidance. Construction, operations and maintenance, and decommissioning noise and vibration impacts are assessed in section 22.9. In accordance with best practice, the noise and vibration assessment has been undertaken with reference to the following: • BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound' (British Standards Institution, 2019) • BS 5228-1:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (British Standards Institution, 2014a) • BS 5228-2:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' (British Standards Institution, 2014b) • BS 7445:2003 – 'Description and measurement of environmental noise' (British Standards Institution, 2003) • BS 8233:2014 – 'Guidance on sound insulation and noise reduction for buildings' (British Standards Institution, 2014c) • Calculation of Road Traffic Noise (CRTN) (Department for Transport, 1988) • Design Manual Roads and Bridges (DMRB) – LA111 – Noise and vibration (Highways England, Transport Scotland, Llwyodraeth Cymry, Department for Infrastructure, 2020). • ISO 9613-2:1996 – Acoustics – 'Attenuation of sound during propagation outdoors – Part 2: General method of calculation'(International Organisation for Standards, 1996).
The applicant should consult with Natural Resources Wales (NRW) as necessary and in particular with regard to the assessment of noise on protected species or other wildlife Paragraph 5.11.7 of NPS EN-1	Noise impacts on wildlife are assessed in volume 3, chapter 18: Onshore ecology and volume 3, chapter 24: Onshore and intertidal ornithology of the PEIR.
NPS EN-3	
Proposals for renewable energy infrastructure should demonstrate good design to mitigate impacts such as noise. Paragraph 2.4.2 of NPS EN-3	The design of the onshore substation is described in volume 1, chapter 3: Project description of the PEIR. Potential noise mitigation measures are provided in section 22.9.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the PEIR
NPS EN-3 provides guidance specifically for renewable energy infrastructure. The applicant should identify impacts of a proposal and these impacts, together with proposals for their avoidance or mitigation wherever possible, should be set out in an Environmental Statement that should accompany each project application. Paragraph 2.6.5 of NPS EN-3.	The construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed using the principles in the relevant BS. The assessment of the offshore and onshore elements of is presented in section 22.9 with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR, and volume 7, annex 22.3: Operational noise technical report of the PEIR.

Table 22.3: Summary of NPS EN-5 policy on decision making relevant to noise and vibration.

Summary of NPS EN-5 provision	How and where considered in the PEIR
NPS EN-5 provides guidance which primarily relates to noise from overhead transmission lines which is not relevant here. Reference is also made to audible noise effects from substation equipment such as transformers. The guidance states that the relevant assessment methodologies should be adopted and that appropriate mitigation options should be considered and adopted where required. paragraphs 2.9.10 and 2.9.11 of NPS EN-5	The construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed using the principles in the relevant British Standards. The assessment of the offshore and onshore elements of is presented in section 22.9 with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR, and annex 22.3: Operational noise technical report of the PEIR.

22.2.4 Planning Policy Wales (Edition 11)

22.2.4.1 Planning Policy Wales (Edition 11) sets out the land use planning policies of the Welsh government to ensure the sustainable delivery of any new development and ensure positive impacts on the social, economic, and cultural well-being of Wales. Key provisions are summarised in Table 22.4 below along with details as to how these have been addressed within this assessment.

Table 22.4: Summary of Planning Policy Wales (Edition 11) policy relevant to noise and vibration.

Summary of Planning Policy Wales (Edition 11) provision	How and where considered in the PEIR
Paragraph 5.9.20 highlights the need to minimise impacts of Renewable and Low Carbon infrastructure on local communities, such as noise and air pollution, to safeguard the quality of life for existing and future generations.	The construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed using the principles in the relevant BS. The assessment of the offshore and onshore elements of is presented in sections 22.9.2 and 22.9.3 to 22.9.9, respectively, with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR, and volume 7, annex 22.3: Operational noise technical report of the PEIR.
Paragraph 6.7.18 states that early consideration is required to ascertain whether the location and design of proposed development is acceptable where air pollution or noise generating development is likely to affect a protected species or a tranquil urban green space.	Noise impacts on wildlife are assessed in volume 3, chapter 18: Onshore ecology of the PEIR and volume 3, chapter 24: Onshore and intertidal ornithology of the PEIR.
Paragraph 6.7.21 highlights the need to consider the existing soundscape as part of development strategies prior to determining planning applications.	A baseline sound survey has been undertaken at locations representative of the nearest and most exposed noise-sensitive receptors the Mona Onshore Substation and construction areas at landfall. Details are provided in volume 7, annex 22.1: Baseline sound survey of the PEIR.

22.2.5 Planning Guidance (Wales), Technical Advice Note 11 (TAN 11)

22.2.5.1 TAN 11 contains guidance on noise criteria and assessments for local planning authorities in Wales when preparing development plans and considering individual planning applications. The guidance is broken down into the following sections:

- Noise generating development
- Noise-sensitive development
- Measures to mitigate the impact of noise.

22.2.5.2 This document was updated in a letter to Local Authorities dated 25 November 2015 to address the need to update the supporting legislation and underpinning BS to the latest and most up-to-date versions.

22.2.5.3 The guidance recommends the use of BS 4142:2014+A1:2019 for the assessment of industrial and commercial noise and BS 5228:2009+A1:2014 for the assessment of construction noise. The guidance within these standards is summarised in sections 22.4.1 and 22.4.2 has been adopted as part of the PEIR assessment.

22.2.6 Local Planning Policies

22.2.6.1 The assessment of potential changes to noise and vibration has also been made with consideration to the specific policies set out in:

- Adopted Local Development Plans (LDPs) of Conwy County Borough Council (CCBC) (adopted in October 2013)
- Denbighshire County Council (DCC) (adopted in June 2013).

22.2.6.2 Replacement LDPs are currently being drafted by CCBC and DCC and will be considered upon publication. Key provisions are set out in Table 22.5 along with details as to how these have been addressed within the assessment.

Table 22.5: Local Planning Policy of relevant to noise and vibration.

Policy	Key provisions	How and where considered in the PEIR
Conwy County Borough Council: Adopted Local Development Plan (October 2013)		
DP/1	Development will only be permitted where the risks of noise pollution have been accounted for and addressed.	The construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed using the principles in the relevant BS. The assessment of the offshore and onshore elements of the Mona Offshore Wind Project is presented in section 22.9 with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR and volume 7, annex 22.3: Operational noise technical report of the PEIR. Noise impacts on wildlife will be assessed fully in the Environmental Statement.
NTE/1	Conservation of the natural environment by preventing, reducing, or remedying all forms of pollution including air, light, noise, soil, and water.	Construction, operation and maintenance, and decommissioning phases of Mona Offshore Wind Project have been assessed using the principles in the relevant British Standards. The assessment of the offshore and onshore elements of the Mona Offshore Wind Project is presented in section 22.9 with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR and volume 7, annex 22.3: Operational noise technical report of the PEIR. Noise impacts on wildlife will be assessed fully in the Environmental Statement.
Denbighshire County Council: Adopted Local Development Plan (June 2013)		
RD 1	Development will only be permitted where the development does not unacceptably affect the amenity of local residents by virtue of noise.	Construction, operation and maintenance, and decommissioning phases of Mona Offshore Wind Project have been assessed using the principles in the relevant British Standards. The assessment of the offshore and onshore elements of the Mona Offshore Wind Project is presented in section 22.9 with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR and volume 7, annex 22.3: Operational noise technical report of the PEIR. Noise impacts on wildlife will be assessed fully in the Environmental Statement.
VOE 10	Development proposals which promote the provision of renewable energy technologies may be supported providing they are located so as to minimise visual, noise and amenity impacts and demonstrate no unacceptable impact upon the interests of nature conservation, and wildlife.	Construction, operation and maintenance, and decommissioning phases of Mona Offshore Wind Project have been assessed using the principles in the relevant British Standards. The assessment of the offshore and onshore elements of the Mona Offshore Wind Project is presented in section 22.9 with details provided in volume 7, annex 22.2: Construction noise and vibration of the PEIR and volume 7, annex 22.3: Operational noise technical report of the PEIR. Noise impacts on wildlife will be assessed fully in the Environmental Statement.

22.3 Consultation

22.3.1.1 A summary of the key issues raised during consultation activities undertaken to date specific to noise and vibration is presented in Table 22.6 below, together with how these issues have been considered in the production of this PEIR chapter. Further consultation will be undertaken with CCBC and DCC post PEIR (as set out in section 22.15).

Table 22.6: Summary of key consultation issues raised during consultation activities undertaken for the Mona Offshore Wind 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
June 2022	The Planning Inspectorate – Scoping Opinion	Table 8.12 of Part 3 of the Scoping Report (Mona Offshore Wind Ltd, 2022) contained proposals to scope out vibration impacts from additional vehicle movements on the local highway network during construction and decommissioning of the onshore transmission assets. The Planning Inspectorate highlighted that since vehicle routes are not yet known, the distance between any human receptor or historic asset is also unknown.	Information regarding construction traffic is provided in volume 3, chapter 21: Traffic and transport of the PEIR. Construction traffic flow data will be reported in the Environmental Statement once the Mona Proposed Onshore Development Area has been refined. Volume 7, annex 22.2: Construction noise and vibration of the PEIR will be updated to include an assessment of the noise impacts from construction traffic.
June 2022	The Planning Inspectorate – Scoping Opinion	Table 8.12 of Part 3 of the Scoping Report (Mona Offshore Wind Ltd, 2022) proposed that impacts on human receptors due to vibration generated during the operations and maintenance of the onshore transmission assets be scoped out of the assessment. The Planning Inspectorate is content that vibration from the operations and maintenance of the onshore export cable is unlikely to result in significant effects and can thus be scoped out. However, the Inspectorate is not content that impacts on human receptors due to vibration from the Mona Onshore Substation be scoped out since the distance to nearby receptors was not yet known.	An assessment of the potential impacts of vibration due to the Mona Onshore Substation has been undertaken based on the current Maximum Design Scenario (MDS) of the Mona Onshore Substation. Once plant selections have been confirmed, it will be demonstrated that operational vibration is unlikely to cause significant effects.
June 2022	The Planning Inspectorate – Scoping Opinion	Paragraphs 8.4.2.1 to 8.4.2.4 of Part 3 of the Scoping Report (Mona Offshore Wind Ltd, 2022) contained details of the proposed study area adopted for noise and vibration sensitive receptors. The Planning Inspectorate requested that the 50km noise and vibration study area proposed for the assessment of offshore generation assets where construction piling is required be justified based on the results of the noise modelling.	An indicative assessment of the noise impacts due to offshore piling works is presented in section 22.9.2.
June 2022	The Planning Inspectorate – Scoping Opinion	The Planning Inspectorate requested that information be provided on the types of vehicles and plant to be used during the construction phase. Where uncertainty exists, a 'worst-case' assessment should be undertaken considering the closest point to nearby receptors within the application boundary.	Information regarding construction traffic is provided in volume 3, chapter 21: Traffic and transport of the PEIR. Construction traffic flow data will be reported in the Environmental Statement once the Mona Proposed Onshore Development Area has been refined. Volume 7, annex 22.2: Construction noise and vibration of the PEIR will be updated to include an assessment of the noise impacts from construction traffic.
June 2022	The Planning Inspectorate – Scoping Opinion	The Planning Inspectorate requested that consideration be given to the noise and vibration effects on terrestrial ecological receptors.	Noise impacts on wildlife are assessed in volume 3, chapter 18: Onshore ecology and volume 3, chapter 24: Onshore and intertidal ornithology of the PEIR.
September 2022	CCBC – Consultation via Email	Consultation was sought with the Environmental Health Department of CCBC to agree upon the proposed noise survey locations at landfall.	No response was received. Details of the survey can be found in volume 7, annex 22.1: Baseline sound survey of the PEIR.
September 2022	DCC Environmental Health Department – Consultation via Email	Consultation was sought with the Environmental Health Department of DCC to agree upon the proposed noise survey methodology for receptors around the proposed substation locations. Mr Caldwell agreed with the proposal but requested that a long-term location be added to the receptor at Plas yr Esgob.	A long-term survey was undertaken at this position, as agreed. Details of the survey can be found in volume 7, annex 22.1: Baseline sound survey of the PEIR.

