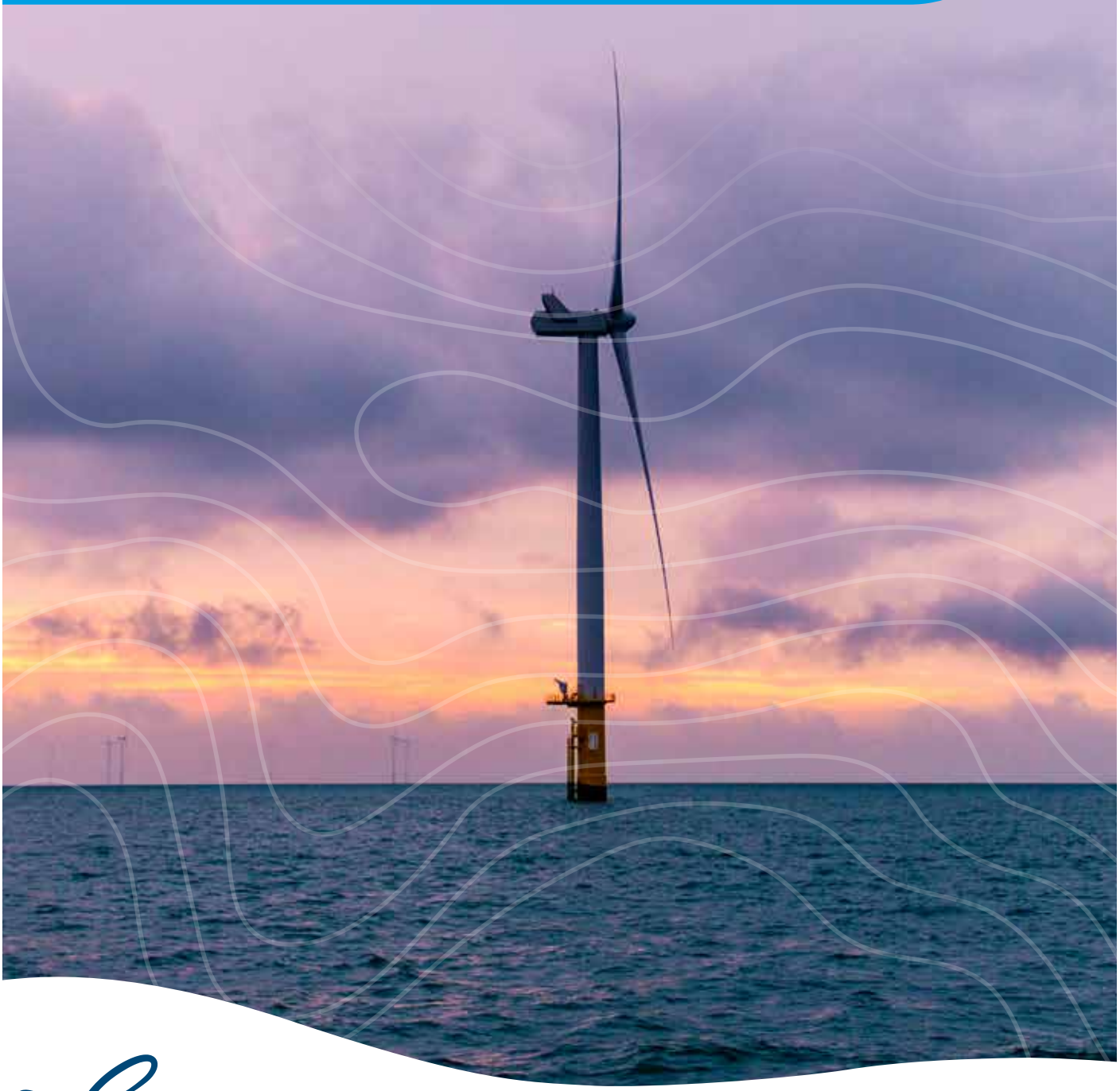
Appendix 5-16:
Monitoring Programme



ORIEL WINDFARM
OFFSHORE RENEWABLE ENERGY

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Energy for generations

ORIEL WIND FARM PROJECT

Environmental Impact Assessment Report - Addendum
Appendix 5-16: Monitoring Programme

MDR1520C
EIAR – Appendix 5-16
A1 C01
December 2025

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1 INTRODUCTION

This document provides details on the proposed monitoring programme for the proposed Oriel Wind Farm Project (hereafter referred to as the Project). The Project is being developed by Oriel Windfarm Limited (hereafter referred to as the Applicant).