22.4 Relevant Guidance

22.4.1 British Standard 4142

22.4.1.1 BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound' provides a method for rating industrial and commercial sound and method for assessing resulting impacts upon people. The method is applicable to fixed plant installations, sound from industrial and manufacturing process and other associated activities.

22.4.1.2 In summary, this standard provides guidance on determining 'rating sound levels' by correcting the 'specific sound level' from the site or operations under consideration for acoustic character corrections such as tonality, impulsivity, and intermittency. The standard provides the following corrections to be applied where each is appropriate:

- "*Tonality -For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0dB and +6dB for tonality. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4dB where it is clearly perceptible, and 6dB where it is highly perceptible*
- *Impulsivity - A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible*
- *Intermittency - When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. … If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied*
- *Other sound characteristics - Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied*."

22.4.1.3 An initial estimate of the impact of the source is obtained by subtracting the measured background sound level from the rating sound level of the proposed plant. Background sound levels at the receptors were identified from a baseline sound survey undertaken in November 2022 (see annex 22.1: Baseline sound survey of the PEIR). Acoustic character corrections are applied to the specific sound level at the receptor.

22.4.2 British Standard 5228

22.4.2.1 BS 5228 comprises two parts:

- BS 5228-1:2009+A1:2014 – '*Code of practice for noise and vibration control on construction and open sites'* – Part 1: Noise
- BS 5228-2:2009+A1:2014 – '*Code of practice for noise and vibration control on construction and open sites'* – Part 2: Vibration

22.4.2.2 The Standard provides guidance, information, and procedures for the control of noise and vibration from demolition and construction sites. BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014 gained approval as guidance on appropriate methods for minimising noise from construction and open sites under the relevant sections of the CoPA 1974.

22.4.2.3 There are no set standards for the definition of the significance of construction noise effects. However, noise example criteria are provided in BS 5228-1:2009+A1:2014 Annex E and vibration example criteria are provided in BS 5228-2:2009+A1:2014 Annex B.

22.4.2.4 BS 5228-1:2009+A1:2014 provides basic information and recommendations for methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels. It includes sections on:

- Community relations
- Noise and persons on site
- Neighbourhood nuisance
- Project supervision
- The control of noise.

22.4.2.5 The annexes include information on legislative background, noise sources, remedies and their effectiveness (mitigation options); current and historic sound level data for on-site equipment and site activities; significance of noise effects; calculation procedures estimating sound emissions from sites and sound level monitoring; types of piling; and air overpressure.

22.4.2.6 BS 5228-2:2009+A1:2014 contains information and recommendations for basic methods of vibration control arising from construction and open sites where work activities/operations generate significant levels of vibration. It includes sections on community relations; vibration and persons on site; neighbourhood nuisance; project supervision; control of vibration and measurement. BS 5228-2:2009+A1:2014 refers to BS ISO 4866:2010; BS 7385-2:1993; BS 6472-1:2008, and BS 6472-2:2008 for further advice on the significance of vibration.

22.4.3 Design Manual for Roads and Bridges (DMRB) – LA111 – Noise and vibration

22.4.3.1 The DMRB LA111 (Highways England, Transport Scotland, Llwyodraeth Cymry, Department for Infrastructure, 2020), provides on guidance on methods for assessing noise and vibration from construction traffic.

22.4.3.2 The magnitude of noise impacts is assessed using the predicted change in the Basic Noise Level (BNL) on the closest public roads to a receptor following the introduction of construction traffic.

22.4.3.3 The noise change is calculated using the methods outlined in the CRTN (Department for Transport, 1988) which considers the following:

- The change in traffic flow due to construction traffic
- Vehicle speed
- The percentage of Heavy Goods Vehicles (HGVs)

22.4.3.4 Paragraph 3.19 of DMRB LA111 states the following:

- '*Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*
  - *10 or more days or nights in any 15 consecutive days or nights;*
  - *A total number of days exceeding 40 in any 6 consecutive months*.'

22.4.3.5 Additional guidance is provided for the determination of construction noise impact criteria in terms of the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL). These are defined in volume 7, annex 22.2: Construction noise of the PEIR.

22.5 Baseline environment

22.5.1 Methodology to inform the baseline

22.5.1.1 Information regarding the baseline sound climate was collected through a mixture of desktop reviews and long-term and short-term sound measurements on site.

22.5.1.2 The desktop study was undertaken to review the nearest noise-sensitive receptors situated within the boundaries of the proposed noise and vibration study areas for sources of noise and vibration during the construction and operation and maintenance phases.

22.5.1.3 Subsequently, a baseline sound survey (volume 7, annex 22.1: Baseline sound survey of the PEIR) was undertaken to obtain representative sound levels for human receptors near landfall and in the vicinity of the proposed Mona Onshore Substation option locations. No information on the locations of ecological receptors was available at the time the survey was undertaken. Additional baseline sound measurements will be undertaken once this information becomes available.

22.5.1.4 There are no significant existing sources of vibration impacting the nearest noise-sensitive receptors which require consideration. As such, no vibration survey is deemed necessary. This is in line with the approach set out in the EIA Scoping Report (Mona Offshore Wind Ltd, 2022). No comments on this approach were raised by The Planning Inspectorate in their scoping opinion.

22.5.2 Desktop study

22.5.2.1 Information on the nearest noise sensitive receptors within the noise and vibration study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 22.7 below.

Table 22.7: Summary of key desktop reports.

Title	Source	Year	Author
OS_MasterMap_Topography_Layer_780637_1046228.dwg	Ordinance Survey	2022	Ordinance Survey
OS Terrain 5	Ordinance Survey	2022	Ordinance Survey
Google Earth Imagery	Data SIO, NOAA, U.S Navy, NGA, GEBCO	2022	Google

22.5.3 Site specific surveys

22.5.3.1 In order to inform the PEIR, site-specific surveys were undertaken, as agreed with the Local Authorities (see Table 22.6 for further details). A summary of the surveys undertaken to inform the noise and vibration impact assessment is outlined in Table 22.10 below.

22.5.3.2 Full details of the survey methodology are presented in volume 7, annex 22.1: Baseline sound survey, of the PEIR. In summary, a mixture of long-term and short-term sound measurements were undertaken at locations representative of the nearest noise sensitive receptors to construction noise and vibration sources at the Mona Landfall and the Mona Onshore Substation option locations.

22.5.3.3 The survey comprises a combination of short-term and long-term sound monitoring at 12 locations within the Mona Proposed Onshore Development Area. The proposed monitoring locations were discussed with CCBC and DCC (see Table 22.6) and follows the approach set out in the Mona Offshore Wind EIA Scoping Report (Mona Offshore Wind Ltd, 2022).

22.5.3.4 The measurement positions are presented in Table 22.8 and Table 22.9 below.

Table 22.8: Descriptions of long term (LT) and short term (ST) sound monitoring locations at the Mona Landfall.

Position	Location	Representative Receptor
LT1	Northern boundary of Abergele Golf Course.	Residential receptors on Tron Way.
LT2	Western boundary of Abergele Golf Course.	Residential receptor at Gwyrch House.
ST1	Northern boundary of Castle Cove Caravan Park.	Static caravans at Castle Cove Caravan Park.
ST2	Southern boundary of land at Tan yr Ogof Farm.	Residential receptors at Tan yr Ogof Farm and Tan yr Ogof Caravan Park.

Table 22.9: Descriptions of LT and ST sound monitoring locations near the Mona Onshore Substation option locations.

Position	Location	Representative Receptor
LT3	Southwestern boundary of the land west of Waen Meredydd.	Residential receptor at Waen Meredydd.
LT4	Eastern boundary of the land west of Tyddyn Meredydd.	Residential receptor at Tyddyn Meredydd.
LT5	Rear garden of the property at Cae yr Haul, Lon Coed yr Esgob.	Residential receptors on Lon Coed yr Esgob and Glascoed Road.
LT6	Western boundary of the land east of Plas yr Esgob.	Residential receptors at Plas yr Esgob and Coed yr Esgob.

Position	Location	Representative Receptor
LT7	Eastern boundary of the land east of Tyn y Ffordd Fawr.	Residential receptors near Cefnmeiriadog and caravans at Lyons Eryl Hall Caravan Park & Country Club.
LT8	Southeastern boundary of the land at Tyn y Ffordd Newydd.	Residential receptors at Tyn y Ffordd Newydd, Rhos Aber, and Isfryn.
ST3	Southern boundary of the land north of Coed yr Esgob.	Residential receptor at Coed yr Esgob.
ST4	Western boundary of the land east of Tyn y Ffordd Fawr.	Residential receptors near Cefnmeiriadog.

22.5.3.5 Monitoring was not undertaken within other areas of the Mona Proposed Onshore Development Area as the location of the Mona Onshore Cable Corridor and Mona 400kV Grid Connection Corridor has not been confirmed. Following the refinement of the Mona Proposed Onshore Development Area, further baseline sound surveys may be undertaken (see section 22.15).

Table 22.10: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
Baseline sound survey	Mona Landfall.	Baseline sound survey at locations representative of the nearest noise-sensitive receptors to Mona Onshore Cable Corridor at landfall.	RPS	November 2022	Volume 7, annex 22.1: Baseline sound survey of the PEIR
	Mona Onshore Substation option locations	Baseline sound survey at locations representative of the nearest noise-sensitive receptors to the proposed Mona Onshore Substation options.			

22.5.4 Baseline environment

22.5.4.1 The measured baseline sound levels at the survey locations detailed in Table 22.8 and Table 22.9 above are presented in Table 22.11 below.

Baseline sound survey results (operational noise)

22.5.4.2 Representative baseline sound levels have been derived in accordance with the guidance presented in BS 4142:2014+A1:2019. The residual sound levels, $L_{Aeq,T}$, have been calculated by logarithmically averaging the measured data over 16-hour and 8-hour periods for the day and night-time, respectively.

22.5.4.3 The representative background sound levels, $L_{A90,T}$, have been derived through statistical analysis of the measured background sound level data. The guidance in BS 4142:2014+A1:2019 states the following:

'A representative level should account for the range of background sound levels and should not automatically be assumed to be either the minimum or modal value.'

22.5.4.4 Based on the above, an initial estimate of the representative background sound levels at each long-term measurement position have been derived by calculating the $L_{A90,15min}$ level that is not exceeded for more than 25% of the relevant day or night-time period. These values have been reviewed against the time-history graphs in Appendix B of volume 7, annex 22.1: Baseline sound survey of the PEIR and are considered acceptable. The results are presented in Table 22.11 below.

Table 22.11: Baseline sound survey results (operational noise).

Location	Measured Sound Level, (dB)			
	Day (0700-2300 hours)		Night (2300-0700 hours)	
	Residual Sound Level, $L_{Aeq,16h}$	Background Sound Level, $L_{A90,15min}$	Residual Sound Level, $L_{Aeq,8h}$	Background Sound Level, $L_{A90,15min}$
LT1	51	41	42	31
LT2	52	44	46	35
LT3	42	33	36	30
LT4	44	37	40	35
LT5	47	38	37	32
LT6	45	36	38	31
LT7	43	34	35	30
LT8	42	27	36	25

22.5.5 Future baseline scenario

22.5.5.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires that '*an outline of the likely evolution thereof without implementation of the 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 Environmental Statement. In the event that the Mona Offshore Wind Project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

22.5.5.2 The existing sound climate is dominated primarily by distant traffic on local roads. As the quantity of electric cars increases on roads, it is possible that traffic noise levels may reduce slightly due to the lower engine-noise levels, although at higher speeds there will still be influence from noise due to tyre-road interaction.

22.5.5.3 The A55 and A547 are well-trafficked roads with speed limits between 50 to 70mph. As such, it is not anticipated that that the future baseline scenario will change significantly in the absence of the development.

22.5.6 Data limitations

Baseline sound survey

22.5.6.1 All sound surveys are limited by the instrumentation used to undertake the measurements. Uncertainty may arise as a result of the internal processes within the sound level meter to measure and process the measured data into the relevant noise indices. However, modern sound level meters are precision instruments. The equipment used for the baseline sound survey are Class 1 instruments according to BS EN 61672-1:2003, has a sampling cycle of 100ms and a measurement range of A-weighted levels between 25 dB and 138dB. The uncertainty due to fluctuations in temperature and humidity is ≤0.5dB. The accuracy of the equipment used has been monitored via calibration both prior to and upon completion of the survey at each position.

22.5.6.2 There may be temporal and seasonal variations to the local noise climate. The temporal variation has been accounted for by undertaking long-term measurements over a period of two weeks. This allows for statistical analysis of any temporal variations in the noise climate to reduce uncertainty in the derivation of representative sound levels at nearby receptors. The seasonal variation in the local noise climate could be accounted for via additional sound surveys in spring/summer. However, there is likely to be a greater influence from traffic noise levels at these times due to the flux of tourists travelling via car along the A55. Whilst weather conditions are less favourable on average, it is possible that the adopted survey period presents a quieter period in the year.

22.5.6.3 Any influence due to human error has been minimised by ensuring that all sound monitoring equipment was installed safely and securely. All measurements were undertaken at a minimum height of 1.5m above local ground level and 3.5m from other reflective surfaces to minimise interference from reflected sound waves.

Construction noise and vibration

22.5.6.4 The quantities, locations, and models of the construction plant have not yet been selected and thus it is not possible to carry out a full detailed assessment.

22.5.6.5 Construction noise levels have been calculated at varying distances from the boundary of the temporary construction compounds which represents the MDS as stated in Table 22.19.

22.5.6.6 An indicative plant list has been provided and professional judgement applied to the assignment of appropriate sound level spectra and vibration levels (where appropriate) from BS 5228:2009+A1:2014 for each construction activity. This is a standard approach and is considered both robust and acceptable at this stage.

Construction traffic noise

22.5.6.7 The impacts due to construction traffic noise have been estimated based on traffic data for the key highway links. The traffic flows have been obtained from a mixture of existing studies and data sets, and on-site measurements over a two-week period.

22.5.6.8 At this stage, only key highway links are considered and a detailed assessment of the impacts of construction traffic noise will be undertaken as part of the Environmental Statement.

Source data

22.5.6.9 The layout and plant strategy for the Mona Onshore Substation has not yet been confirmed and thus a full assessment is not possible at this stage.

22.5.6.10 A list of typical plant items for the Mona Onshore Substation has been provided along with indicative quantities and broadband sound power levels. Spectral shapers obtained from similar projects have then been applied to the single-figure levels to obtain typical spectral noise levels and thus allow for a more robust assessment. This is a standard approach and is acceptable.

Prediction methods

22.5.6.11 Uncertainty and limitations may arise during the modelling process due to the sound propagation models used to inform the calculations. The sound levels at the nearest receptors have been calculated using the internationally accepted guidance within ISO 9513-2:1996 which is implemented by the 3D acoustic modelling software (SoundPLAN) used to predict noise levels from the Mona Offshore Wind Project. This standard claims an accuracy of ±3 dB for source heights up to 30m and propagation distances between 100m and 1km.

22.5.6.12 Vibration levels have been predicted at varying distances from the piling activities in the intertidal region using a method by Heckman & Hagerty (1978). This method is conservative and has been known to overestimate the levels of vibration close to the source. This approach is considered acceptable, but other methods will also be explored once full information on piling plant and activities is available.

22.6 Impact assessment methodology

22.6.1 Overview

22.6.1.1 The noise and vibration impact assessment has followed the methodology set out in volume 1, chapter 5: EIA methodology of the PEIR. Specific to the noise and vibration impact assessment, the following guidance documents have also been considered:

- BS 4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound (British Standards Institution, 2019)
- BS 5228-1:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (British Standards Institution, 2014a)
- BS 5228-1:2009+A1:2014 – 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' (British Standards Institution, 2014b)
- BS 7385-2:1993 – 'Evaluation and measurement of vibration in buildings – Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings' (British Standards Institution, 1993)
- DMRB – LA 111 Noise and vibration (Highways England, Transport Scotland, Llwyodraeth Cymry, Department for Infrastructure, 2020).

22.6.1.2 In addition, the noise and vibration impact assessment has considered the following legislative framework:

- Control of Pollution Act (1974), Chapter 40, Part III
- Environmental Protection Act (1990), Chapter 43, Part III.

22.6.2 Impact assessment criteria

Significance of effects

22.6.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in volume 1, chapter 5: EIA methodology of the PEIR.

22.6.2.2 The criteria for defining magnitude in this chapter are outlined in Table 22.12 below.

Table 22.12: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
High	An effect caused by a significant exceedance of a defined limit or standard.

Magnitude of impact	Definition
Medium	An effect in relatively close agreement with a defined limit or standard. The range can be broad and thus emphasis is placed on demonstrating that the effect has been reduced to as low as is reasonably practical.
Low	An effect considered sufficiently small, with or without mitigation, to be well within accepted limits or standards. No action is required if it can be controlled by adopting practical means.
Negligible	An effect which is found to be insignificant in the context of the stakeholder and/or regulatory objectives or legislative requirements.
No change	No discernible effect.

22.6.2.3 The definitions in Table 22.12 refer to the assessment of adverse impacts only since it is unlikely that any significant beneficial noise and vibration effects will arise as a result of Mona Offshore Wind Project.

22.6.2.4 The criteria for defining sensitivity in this chapter are outlined in Table 22.13 below.

Table 22.13: Definition of terms relating to the sensitivity of the receptor.

Sensitivity	Definition
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale and limited potential for substitution
Medium	High or medium importance and rarity, regional scale, limited potential for substitution
Low	Low or medium importance and rarity, local scale
Negligible	Very low importance and rarity, local scale

22.6.2.5 The significance of the effect upon noise and vibration is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 22.14. Where a range of significance of effect is presented in Table 22.14, the final assessment for each effect is based upon expert judgement.

22.6.2.6 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended).

Table 22.14: Matrix used for the assessment of the significance of the effect.

Sensitivity of receptor	Magnitude of impact				
	No Change	Negligible	Low	Medium	High
Negligible	No change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No change	Minor	Minor or Moderate	Moderate or Major	Major
Very High	No change	Minor	Moderate or Major	Major	Major

Noise and vibration assessment criteria

22.6.2.7 This section outlines how the qualitative impacts detailed in Table 22.12 can be translated into quantified criteria for use in the assessment of noise and vibration impacts.

Construction noise

22.6.2.8 Impact criteria for construction noise have been determined in accordance with the guidance in DMRB LA111 and Annex E of BS 5228-1:2009+A1:2014. Full details are provided in volume 7, annex 22.3: Construction noise and vibration of the PEIR.

22.6.2.9 The impact criteria are presented in Table 22.15: below.

Table 22.15: Construction noise criteria.

(1) Typical ambient sound level derived from baseline sound survey data near the Mona Landfall.

(2) Typical ambient sound level derived from baseline sound survey data near the Mona Onshore Substation option locations.

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Threshold value (dB)		
	Weekdays (0700-1900 hours) & Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
Receptors near the Mona Landfall			
High	$L_{Aeq,T} > 70$	$L_{Aeq,T} > 60$	$L_{Aeq,T} > 50$
Medium	$65 \leq L_{Aeq,T} < 70$	$55 \leq L_{Aeq,T} < 60$	$45 \leq L_{Aeq,T} < 50$
Low	$52^{(1)} \leq L_{Aeq,T} < 65$	$46^{(1)} \leq L_{Aeq,T} < 55$	$42^{(1)} \leq L_{Aeq,T} < 45$

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Threshold value (dB)		
	Weekdays (0700-1900 hours) & Saturdays (0700-1300 hours)	**Evening (1900-2300 hours) and weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)**	**Night (2300-0700 hours)**
Negligible	$L_{Aeq,T} < 52$[1]	$L_{Aeq,T} < 46$[1]	$L_{Aeq,T} < 42$[1]
Receptors near the Mona Onshore Substation option locations			
High	$L_{Aeq,T} > 70$	$L_{Aeq,T} > 60$	$L_{Aeq,T} > 50$
Medium	$65 \leq L_{Aeq,T} < 70$	$55 \leq L_{Aeq,T} < 60$	$45 \leq L_{Aeq,T} < 50$
Low	45[2] $\leq L_{Aeq,T} < 65$	41[2] $\leq L_{Aeq,T} < 55$	38[2] $\leq L_{Aeq,T} < 45$
Negligible	$L_{Aeq,T} < 45$[2]	$L_{Aeq,T} < 41$[2]	$L_{Aeq,T} < 38$[2]

Construction traffic

22.6.2.10 There may be a change in local noise levels due to contributions from construction traffic on local road networks and temporary diversion networks during the construction of the Mona Offshore Wind Project.

22.6.2.11 The impact assessment will take account of the absolute level of the road traffic noise and the existing sound levels at the nearest receptors.

22.6.2.12 Impact criteria for these changes have been obtained from the guidance in DMRB LA 111 and are presented in Table 22.16 below.

Table 22.16: Construction traffic criteria.