This document has been prepared in response to the Request for Further Information (RFI) made by An Coimisiún Pleanála (ACP) (formerly An Bord Pleanála) regarding the planning application (case reference ABP-319799-24) for the Oriel Wind Farm Project (hereafter referred to as "the Project").

Item 1.D of Schedule – Further Information Request requested the Applicant to:

> *The applicant is requested to provide details of an operational monitoring programme for the proposed development. In this regard, the applicant is advised that the proposed operational monitoring programme should fully inform the requirements of any future decommissioning plans and justify any adaptive mitigation measures required. Proposed operational monitoring should be provided at appropriate intervals, for appropriate periods, and provide for adequate reporting to the relevant compliance authorities*.

1.1 Purpose of the programme

The main purpose of the programme is to provide the over-arching framework by which the Applicant will monitor how the marine ecosystems respond to the Project through its lifetime and during decommissioning.

The Project has a design life of 40 years. Therefore, this programme will remain a live document throughout the lifetime of the project to allow the programme to adapt to monitoring findings and new research. It will be used also to review and adapt mitigation and monitoring to findings as required.

This document also provides assurance that the Applicant is committed to implementing the necessary offshore monitoring during all phases of the Project and ensuring it is formally managed.

It should be noted that the final detailed plans for monitoring cannot be produced until post consent and closer to the time that construction commences. It is intended that this document will provide the basis for further discussions with the relevant key stakeholders including prescribed bodies such as the Marine Institute and National Parks and Wildlife Service, other offshore wind farm developers and the relevant compliance authorities. It is important to note that a specific monitoring survey and programme will be designed and developed for each receptor in consultation with the aforementioned stakeholders and therefore complete details on monitoring cannot be provided at this state. This approach to the development of a robust monitoring programme is typical for offshore wind farm developments in the UK and Europe.

1.2 Monitoring Programme structure

This document provides the following:

- Provides an overview of the programme and background to Project (section 1)
- Presents the monitoring programme principles that will be used to guide the development and design and implementation of the monitoring programme and provide details on the Applicant's commitment to implementation of the monitoring programme (section 2);
- Provides details on the approach to the design of the monitoring methodologies (section 3); and
- Proposed details of the Applicant's commitments to monitoring for each of the receptor groups for the Project (section 4).

1.3 Project background

The Project will be located in the Irish Sea, off the coast of County Louth (approximately 22 km east of Dundalk town centre and 18 km east of Blackrock) and will have a maximum export capacity (MEC) of 375 MW.

The Project will comprise of onshore and offshore infrastructure and includes the following key components:

- 25 wind turbine foundations (monopiles) attached to the seabed and associated scour protection;

- 25 WTGs (each comprising a tower section, nacelle and three rotor blades);
- One offshore substation (OSS) and associated foundation (monopile) attached to the seabed;
- A network of 41 km of inter-array cables linking the individual wind turbines to each other and to the offshore substation and associated cable protection;
- A 16 km offshore cable (located in an offshore cable corridor);
- 20.1 km of onshore cables (three) which will be connected to the single offshore cable at a Transition Joint Bay (TJB), a fully buried concrete chamber located at the landfall. The three onshore cables will be installed in the same trench and buried for the entirety of the length from the TJB to the onshore substation; and
- The onshore substation will consist of two parts: a gas insulated switchgear equipment (GIS) located inside a building and outdoor air insulated switchgear equipment (AIS). The GIS will be owned by EirGrid and operated by the ESB Networks as Transmission System Operator. The AIS will form part of the offshore grid which will be owned and operated by EirGrid. Transmission cables from the onshore substation will connect to an existing overhead power line through two new line/cable interface (pylon) masts.