Magnitude of Impact	Increase in Basic Noise Level (BNL) of closest public road used for construction traffic (dB)
High	BNL ≥ 5
Medium	3 ≤ BNL < 5
Low	1 ≤ BNL < 3
Negligible	BNL < 1
No change	-

Construction vibration

22.6.2.13 Impact criteria for vibration from construction have been identified based on guidance provided in BS 5228-2:2009+A1:2014. The following outline criteria in terms of peak particle velocity (PPV) can be used to identify potential significant impacts on nearby receptors.

Table 22.17: Construction vibration criteria.

[1] Vibration at these levels is unlikely to be tolerable for more than a very brief period and major effects could occur below these levels, particularly where impacts occur for longer periods.

Magnitude of Impact	Vibration Level, Peak Particle Velocity (PPV), mm/s
High	PPV ≥ 10*
Medium	PPV ≥ 1
Low	PPV ≥ 0.3
Negligible	PPV < 0.3
No change	-

22.6.2.14 The magnitude of impact will also depend on the frequency and duration for which people are likely to be exposed to vibration. As an example, a single vibration event of 1mm/s PPV is unlikely to be considered significant in isolation. Conversely, a very high level of vibration (i.e. over 3 mm/s) for a short duration may not result in a major impact.

Operational noise

22.6.2.15 The significance of noise effects associated with the operation of the Mona Onshore Substation has been determined based upon the methodology outlined in BS 4142:2014+A1:2019. This methodology includes calculating the operational rating sound level $L_{Ar,Tr}$ predicted at nearby receptors due to the operation of the Mona Onshore Substation, defined as operational specific sound level plus any acoustic character corrections due to tonality, impulsivity, intermittency, or any other distinct acoustic characteristics.

22.6.2.16 The rating sound level is then compared to the representative background sound level $L_{A90,T}$ at the nearest receptors which is obtained via measurements of the baseline acoustic environment. The difference between the rating sound level and the representative background sound level is used to determine the impacts which can be assessed in accordance with Section 11 of BS 4142:2014+A1:2019, with consideration also required for the context in which the sound has been assessed.

22.6.2.17 Based on the above, the following impact criteria in Table 22.18 have been defined for operational noise.

Table 22.18: Operational noise criteria.

Magnitude of impact	BS 4142:2014+A1:2019 semantic description	Difference Δ between rating sound Level $L_{Ar,Tr}$ and background sound level $L_{A90,T}$ (dB)
High	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.	Δ ≥ 10
Medium	A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.	5 ≤ Δ < 10
Low	Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.	0 ≤ Δ < 5
Negligible		-10 ≤ Δ ≤ 0
No change	-	Δ < -10

22.7 Key parameters for assessment

22.7.1 Maximum design scenario

22.7.1.1 The MDSs identified in Table 22.19 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the Project Design Envelope provided in volume 1, chapter 3: Project description of the PEIR. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

Table 22.19: Maximum design scenario considered for the assessment of potential impacts on noise and vibration.

[a] C=construction, O=operations and maintenance, D=decommissioning

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Noise impacts due to offshore piling.	✓	×	×	**Construction phase** Monopiling methods will be adopted for the installation of the foundations for the Offshore Substation Platform (OSP) and wind turbines. • The piles will be embedded 60m below the seabed with a maximum hammer energy of 5,500kJ • The hammer ramp up to the standard operational level although it has been assumed that the hammer will operate at maximum energy for the duration of the piling activities • Two events will occur concurrently in close proximity • There is potential for piling activities to be undertaken over a full 24-hour period • The strike rate will be 40 strikes per minute for approximately eight-hours equating to a total number of 18,000 strikes • Noise levels have been predicted in downwind conditions.	**Construction phase** The MDS is that the monopiles will be driven into the seabed using piling techniques. The maximum hammer energy is likely to be lower than 5,500kJ. – A typical sound power level of L_W = 143dB(A) has been adopted for an indicative assessment obtained from estimations undertaken in liaison with Seiche Ltd and the results of numerical modelling for volume 5, annex 3.1: Underwater sound technical report of the PEIR. Full details can be found in volume 7, annex 22.2: Construction noise of the PEIR.
Noise impacts due to the onshore export cables at the Mona Landfall.	✓	×	✓	**Construction phase** Trenchless techniques (e.g., HDD, thrust bore, or other trenchless techniques) may be adopted to pull the offshore export cable from within the intertidal region between MLWS and MHWS to meet the onshore export cable at the Transition Joint Bays (TJB) approximately 600m inland: • Up to four HDD exit pits will be required with dimensions of approximately 80m x 20m and a depth of 2.5m • The maximum burial depth of the HDD will be 25m between MLWS and MHWS; the maximum burial depth landward of MHWS is approximately 30m • The HDD working compound area measures up to 150m x 100m • The maximum duration for works on all four exit pits will be eight weeks broken down into two x four-week periods in each of two seasons • Major HDD works may require 24-hours works dependent upon requirements • HDD works at landfall will be nine months in duration • The plant list for the HDD works includes: – Mobile crane – Articulated trucks – CAT 320 excavators – Diesel compressors – Diesel generators in operation 24-hours a day – Concrete pumps – A tracked drilling rig will be used and will operate 24-hours a day. The offshore export cable pull-in may require the installation of a cofferdam to reduce water intrusion. • Two small cofferdams will be constructed in both year 2 and year 3 of construction to assist with the pull-through of two of the four cable circuits • Metal sheet piles will be installed via vibratory piling techniques in daylight hours • The piling rig will either be mounted upon a small jack-up barge or landing craft • The plant list for the cofferdam installation includes: – Vibratory piling rig	Trenchless techniques at the Mona Landfall represents the MDS as it uses of equipment with higher noise emission levels than open cut trenching techniques, particularly the vibratory piling required to install the cofferdam. Typical noise levels for the indicative construction plant list have been obtained from BS 5228:2009 1+A1:2014. It is likely that construction works will be undertaken within the intertidal region rather than at the boundary with the MHWS. However, in the absence of exact locations, the MHWS boundary of the intertidal region represents the MDS.

Potential impact	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
				• A maximum of six beach-landed construction vehicles will be required • The predicted noise levels have been undertaken at various distances from the MHWS boundary of the intertidal region • The HDD working compound area measures up to 150m x 100m. **Decommissioning phase** • Upon completion of the works, the cofferdam will be removed, and the area restored to a comparable condition • It has been assumed that the piles will be removed using vibratory extraction and a mobile crane.	
Vibration impacts due to the onshore cables at the Mona Intertidal Region.	✓	×	✓	**Construction phase** <u>A cofferdam may be required between MLWS and MHWS to reduce water intrusion when the offshore export cable is pulled through to connect with the onshore export cables:</u> • The cofferdam will be installed using vibratory piling techniques using an indicative plant list above • Metal piles will be installed up to a likely maximum piling depth of 25m • The piling duration is unknown until the cofferdam has been designed and thus a construction duration of four weeks in each of two seasons has been assumed • The cofferdam will be three-sided with dimensions of approximately 80m x 20m • The predicted levels of vibration have been undertaken at various distances from the MHWS boundary of the intertidal region. **Decommissioning phase** • Upon completion of the works, the cofferdam will be removed, and the area restored to a comparable condition • The technique required to remove the sheet piles is not yet known although it is unlikely that the techniques will require methods which emit high levels of vibration.	The MDS is that the cofferdam installation process makes use of vibratory piling techniques which can result in high levels of vibration. Typical vibration levels for the indicative construction plant list have been obtained from BS 5228:2009- 2+A1:2014 and historic projects where similar vibratory piling techniques have been adopted. It is likely that construction works will be undertaken within the intertidal region rather than at the boundary with the MHWS. However, in the absence of exact locations, the MHWS boundary of the intertidal region represents the MDS.
Noise impacts due to the Mona Onshore Cable Corridor landward of MHWS.	✓	×	✓	**Construction Phase** <u>Open cut trenching is proposed to construct the majority of the Mona Onshore Cable Corridor:</u> • The area of the permanent Mona Onshore Cable Corridor is up to 540,000m^2 based on a corridor measuring 30m wide and 18km in length. The temporary working corridor requires an additional 70m wide corridor (making the total width of the Mona Onshore Cable Corridor (temporary and permanent requirements) 100m wide representing an area up to 1,800,000m^2 • The maximum number of TJBs will be four, measuring up to 1,200m^2 and up to 4m deep • There are up to four cable trenches within the permanent Mona Onshore Cable Corridor, each trench measures up to 2.5m wide at the top, up to 1.5m at the base and the depth is approximately 1.8m • The maximum number of joint bays along the Mona Onshore Cable Corridor is 96 (based on a minimum distance of 750m between each joint bay). • The maximum number of link boxes along the Mona Onshore Cable Corridor is 96 (based on a distance of 750m between each link box) • Dewatering of cable trenches, joint bays and link boxes will be required • Trenches will be excavated using a mechanical excavator or trenchers and the ducts will be installed into the open trench. The depth of stabilised backfill in each of the four onshore cable trenches is up to 600mm. Surplus subsoil and topsoil material excavated from the cable trenches, joint bays and link boxes will be spread on site.	The maximum area required for the construction of the Mona Onshore Cable Corridor, Mona 400kV Grid Connection Corridor and associated infrastructure represent the largest construction area. The working hours and duration of construction present the MDS for noise generation. The MDS is for up to 60 HDDs: not all locations are known at this stage and the MDS assumes that HDD will be undertaken at the receptors where baseline sound levels are lowest. HDD requires plant with higher noise levels. Where 24-hour work is deemed necessary, the following indicative plant items and operations would be required: • A tracked drilling rig will be used • HDD may require 24-hour works with generators in operation to power security lighting • Water/mud pumps will be in operation 24-hours a day • Mixing and recycling systems will operate 24-hours a day. An indicative construction plant list has been applied and typical noise levels obtained from BS 5228:2009-1+A1:2014 It is unlikely that the works will be undertaken along the boundary of the construction compounds however this represents the shortest distance to nearby receptors.

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
				Open cut trenching along the Mona 400kV Grid Connection Cable Corridor: • The area of the permanent Mona 400kV Grid Connection Cable Corridor is 48,000m^2 based on a corridor measuring 16m wide and 3km in length. The temporary working corridor requires an additional 44m wide corridor (making the total width of the route to grid connection (temporary and permanent requirements) 60m wide representing an area of up to 180,000m^2 • There are up to two cable trenches within the permanent Mona 400kV Grid Connection Cable Corridor, each trench measures up to 2.5m wide at the top, up to 1.5m at the base and the depth is approximately 1.8m • The maximum number of joint bays along the Mona 400kV Grid Connection Cable Corridor is 10 (based on a minimum distance of 500m between each joint bay) • The maximum number of link boxes along the Mona 400kV Grid Connection Cable Corridor is 10 (based on a distance of 500m between each link box) • Dewatering of cable trenches, joint bays and link boxes will be required • Trenches will be excavated using a mechanical excavator or trenchers and the ducts will be installed into the open trench. The depth of stabilised backfill in each of the two onshore cable trenches is up to 600mm. Surplus subsoil and topsoil material excavated from the cable trenches, joint bays and link boxes will be spread on site. Trenchless techniques • The maximum number of HDD locations along the Mona Onshore Cable Corridor is 72 and 12 along the Mona 400kV Grid Connection Cable Corridor. Primary HDD operations will require a compound, these will measure up to 150m x 100m. Secondary HDDs will require a smaller compound (measuring up to 30m x 20m) and will be located within the 100m temporary construction corridor. Haul road • There is one haul road within the Mona Onshore Cable Corridor and Mona 400kV Grid Connection Cable Corridor for the length of the corridor; up to 6m wide excluding passing places. It will be constructed using imported engineered granular fill with geotextile style layers with a nominal thickness of 400mm and a maximum thickness of up to 1000mm. Construction compounds • Up to two primary construction compounds (each measuring 150m x 150m) and up to 10 secondary construction compounds (each measuring 150m x 100m) will be located along the Mona Onshore Cable Corridor. Soils will be removed and stored for future reinstatement, Crushed stone or other suitable material will be used across the entire area to create the required hardstanding • The predicted noise levels have been undertaken at various distances from the boundaries of the temporary construction compounds. Duration and timing of works • The installation duration will be around 33 months • The works will be undertaken continuously at multiple locations between 07:00 and 19:00 Monday to Saturday. No works are proposed on Sundays. Some trenches may require water to be removed whereby a pump, welfare unit, and generator will be installed to undertake the works. Water pumping may require that works be undertaken over a full 24-hour period. **Decommissioning phase** • The onshore cable and Mona 400kV Grid Connection Cable will remain in situ but the link boxes will be removed.	
Noise impacts due to the Mona Onshore Substation.	✓	✓	✓	**Construction phase** • The maximum footprint of the Mona Onshore Substation will measure up to 125,000m^2 and will be located in the Mona Onshore Substation zone: this area will include the substation buildings	The assessment has considered the following: • Site clearance using CAT 320 tracked excavators and rock breakers

Potential impact	Phase[a] C	O	D	Maximum Design Scenario	Justification
				and the earthworks to create the platform. The Mona Onshore Substation will comprise up to four buildings. The maximum dimensions of the main building are 20m high, 40m wide and 90m long • Access to the substation will be via a new permanent access road measuring up to 8m wide and 1.2km in length • A construction compound will be required to support the construction of the Mona Onshore Substation extending up to 250,000m^2 • Abnormal load trailers will be required to transport elements of the substation plant to site • Significant noise-generating items include rock breakers/concrete munchers, piling rigs, HDD drilling rigs, and plant such as diesel-powered generators, diesel compressors, and pumps • The construction works are likely to last for up to 33 months • The predicted noise levels have been undertaken at various distances from the boundaries of the temporary construction compound. **Operations and maintenance phase** • No specific layout is assumed for the PEIR assessment, and it has been assumed that the following items are to be installed externally: – Super Grid Transformers (inc. Coolers) – Shunt Reactors (inc. Coolers) – Dynamic reactive power compensator (DRC) phase reactors (inc. Coolers) – Mechanically switched reactors – Harmonic filters – Auxiliary transformers – DRC and control building heating, ventilation, and air-conditioning (HVAC) units • The proposed substation plant will have distinct acoustic characteristics and will require corrections in line with the guidance in BS 4142:2014+A1:2019: – The Super Grid Transformers and Shunt Reactors have tonal components at the lower frequencies of their noise emission spectra. A +4dB acoustic character correction has been applied to the level predicted at all receptors where noise from these plant items have the highest contribution. This corresponds to a 'clearly perceptible' tonal component in terms of BS 4142:2014+A1:2019 – Most plant items will operate intermittently and thus a +3dB acoustic character correction has been applied to the predicted level at all receptors when the specific sound level (without character corrections) exceeds the background sound level – The predicted level at receptors where the Super Grid Transformers and/or Shunt Reactors dominate and where the rating sound level exceeds background sound level has been corrected by +7dB to account for both of the above acoustic characteristics. **Decommissioning phase** • Mona Onshore Substation facilities will be removed, and the site restored to a comparable condition – Decommissioning has been assessed on the basis that the concrete foundations will be broken up using hydraulic breakers. The demolished materials may be processed on-site using crushers and screens for disposal as recycled materials. – Lorries will be used to remove the equipment from the site.	• Piling using a four-tonne hydraulic hammer rig. This is not the most likely piling method but has been adopted as the MDS • Foundation formation using concrete pumps in operation 24-hours a day • Diesel generators for security lighting in operation 24-hours a day • Equipment installation using articulated trucks • An indicative construction plant list has been required and typical noise levels obtained from BS 5228:2009-1+A1:2014. It is unlikely that the works will be undertaken along the boundary of the construction compounds however this represents the shortest distance to nearby receptors. A detailed assessment of the operation of the Mona Onshore Substation has been undertaken by applying representative spectral shapes for similar plant items to the indicative, broadband (single-figure) noise levels provided by the Applicant. The plant may not all be situated externally but this presents the MDS. The acoustic characteristics may not be as influential once the plant is enclosed within buildings however this represents the MDS.

22.7.2 Impacts scoped out of the assessment

22.7.2.1 On the basis of the baseline environment and the description of development outlined in volume 1, chapter 3: Project description of the PEIR, two impacts are proposed to be scoped out of the assessment for noise and vibration. These impacts are outlined, together with a justification for scoping them out, in Table 22.20.

Table 22.20: Impacts scoped out of the assessment for noise and vibration.

Potential impact	Justification
The impact on human receptors and historic assets arising from vibration generated during the operations and maintenance of the onshore transmission assets.	The operations and maintenance of the onshore transmission assets will not generate any significant levels of vibration.
The impact of noise and vibration generated during the operations and maintenance of the offshore and onshore export cables.	The buried cables will not generate any perceptible noise or vibration detected above the surface.

22.8 Measures adopted as part of the Mona Offshore Wind Project

22.8.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from IEMA, 2016):

- Measures included as part of the project design. These include modifications to the location or design of the Mona Offshore Wind Project which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in IEMA, 2016)
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in IEMA, 2016).

22.8.1.2 A number of measures (primary and tertiary) have been adopted as part of the Mona Offshore Wind Project to reduce the potential for impacts on noise and vibration. These are outlined in Table 22.21 below. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Mona Offshore Wind Project and have therefore been considered in the assessment presented in section 22.9 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

Table 22.21: Measures adopted as part of the Mona Offshore Wind Project.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Primary measures: Measures included as part of the project design		
The following noise control measures will be considered in the design of the Mona Onshore Substation: • The orientation and layout of the Mona Onshore Substation will be designed to minimise noise levels at nearby receptors • Quieter equipment will be selected, where available and practicable (e.g. the inclusion of harmonic filters in the plant strategy) and mitigation measures such as acoustic barriers and enclosures will be specified where necessary • The main equipment will either be housed within a single or multiple buildings, in an open space or a combination of buildings and open space. There may also be some smaller buildings required to house components such as smaller equipment and control rooms.	To minimise noise and vibration, where reasonably practicable.	Secured through the project description.
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
A Construction Noise Management Plan will be prepared as part of the Code of Construction Practice (CoCP). It will include BPM to mitigate noise from construction activities associated with the Mona Offshore Wind Project.	To ensure compliance with local authority requirements. Minimisation of noise impacts due to construction noise and vibration.	These measures would be secured as a requirement of the DCO.
An Operational Noise Management Plan will be prepared that will include BPM. The Plan will identify the noise limits for the operation of the Mona Onshore Substation and the measures for how these limits would be monitored. It will be informed by a full assessment of operational noise to be undertaken once the plant design is complete.	Minimisation of noise impacts due to operational noise and vibration.	These measures would be secured as a requirement of the DCO.

22.8.1.3 Where significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA 2016) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in section 22.9 below.

22.9 Assessment of significant effects

22.9.1.1 The impacts of the construction, operation and maintenance, and decommissioning phases of the Mona Offshore Wind Project have been assessed on noise and vibration. The potential impacts arising from the construction, operations and

maintenance, and decommissioning phases of the Mona Offshore Wind Project are listed in Table 22.19, along with the MDS against which each impact has been assessed.

22.9.1.2 A description of the potential effect on noise and vibration receptors caused by each identified impact is given below.

22.9.2 Noise impacts due to the offshore piling

22.9.2.1 The construction of offshore foundations and wind turbines may lead to negligible impacts during the day, low impacts during the evening and medium impacts at night. The MDS is represented by the installation of the monopile foundations as presented in Table 22.19.

22.9.2.2 The exact location and techniques adopted for the piling works is not yet known and thus predictions have been undertaken for construction noise levels over a range of distances to determine at what distances impacts are reduced. Only the night-time construction criteria have been considered for this activity since this is when impacts are likely to be greater.

22.9.2.3 Operational noise impacts due to the offshore cable route have been scoped out of this assessment and thus only construction noise impacts are considered.

Construction phase

Magnitude of impact

22.9.2.4 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitudes at various distances from the construction site are presented in Table 22.22.

Table 22.22: Offshore piling noise impact magnitudes.

Magnitude of Impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (km) required for magnitude of impact
	Night (2300-0700 hours)
High	$d < 6$
Medium	$6 \leq d < 10$
Low	$10 \leq d < 14$
Negligible	$d \geq 14$

Sensitivity of the receptor

22.9.2.5 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.2.6 An assessment of the magnitude of the impact and receptor sensitivity against the criteria presented in Table 22.14 results in an effect of negligible or minor significance.

22.9.2.7 As discussed in section 22.5.6, the techniques are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds and considering the distances at which the various effects might occur. The nearest receptors are situated approximately 34km away from the boundary of the Mona Offshore Array Area along the coast.

22.9.2.8 Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

22.9.3 Noise impacts due to the onshore export cable at the Mona Landfall

22.9.3.1 The construction and decommissioning of the onshore export cable at the Mona Landfall may lead to negligible impacts during the day, low impacts during the evening and high impacts at night. The MDS is represented by the use of trenchless techniques to assist in the pull through of the offshore export cable.

22.9.3.2 Consideration has also been given to the installation of a cofferdam between MLWS and MHWS using vibratory piling techniques as summarised in Table 22.19, as well as open-cut trenching in the intertidal region as summarised in Table 22.25.

22.9.3.3 It has been assumed that all plant used for HDD works is operational 24-hours a day which forms the MDS in Table 22.19. The exact locations where works will be carried out is not yet known and thus predictions have been undertaken of the construction noise levels emitted from an indicative TJB location over a range of distances to determine at what distances impacts are reduced.

22.9.3.4 Operational noise impacts due to the onshore export cable have been scoped out of this assessment and thus only construction noise impacts are considered.

Construction phase

Magnitude of impact

22.9.3.5 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitudes at various distances from the construction site for each activity are presented in Table 22.23 to Table 22.5.

Table 22.23: Landfall construction noise impact magnitude (HDD).