Full details of project description are provided in the EIAR (see volume 2A, chapter 5: Project Description and chapter 5 Addendum: Project Description in EIAR volume 2A Addendum).

The Application was granted a Maritime Area Consent (MAC) in September 2022 (Ref. MAC No. 2002-MAC-001). The Applicant submitted an EIAR in May 2024 along with an application for permission to construct and operate the Project under the Planning and Development Act 2000, as amended.

2 MONITORING PROGRAMME PRINCIPLES

The Applicant proposes the following guiding principles, which will apply to the development of the monitoring programme outlined in this document:

- The Applicant is committed to establishing and maintaining a robust environmental monitoring programme.
- The Applicant is committed to implementing all consent conditions, including those relating to environmental monitoring, stipulated in a grant of permission.
- The Applicant is committed to working with the ORE sector and key industry stakeholders in Ireland to design and implement an integrated 'fit for purpose' environmental monitoring programme that considers the strategic monitoring of OWF developments in the Irish Sea.
  - The Applicant would support agreeing Terms of Reference with the relevant Governmental Departments and stakeholders to provide a clear framework to implement the monitoring of key receptors in the Irish Sea;
  - The Applicant would support setting up advisory groups to develop and design the survey programmes; and
  - The Applicant would support designing a programme to allow for implementation of a standardised approach using common indicators and monitoring methods to allow data sharing and comparison and to facilitate results-based decision making.
- The Applicant is committed to consulting and working with stakeholders and scientific organisations including the Marine Institute, NPWS, BWI, IWDG on the design and scope of environmental monitoring programmes at appropriate spatial and temporal scales using useful and relevant metrics.
- The Applicant is committed to ensuring the environmental monitoring programme follows international best practice. The Applicant is committed to ensuring expertise and knowledge from similar programmes run in other countries is considered in the design of the programme.
- The Applicant would support regular review of the monitoring programme at a frequency to be agreed, to consider lessons learned, new scientific information, new survey technology.
- The Applicant is committed to monitoring to validate the results of models/assessments and if results are higher than predicted, to implement measures to minimise impacts.
- The Applicant is committed to utilising an adaptive approach to update and improve monitoring practices. Such an iterative approach should be taken whereby the scope and design of any new monitoring work should be based on a review of the findings of any preceding phases of monitoring or relevant survey work.
- The Applicant is committed to sharing monitoring data and research findings openly with regulatory bodies, researchers, and other developers to facilitate regional cooperation, and promote best practices.

2.1 East Coast Monitoring Group

The East Coast Phase One offshore wind farm projects (Oriel Wind Farm Project, North Irish Sea Array (NISA), Dublin Array Offshore Wind Farm, Codling Wind Park and Arklow Bank Wind Park 2) recognise the potential need for, and benefits of, strategic monitoring initiatives related to the proposed developments for which consents are being sought. In particular, the complex ecology and mobile nature of some marine receptors mean that a joint approach would be of greatest strategic benefit.

In advance of the submission of the development consent applications, the 'East Coast Monitoring Group' (ECMG) was established following ongoing discussions amongst the developers on the potential benefits of pro-actively establishing a working group. The pro-active approach to establish the ECMG allows for any strategic monitoring to commence in a timely manner if required.

This joint approach is common and has proven effective across a number of jurisdictions including in Scotland and England. The East Coast Phase One offshore wind farm projects have therefore established the ECMG to facilitate the process.