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (m) required for magnitude of impact		
	Weekdays (0700-1900 hours) and Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and Weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
High	d < 58	*d* < 184	*d* < 579
Medium	58 ≤ d < 103	184 ≤ *d* < 326	579 ≤ *d* < 1030
Low	103 ≤ d < 460	326 ≤ *d* < 809	1030 ≤ *d* <1454
Negligible	d ≥ 460	*d* ≥ 918	*d* ≥ 1454

Table 22.24: Vibratory piling noise impact magnitudes (cofferdam installation).

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (m) required for magnitude of impact		
	Weekdays (0700-1900 hours) and Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and Weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
High	d < 154	*d* < 487	*d* < 1539
Medium	154 ≤ d < 274	487 ≤ *d* < 865	1539 ≤ *d* < 2750
Low	274 ≤ d < 1222	865 ≤ *d* < 2400	2750 ≤ *d* <3865
Negligible	d ≥ 1222	*d* ≥ 2400	*d* ≥ 3865

Table 22.25: Construction noise impact magnitudes for open cut trenching.

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (m) required for magnitude of impact		
	Weekdays (0700-1900 hours) and Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and Weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
High	*d* < 7	*d* < 21	*d* < 65
Medium	7 ≤ *d* < 11	21 ≤ *d* < 37	65 ≤ *d* < 115
Low	11 ≤ *d* < 113	37 ≤ *d* ≤ 181	115 ≤ *d* ≤ 204
Negligible	d ≥ 113	*d* ≥ 181	*d* ≥ 204

Sensitivity of the receptor

22.9.3.6 The nearest receptors within the noise and vibration study area at the Mona Landfall are static caravans near the cast at Castle Cove Caravan Park and Tan-yr-Ogof Caravan Park, as well as residential dwellings landward of MHWS in Abergele.

22.9.3.7 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.3.8 Construction effects are typically temporary and short-term.

22.9.3.9 The HDD works required at landfall will be undertaken near to residential receptors and static caravans. The static caravans are likely only to be occupied during spring/summer however the HDD works will be up to nine months in duration and thus may have a greater impact on local amenity.

22.9.3.10 The installation of the cofferdam will be undertaken across two 4-week periods spread between two seasons. The nearest receptors to these works are static caravans which are likely only to be occupied during spring/summer. Due to a lack of available manufacturers' data for vibratory piling plant, library data from historic projects has been used for this assessment, which is an extremely high-powered drill as shown by the specification in volume 7, annex 22.2: Construction noise of the PEIR. As such, the results are likely an overestimation of the noise impacts due to vibratory piling.

22.9.3.11 In addition, the noise levels have been calculated from the boundary of an indicative area where the works are proposed. It is likely distances to the nearest receptors will be greater However, it is likely the cofferdam and associated works at landfall will be situated at a greater distance from the nearest receptors.

22.9.3.12 The CoCP will include a noise management plan which will outline measures required such as the use of quieter equipment, acoustic screens, agreed working hours, and communication with the local community.

22.9.3.13 Overall, the magnitude of the impact is deemed to be medium and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

22.9.3.14 As discussed in section 22.5.6, the exact plant and location of the cofferdam are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds and considering the distances at which the various effects might occur.

22.9.3.15 Open-cut trenching will be undertaken during the agreed working hours with no night-time working required. Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** significance, which is not significant in EIA terms.

Further mitigation and residual effect

22.9.3.16 Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source.

22.9.3.17 If such measures are implemented, the effects may be reduced to **minor adverse**, which is not significant in EIA terms.

Decommissioning phase

22.9.3.18 The cofferdam will be decommissioned using the vibratory piling techniques adopted for installation.

Magnitude of impact

22.9.3.19 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **medium**.

Sensitivity of receptor

22.9.3.20 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

22.9.3.21 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **moderate adverse** significance, which is not significant in EIA terms.

22.9.3.22 As discussed in section 22.5.6, the exact plant and location of the cofferdam are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds.

Further mitigation and residual effect

22.9.3.23 Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source.

22.9.3.24 If such measures are implemented, the effects may be reduced to **minor adverse**, which is not significant in EIA terms.

22.9.4 Future monitoring

22.9.4.1 Depending on the locations of the construction works and the activities required, a noise monitoring strategy may be agreed upon with the relevant stakeholders to ensure compliance with the agreed noise threshold values.

22.9.5 Vibration impacts due to the onshore export cable at the Mona Landfall

22.9.5.1 The construction of the onshore export cable at the Mona Landfall may lead to medium impacts. The MDS is represented by the installation of a cofferdam between MLWS and MHWS and is summarised in Table 22.19.

22.9.5.2 Initial predictions of the potential vibration impact due to the vibratory piling techniques used for the installation of the cofferdam have been undertaken using library data for typical equipment and calculated over various distances.

Construction phase

Magnitude of impact

22.9.5.3 The impact is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitudes at various distances from the construction site are presented in Table 22.26 below.

Table 22.26: Landfall construction vibration impact magnitudes.

Magnitude of Impact	Distance *d* to Receptor (m) Required for Magnitude of Impact
High	$d < 10$
Medium	$10 \leq d \leq 80$
Low	$81 \leq d \leq 272$
Negligible	$d > 273$

Sensitivity of the receptor

22.9.5.4 The nearest receptors within the noise and vibration study area at the Mona Landfall are static caravans near landfall at Castle Cove Caravan Park and residential dwellings landward of MHWS in Abergele.

22.9.5.5 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.5.6 Construction effects are typically temporary and short-term. The installation of the cofferdam will be undertaken across two 4-week periods spread between two seasons. The nearest receptors to these works are static caravans which are likely only to be occupied during spring/summer.

22.9.5.7 The magnitude of impact is dependent upon the distance of the receptor to the construction works as shown in Table 22.26. The nearest receptor is Ty Crwyn, Llanddulas Road situated approximately 70m from MHWS. However, it is likely the cofferdam and associated works at landfall will be situated at a greater distance from the nearest receptors. It should also be noted that the caravans are likely only to be occupied during spring/summer and thus Ty Crwyn is the only permanent residence within the high and medium impact magnitude bands.

22.9.5.8 Overall, the magnitude of the impact is deemed to be low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

22.9.5.9 As discussed in section 22.5.6, the exact plant and location of the cofferdam are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds and considering the distances at which the various effects might occur.

22.9.6 Future monitoring

22.9.6.1 Depending on the locations of the construction works and the activities required, a noise and vibration monitoring strategy may be agreed upon with the relevant stakeholders to ensure compliance with the agreed noise and vibration threshold values.

22.9.7 Noise impacts due to the Mona Onshore Cable Corridor landward of MHWS

22.9.7.1 The construction of the Mona Onshore Cable Corridor landward of MHWS may lead to medium impacts. The MDS is represented by open cut trenching techniques during for a majority of the Mona Onshore Cable Corridor with trenchless techniques such as HDD at road crossings and landmarks. This is summarised in Table 22.19. The assessment of noise impacts at a location where HDD works are likely to be required is presented in Table 22.23.

22.9.7.2 The introduction of additional construction vehicles on local highways may increase noise levels at receptors close to the road. An indicative construction traffic noise assessment has been undertaken and is detailed in volume 7, annex 22.2: Construction noise of the PEIR.

22.9.7.3 Initial predictions of the potential construction noise impacts have been undertaken using library data for typical equipment and calculated over various distances. It has been assumed that all plant is operational for 50% of the activity time with all generators and pumps in operation 24-hours a day.

Construction phase

Magnitude of impact

22.9.7.4 The impact is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitudes at various distances from the construction site are presented in Table 22.27: for open cut trenching techniques.

Table 22.27: Construction noise impact magnitudes for open cut trenching.

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (m) required for magnitude of impact		
	Weekdays (0700-1900 hours) and Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and Weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
High	$d < 7$	$d < 21$	$d < 65$
Medium	$7 \leq d < 11$	$21 \leq d < 37$	$65 \leq d < 115$
Low	$11 \leq d < 113$	$37 \leq d \leq 181$	$115 \leq d \leq 204$
Negligible	$d \geq 113$	$d \geq 181$	$d \geq 204$

22.9.7.5 The change in BNL on local roads due to construction traffic has been predicted to have a **low** impact overall.

Sensitivity of the receptor

22.9.7.6 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.7.7 Construction effects are typically temporary and short-term.

22.9.7.8 The magnitude of impact is dependent upon the distance of the receptor to the construction works as shown in Table 22.27 above. Initial information on potential temporary construction compound locations shows residential receptors within 100m of the compound boundary. Construction working hours are proposed 0700-1900 hours Monday to Saturday with no works proposed on Sundays or Bank Holidays. As such, only power supplies for the construction compounds (lighting, security, etc.) are considered during the night-time hours.

22.9.7.9 The CoCP will include a Construction Noise Management Plan which will outline measures required such as the use of quieter equipment, acoustic screens, agreed working hours, and communication with the local community.

22.9.7.10 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

22.9.7.11 Trenchless techniques (HDD) may require 24-hours works and thus are considered separately. These works will only be required at crossings such as roads, railways, and landmarks. Volume 1, chapter 3: Project description of the PEIR discusses possible locations where HDD may be required. The nearest main roads (A55 and A547) and railway lines are situated near the Mona Landfall. An assessment of the impacts has been undertaken using threshold values derived for these locations, as described in volume 7, annex 22.3: Construction noise of the PEIR. The results are presented in Table 22.23.

22.9.7.12 Overall, the magnitude of the impact is deemed to be high, and the sensitivity of the receptor is considered to be medium. The effect will therefore, be of **moderate adverse** significance, which is significant in EIA terms.

22.9.7.13 As discussed in section 22.5.6, the exact plant and location of the works are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds and considering the distances at which the various effects might occur.

22.9.7.14 A maximum increase in the BNL of 1dB is predicted based on the available information. Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Further mitigation and residual effect

22.9.7.15 Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source.

22.9.7.16 If such measures are implemented, the effect may be reduced to **minor adverse**, which is not significant in EIA terms.

22.9.8 Future monitoring

22.9.8.1 Depending on the locations of the construction works and the activities required, a noise and vibration monitoring strategy may be agreed upon with the relevant stakeholders to ensure compliance with the agreed noise and vibration threshold values.

22.9.9 Noise impacts due to the Mona Onshore Substation

22.9.9.1 The construction and decommissioning of the Mona Onshore Substation may lead to high impacts. The MDS for construction is represented by the construction of four main buildings using significant noise generating construction equipment and is summarised in Table 22.19.

22.9.9.2 The operation of the Mona Onshore Substation may lead to high impacts. The MDS for operational noise is represented by all plant items being situated externally and operating concurrently 24-hours a day and is summarised in Table 22.19.

Construction phase

Magnitude of impact

22.9.9.3 The impact is predicted to be of local spatial extent, short-term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitudes at various distances from the construction site are presented in Table 22.28:.

Table 22.28: Mona Onshore Substation construction noise impact magnitudes.

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (m) required for magnitude of impact		
	Weekdays (0700-1900 hours) and Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
High	$d < 67$	$d < 216$	$d < 65$
Medium	$67 \leq d \leq 121$	$216 \leq d < 383$	$65 \leq d < 115$
Low	$121 \leq d \leq 1000$	$383 \leq d \leq 1000$	$115 \leq d \leq 204$
Negligible	$d > 1000$	$d \geq 1000$	$d \geq 204$

Sensitivity of the receptor

22.9.9.4 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.9.5 The exact locations of the temporary construction compounds are not yet known. However, initial proposals show the potential for noise-sensitive receptors to be within 100m of the compound boundary. General construction is proposed between 07:00 hours and 19:00 hours from Monday to Saturday. Extended working hours may be required to maintain programme progress; some activities may require limited 24 hour works, such as the operation of dewatering pumps.

22.9.9.6 The CoCP will include a noise management plan which will outline measures required such as the use of quieter equipment, acoustic screens, agreed working hours, and communication with the local community.

22.9.9.7 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

22.9.9.8 The exact plant and location of the construction works are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This

has been addressed by adopting precautionary thresholds and considering the distances at which the various effects might occur.

Operations and maintenance phase

Magnitude of impact

22.9.9.9 The design will incorporate noise control measures such as positioning louder plant items away from receptors and/or within sound insulated buildings, selecting low-noise plant options where available, and mitigation measures such as acoustic enclosures or barriers.

22.9.9.10 Indicative estimations based on conservative losses associated with typical mitigation measures show that noise levels from the substation plant items can be suitably controlled at nearby receptors. Full details can be found in volume 7, annex 22.3: Operational noise technical report of the PEIR.

22.9.9.11 The impact is predicted to be of local spatial extent, long term duration, and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

22.9.9.12 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.9.13 The exact substation locations are not yet known. However, due to the low existing background sound levels at receptors around both Option 2 and Option 7 for the Mona Onshore Substation, the operation of the substation unmitigated will generate noise emission levels in excess of the background levels.

22.9.9.14 Overall, the magnitude of the impact is deemed to be and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is significant in EIA terms.

22.9.9.15 The substation location and plant strategy is not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds and accounting for maximum operation as part of the MDS.

Decommissioning phase

Magnitude of impact

22.9.9.16 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitudes at various distances from the works site are presented in Table 22.29:.

Table 22.29: Mona Onshore Substation decommissioning noise impact magnitudes.

Magnitude of impact and threshold value period ($L_{Aeq,T}$)	Distance *d* to receptor (m) required for magnitude of impact		
	Weekdays (0700-1900 hours) and Saturdays (0700-1300 hours)	Evening (1900-2300 hours) and weekends (13:00-2300 hours on Saturdays and 0700-2300 hours on Sundays)	Night (2300-0700 hours)
High	$d < 20$	$d < 62$	$d < 217$
Medium	$20 \leq d \leq 34$	$63 \leq d \leq 110$	$218 \leq d \leq 386$
Low	$35 \leq d \leq 62$	$111 \leq d \leq 197$	$387 \leq d \leq 687$
Negligible	$d > 62$	$d > 197$	$d > 687$
No change	-	-	-

Sensitivity of the receptor

22.9.9.17 The nearest receptors are residential in nature and thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

22.9.9.18 The exact locations of the temporary construction compounds are not yet known. Initial proposals show the potential for noise-sensitive receptors to be within 120m of the Mona Onshore Substation site although these properties are static caravans on Lyon Eryl Hall Country Club and Carvan Park and may only be occupied for part of the year. Works are assumed to occur between 07:00 hours and 19:00 hours from Monday to Saturday.

22.9.9.19 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

22.9.9.20 The exact plant and location of the construction works are not yet known and thus there is a high degree of uncertainty to the significance of effects determined. This has been addressed by adopting precautionary thresholds and considering the distances at which the various effects might occur.

22.10 Cumulative Effect Assessment methodology

22.10.1 Methodology

22.10.1.1 The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Mona Offshore Wind Project together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are

based upon the results of a screening exercise (see volume 5, annex 5.1: CEA screening matrix of the PEIR). 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.

22.10.1.2 The noise and vibration CEA methodology has followed the methodology set out in volume 1, chapter 5: EIA methodology of the PEIR. As part of the assessment, all projects and plans considered alongside the Mona Offshore Wind Project have been allocated into 'tiers' reflecting their current stage within the planning and development process, these are listed below.

22.10.1.3 A tiered approach to the assessment has been adopted, as follows:

- Tier 1
  - Under construction
  - Permitted application
  - Submitted application
  - Those currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact
- Tier 2
  - Scoping report has been submitted and is in the public domain
- Tier 3
  - Scoping report has not been submitted
  - Identified in the relevant Development Plan
  - Identified in other plans and programmes.

22.10.1.4 This tiered approach is adopted to provide a clear assessment of the Mona Offshore Wind Project alongside other projects, plans and activities.

22.10.1.5 The specific projects, plans and activities scoped into the CEA, are outline in Table 22.30.

22.10.1.6 National Grid Electricity Transmission (NGET) are proposing to undertake upgrades to their Bodelwyddan substation; to facilitate the connection of multiple projects (e.g. Awel Y Môr). The upgrades will comprise works to the existing substation, an extension to the substation and associated works and infrastructure (e.g. new overhead gantries).

22.10.1.7 It is understood that works to the existing substation will be undertaken via NGET's permitted development rights. The proposed extension to Bodelwyddan substation will require planning consent. At the time of writing, an application had not been submitted to Denbighshire County Council but the anticipated timeframe is early 2024. Given that an application has not been submitted, the potential cumulative impacts of the Bodelwyddan upgrade have not been assessed within the PEIR. This will be re-visited in the application for consent for the Mona Offshore Wind Project should further information become available.

Table 22.30: List of other projects, plans and activities considered within the CEA.

Project/Plan	Status	Distance from the Mona Array Area (km)	Distance from the Mona Offshore/Onshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Tier 1							
Awel y Môr Offshore Windfarm (Onshore Infrastructure)	Application Submitted	12.2	62.1	Application for the construction of a 500MW offshore windfarm. Applicant expects consent in Q3 2023 of 2023.	Construction to commence in 2026.	Site to be commissioned by 2030.	Yes
Major Developments 40/2021/0309	Approved within last 5 years	40.8	0.8	Erection of a 198 bed Registered Care Home (Use Class C2), landscaping, parking facilities and associated works (Resubmission).	Construction to commence in 2024.	N/A	Yes

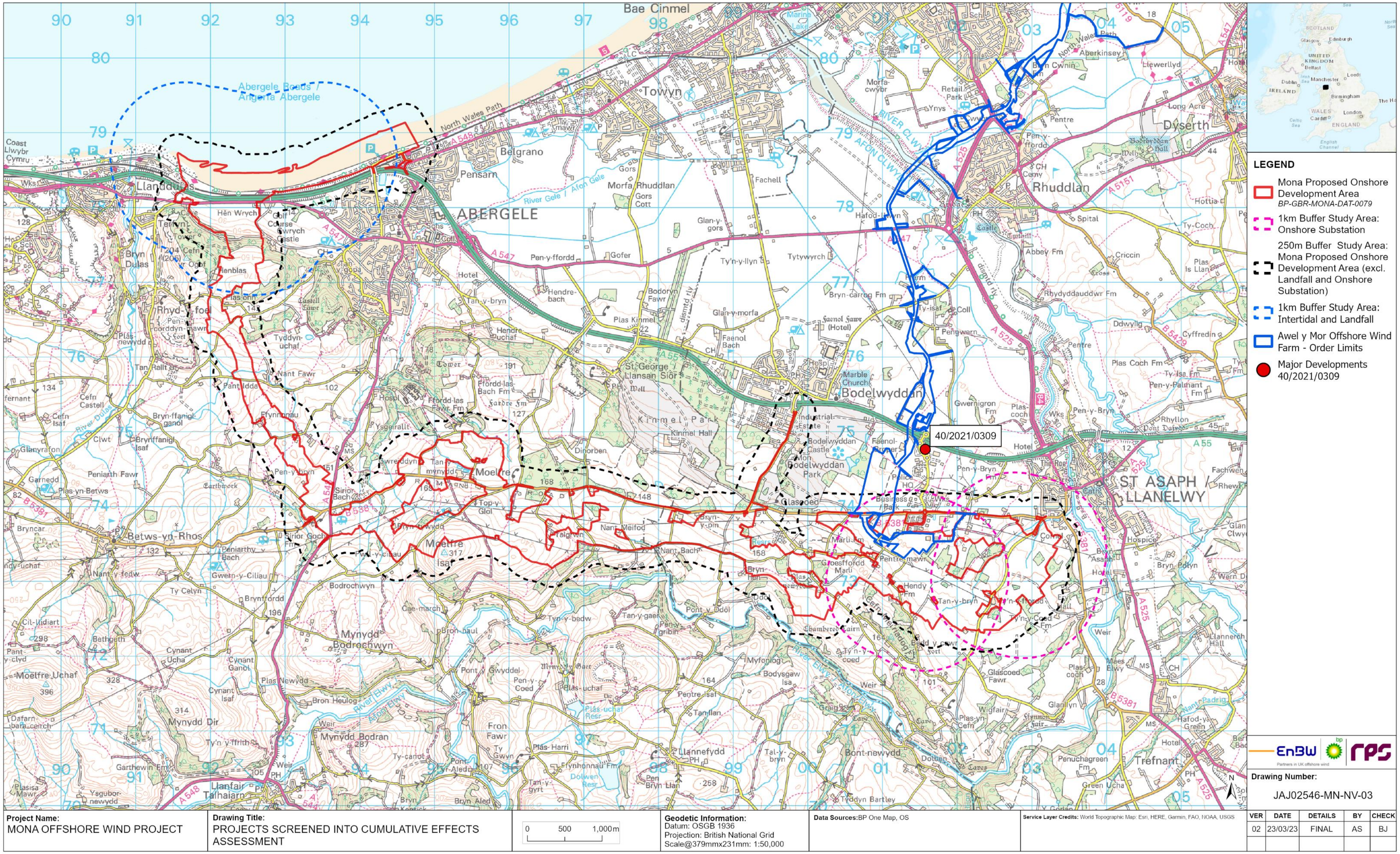

Figure 22.5: Other projects, plans and activities screened into the cumulative effects assessment.

22.10.2 Maximum design scenario

22.10.2.1 The MDSs identified in Table 22.31 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the Project Design Envelope provided in volume 1, chapter 3: Project Description, of the PEIR as well as the information available on other projects and plans, in order to inform an MDS. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different wind turbine layout), to that assessed here, be taken forward in the final design scheme.

Table 22.31: Maximum design scenario considered for the assessment of potential cumulative effects on noise and vibration.