The ECMG are committed to continued collaboration within the group, and with those relevant statutory and technical stakeholders, in order to agree and implement strategic monitoring initiatives where appropriate and relevant. Monitoring initiatives implemented by the Phase One projects will be determined by the conclusions of

the EIAR process, with a focus on validation and evidence gathering. It is anticipated that the ECMG, alongside those relevant statutory and technical stakeholders, would seek to explore and agree monitoring objectives, methodologies and outcomes via ongoing collaborative engagement following consent of the respective projects. The need for site specific monitoring in addition to strategic monitoring, and an individual project's participation in each monitoring proposal, or their level of contribution to agreed monitoring proposals, will be proportionate to the conclusions of the EIAR process.

The Applicant is committed to participating in the ECMG and any other group as required by any future consent on the approach to monitoring environmental receptors and reporting to provide more strategic outputs and potential cost savings.

2.1.1 Strategic monitoring approach

The phase one project developers propose to develop a Strategic Monitoring Programme. This programme will focus on the monitoring of birds, marine mammals and bats in the marine environment to answer key questions at both a development level and a regional level.

An example framework of the approach is outlined in Table 2-1 below. It provides examples of the types of questions that may be posed along with details on group or individual species, proposed methods and an identified preferred method. Once developed this programme, would be subject to agreement with the relevant stakeholders. The Applicant is committed to developing the Strategic Monitoring Programme further with the other developers post consent.

Table 2-1:Example questions to be included in the ECMG Phase 1 Strategic Monitoring Proposal.

Question	Level	Species	Potential Methods	Preferred Method (to be agreed in consultation with key stakeholders)
Birds				
To what extent do seabirds avoid rotor blades and turbines at the micro (blade), meso (individual turbine/row) and macro (entire wind farm) scales?	Strategic	All species	TBC	TBC
Marine Mammals				
Does disturbance to harbour porpoise occur over the predicted ranges? PAM along an impact gradient to monitor echolocation.	Strategic	Harbour Porpoise	PAM along an impact gradient to monitor echolocation	TBC
Bats				
Do bats use the marine environment and, if so, to what distance (km)?	Strategic	All species	Static bat recorders, infrared cameras, LiDAR	TBC

3 MONITORING METHODOLOGY

3.1 Development of monitoring methods

Monitoring should have a clear purpose and be designed to provide answers to specific questions where significant environmental impacts have been identified (Cefas, 2012; OSPAR, 2008). Therefore, the Applicant is committed to designing an appropriate monitoring programme using appropriate methodologies which would;

- Define a clear purpose to provide answers to specific questions;
- Target particularly sensitive receptors/features;
- Utilise appropriate indicators and best available technologies & techniques;
- Follow established, standardised protocols;
- Be based on best practices and outcomes of the latest review of environmental data to ensure robust sample design, statistical power and consistent replication of methods;
- Ensure scientific credibility, reliability, precision, accuracy and feasibility;
- Adopt data standards so that data can be shared with other national, international organisations; and
- Operate across an appropriate scope and scale (temporal and spatial), considering the scale and nature of the Project, environmental pressures and likely significant effects identified and mitigated in the EIAR.

3.2 Consultation

The Applicant is committed to consulting with the compliance authorities and key stakeholders to inform the development of the survey design. The Applicant proposes that consultation would commence on receipt of a consent. Steps proposed are outlined below:

- Meeting with key stakeholders to discuss requirements for monitoring design and methodology;
- Issue draft survey design and methodology;
- Further meeting with key stakeholders to discuss survey feedback;
- Issue final design and methodology;
- Agreement / Approval of survey;
- Issue of survey results/monitoring report to key stakeholders;
- Meeting to discuss adaptive mitigation / monitoring if required;
- Issue of monitoring reports.

The relevant stakeholders for each topic will be agreed as part of the development of the programme and is likely to include those listed in Table 3-1 below along with the agreed compliance authorities.

Table 3-1: Non exhaustive list of key stakeholders for consultation on monitoring programme.