[a] C=construction, O=operations and maintenance, D=decommissioning

Potential cumulative effect	Phase[a]			Maximum Design Scenario	Justification
	C	O	D		
Noise impacts due to the onshore cable route landward of MHWS.	✓	×	×	MDS as described for the Mona Offshore Wind Project (Table 22.19) assessed cumulatively with the following other projects/plans: **Tier 1** • Awel y Môr Offshore Windfarm (Onshore Infrastructure) – Construction works to occur concurrently with the Mona Offshore Wind Project – Night-time HDD to be undertaken simultaneously near Faenol Bropor, St Asaph Road • Major Developments 40/2021/0309T – Construction works to occur concurrently with the Mona Offshore Wind Project – Works to be undertaken during the daytime only.	• Outcome of the CEA will be greatest when the greatest number of other schemes are considered • Volume 3, chapter 10: Noise and vibration of the Awel y Môr Offshore Wind Farm Environmental Statement shows HDD works at a crossing site near the A55 with Faenol Bropor a closest receptor. There may also be an overlap in construction works at the National Grid substation for both the Mona Offshore Wind Project and Awel y Mor.
Noise impacts due to the Mona Onshore Substation.	✓	✓	×	MDS as described for the Mona Offshore Wind Project (Table 22.19) assessed cumulatively with the following other projects/plans: **Tier 1** • Awel y Môr Offshore Windfarm (Onshore Infrastructure) – Onshore substation to commence operation at the same time as the Mona Onshore Substation • Major Developments 40/2021/0309T – Construction works to occur concurrently with the Mona Offshore Wind Project – Works to be undertaken during the daytime only.	• Both the Mona Offshore Wind Project and Awel y Môr Offshore Windfarm proposed to conclude construction at similar times • Construction works for the Mona Offshore Wind Project and Major Developments 40/2021/0309T may occur concurrently.

22.11 Cumulative Effects Assessment

22.11.1.1 A description of the significance of cumulative effects upon noise and vibration receptors arising from each identified impact is given below.

22.11.2 Noise impacts due to the Onshore Cable Corridor landward of the MHWS

Tier 1

Construction phase

Magnitude of impact

22.11.2.1 Volume 3, chapter 10: Noise and vibration of the Awel y Môr Offshore Wind Farm Environmental Statement predicts the following night-time noise level in Table 22.32 at Faenol Bropor, St Asaph Road to be 64 dB $L_{Aeq,8h}$. The closest temporary construction compound in the Mona Proposed Onshore Development Area to this receptor is situated approximately 860m south. The level predicted at this receptor is also presented in Table 22.32 below.

Table 22.32 Night-time HDD noise levels at Faenol Bropor.

Receptor	Noise Level, $L_{Aeq,8h}$ (dB)		Cumulative Level (dB)
	Mona Offshore Wind Project	Awel y Môr Offshore Wind Farm	
Faenol Bropor	38	64	64

22.11.2.2 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **high.**

22.11.2.3 No detailed information on the construction of the erection of a 198 bed Registered Care Home is available. However, there are unlikely to be any noise impacts due to construction of this development due to the distance to the nearest common receptors with the Mona Offshore Wind Project.

22.11.2.4 Volume 3, chapter 10: Noise and vibration of the Awel y Môr Offshore Wind Farm Environmental Statement predicts negligible impacts from the construction of the onshore substation at all receptors.

22.11.2.5 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Sensitivity of the receptor

22.11.2.6 Faenol Bropor and other local receptors are residential and are thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

22.11.2.7 The CoCP will include a noise management plan which will outline measures required such as the use of quieter equipment, acoustic screens, agreed working hours, and communication with the local community.

22.11.2.8 Overall, the magnitude of the impact for concurrent construction between Awel y Môr and the Mona Offshore Wind Project is deemed to be high, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **moderate adverse** significance, which is significant in EIA terms.

22.11.2.9 Overall, the magnitude of the impact for concurrent construction of the proposed 198 bed Registered Care Home and the Mona Offshore Wind Project is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Further mitigation and residual effects

22.11.2.10 Construction noise will be managed via the implementation of a CoCP and best practicable means in the form of mitigation and a noise management plan.

22.11.2.11 Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source.

22.11.2.12 If such measures are implemented, the effect may be reduced to **minor adverse**, which is not significant in EIA terms.

22.11.3 Noise impacts due to the Mona Onshore Substation

Tier 1

Construction phase

Magnitude of impact

22.11.3.1 No detailed information on the construction of the erection of a 198 bed Registered Care Home is available. However, there are unlikely to be any noise impacts due to construction of this development due to the distance to the nearest common receptors with the Mona Offshore Wind Project.

22.11.3.2 Volume 3, chapter 10: Noise and vibration of the Awel y Môr Offshore Wind Farm Environmental Statement predicts negligible impacts from the construction of the onshore substation at all receptors.

22.11.3.3 The cumulative effect is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Sensitivity of the receptor

22.11.3.4 The relevant receptors are residential and are thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

22.11.3.5 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

22.11.3.6 Volume 3, chapter 10: Noise and vibration of the Awel y Môr Offshore Wind Farm Environmental Statement predicts mitigated operational rating sound levels along Glascoed Road of between 26 dB and 29 dB $L_{Ar,Tr}$.

22.11.3.7 Unmitigated levels from the Mona Onshore Substation at these locations is calculated to be around 28 dB $L_{Ar,Tr}$ which is below the night-time background sound level at this location.

22.11.3.8 The cumulative effect is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low.**

Sensitivity of the receptor

22.11.3.9 The relevant receptors are residential and are thus deemed to be of high vulnerability, high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

22.11.3.10 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

22.12 Transboundary effects

22.12.1.1 A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regard to noise and vibration from the Mona Offshore Wind Project upon the interests of other states.

22.13 Inter-related effects

22.13.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Mona Offshore Wind Project (construction, operations and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases (e.g. subsea noise effects from piling, operational wind turbines, vessels and decommissioning)
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on noise and vibration, such as noise from the construction plant, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

22.13.1.2 A description of the likely interactive effects arising from the Mona Offshore Wind Project on noise and vibration is provided in volume 3, chapter 24: Inter-related effects of the PEIR - Onshore.

22.14 Summary of impacts, mitigation measures and monitoring

22.14.1.1 Information on noise and vibration within the noise and vibration study area was collected through desktop review and site surveys.

- Table 22.33 presents a summary of the potential impacts, measures adopted as part of the project and residual effects in respect to noise and vibration. The impacts assessed include:
  - Noise impacts due to offshore piling
  - Noise impacts due to the onshore export cable at the Mona Landfall
  - Vibration impacts due to the onshore export cable at the Mona Landfall
  - Noise impacts due to the Mona Onshore Cable Corridor landward of MHWS
  - Noise impacts due to the Mona Onshore Substation
- Overall, it is concluded that there will be the following significant effects arising from the Mona Offshore Wind Project during the construction, operations and maintenance, or decommissioning phases
  - Construction and decommissioning noise impacts due to the onshore export cables at the Mona Landfall
  - Construction noise impacts due to the Mona Onshore Cable Corridor landward of MHWS
- Table 22.34 presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include:
  - Noise impacts due to the Mona Onshore Cable Corridor landward of MHWS
  - Noise impacts due to the Mona Onshore Substation
- Overall it is concluded that there will be no significant cumulative effects from the Mona Offshore Wind Project alongside other projects/plans.

Table 22.33: Summary of potential environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of impact	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Noise impacts due to offshore piling.	✓	×	✓	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan	C: Low D: Low	C: Medium D: Medium	C: Minor adverse D: Minor Adverse	N/A	N/A	N/A
Noise impacts due to the onshore export cable at the Mona Landfall.	✓	×	✓	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan. Temporary acoustic barriers, quieter equipment, and minimising the amount of night-time work required are possible measures which may reduce noise impacts.	C: High D: High	C: Medium D: Medium	C: Moderate adverse D: Moderate adverse	Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source.	C: Minor adverse	A noise and vibration monitoring strategy may be agreed upon with the relevant stakeholders to ensure compliance with the agreed noise and vibration threshold values.
Vibration impacts due to the onshore export cable at the Mona Landfall.	✓	×	✓	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan	C: Low D: Low	C: Medium D: Medium	C: Minor adverse D: Minor adverse	N/A	N/A	N/A
Noise impacts due to the Mona Onshore Cable Corridor landward of MHWS (HDD).	✓	×	×	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan. Temporary acoustic barriers, quieter equipment, and minimising the amount of night-time work required are possible measures which may reduce noise impacts.	C: High D: Low	C: Medium D: Medium	C: Moderate adverse D: Moderate adverse	Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source.	C: Minor adverse	A noise and vibration monitoring strategy may be agreed upon with the relevant stakeholders to ensure compliance with the agreed noise and vibration threshold values.
Noise impacts due to the Mona Onshore Substation.	✓	✓	✓	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan. Temporary acoustic barriers, quieter equipment, and minimising the amount of night-time work required are possible measures which may reduce noise impacts. An operational noise management plan will also be implemented. The design will incorporate noise control measures such as housing plant internally, positioning equipment away from nearby receptors, and acoustic mitigation such as enclosures and barriers.	C: Low O: Low D: Low	C: Medium O: Medium D: Medium	C: Minor adverse O: Minor adverse D: Minor adverse	N/A	N/A	N/A

Table 22.34: Summary of potential cumulative environmental effects, mitigation and monitoring.

[a] C=construction, O=operations and maintenance, D=decommissioning

Description of effect	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Tier 1										
Noise impacts due to the Mona Onshore Cable Corridor landward of MHWS.	✓	×	×	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan. Temporary acoustic	C: High	C: Medium	C: Moderate adverse	Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators	C: Minor adverse	A noise and vibration monitoring strategy may be agreed upon with the relevant stakeholders to ensure compliance with the

Description of effect	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
				barriers, quieter equipment, and minimising the amount of night-time work required are possible measures which may reduce noise impacts.				will reduce the noise impacts at the source.		agreed noise and vibration threshold values.
Noise impacts due to the Mona Onshore Substation.	✓	✓	×	Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise and vibration management plan. Temporary acoustic barriers, quieter equipment, and minimising the amount of night-time work required are possible measures which may reduce noise impacts.	C: Low O: Low	C: Medium O: Medium	C: Minor adverse O: Minor adverse	N/A	N/A	N/A

22.15 Next steps

22.15.1.1 Post-PEIR, the Mona Proposed Onshore Development Area will be refined to confirm location of the Mona Onshore Cable Corridor, Mona 400kV Grid Connection Cable Corridor and the Mona Onshore Substation. Additional baseline sound measurements will be undertaken to quantify the noise climate at human receptors along the Mona Proposed Onshore Development Area to derive construction threshold limits and inform mitigation strategies to be adopted.

22.15.1.2 Measurements will also be undertaken at locations containing noise sensitive ecological receptors based on the results of ecological surveys undertaken as part of the Mona Offshore Wind Project.

22.15.1.3 The construction noise and vibration assessment will be updated with the construction traffic flows. A full noise assessment will be undertaken for the selected Mona Onshore Substation based on the plant list and layout and noise contours generated from the acoustic model of the Mona Onshore Substation site. The updated construction and operational noise assessments will inform the selection of mitigation measures in consultation with the CCBC and DCC.

22.15.1.4 Mitigation measures can be implemented at the source or between the source and receiver of noise. This includes careful plant selection and design, acoustic enclosures, and barriers. The noise management plan will set out agreed principles and parameters for noise attenuation, which will be incorporated into future noise modelling, as part of the final application.

22.15.1.5 Measures to manage potential construction effects will be further developed and set out in the CoCP. As above, those measures will be developed in consultation with the relevant local planning authorities. This will also include proposed construction hours, covering the different construction sites and types of construction activities that are anticipated for the Mona Offshore Wind Project.

22.16 References

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