Topic	Consultee
Benthic Subtidal and Intertidal Ecology	NPWS, Louth Co. Co. Marine Institute, EPA
Fish & Shellfish Ecology	NPWS, IFI, Marine Institute
Marine Mammals and Megafauna	NPWS, IWDG, Marine Institute
Ornithology	NPWS, BirdWatch Ireland, Louth Co. Co., Marine Institute
Bats	NPWS, Bat Conservation Ireland, Louth Co. Co.
Commercial Fisheries	SFPA, Fishing Organisations
Marine Archaeology	National Monuments Service (including Underwater Archaeology unit), Louth Co. Co.

3.3 Guidance / Best Practice

Part 1 of the *Guidance on Marine Baseline Ecological Assessments and Monitoring Activities Offshore Renewable Energy Projects (*Department of Climate, Energy and the Environment*, 2018)* provides a non-technical summary of the baseline data requirements and monitoring that may be necessary to evaluate potential impacts of offshore renewable energy projects on the marine environment. Although this guidance relates to collection of baseline data, it provides useful information on survey timings, survey design and post construction operational monitoring methods. Part 2 provides greater technical detail on the design of monitoring and assessments for pre-construction and post construction phases.

The EPA Guidelines on the *Information to be Contained in Environmental Impact Statements (2002) EPA Guidelines* (2022) does not provide detail regarding the design of monitoring programme, however they state that 'It may be appropriate, where relevant, to propose monitoring takes place after consent is granted in order to check that the project in practice conforms to the predictions made during the EIA and to record any unforeseen effects in order to undertake appropriate remedial action'.

There are a number of guidance documents in the UK and Europe which can be considered when developing the monitoring programme. These include Standardisation of Post-Consent Environmental Monitoring for Wind Farms in English Waters (Marine Management Organisation (MMO), 2025). The guidance was developed in collaboration with industry groups and statutory nature conservation bodies (SNCBs) to standardise the monitoring of offshore wind farms.

As part of the development of the survey methodology, relevant and up to date guidance will be listed and referenced to inform the survey design. Specific guidance relevant to each receptor group will be referenced.

The Applicant is also committed to ensure the monitoring programme is developed having regard to other similar monitoring programmes that are in place across Europe. The Applicant notes 'Review of Biodiversity Data Needs and Monitoring Protocols for the Offshore Wind Energy Sector undertaken by Renewables Grid Initiative (The Renewables Grid Initiative is a unique collaboration of environmental NGOs and Transmission System Operators from across Europe). This document provides the results of a review undertaken in 2021 into current biodiversity monitoring needs and practices in the Baltic Sea and the North Sea, where wind energy development has taken place. The key recommendations from this programme include:

1. Adopt common core indicators.
2. Use harmonised monitoring methods and standardised protocols in integrated systems.
3. Adopt a set of key monitoring principles and approaches, focused on:
   - best practice for indicator development;
   - choosing methods based on indicators and monitoring questions;
   - defining the appropriate scope and spatial and temporal scale;
   - engaging key actors;
   - designing fit-for-purpose monitoring programmes;
   - and collating data in standard formats to facilitate data sharing.
4. Conduct research to improve monitoring focus and effectiveness.
5. Enhance regional and sectoral collaboration on standardising monitoring protocols and data collection formats to facilitate data sharing and results-based decision-making.

Lessons learned from these and other programmes will inform the development of the monitoring programme.

3.4 National / regional monitoring programmes

The Marine Institute in their submission to An Coimisiún Pleanála (formally An Bord Pleanála) referred to the requirement for ongoing monitoring and outlined that the parameters to be monitored should be defined in consultation with existing national monitoring programmes and based on international best practice. The Marine Institute also referenced ongoing monitoring studies (such as Royal Belgian Institute of Natural Sciences) to inform the selection of metrics and that data management processes will need to comply with recognised international standards.

National monitoring programmes such as INFOMAR and ObSERVE and those undertaken by the Marine Institute are established monitoring programmes. As part of the implementation and monitoring of the SC-DMAP, the Marine Institute will also develop a monitoring and research programme within the SC-DMAP area, in order to monitor whether there are changes to the marine ecosystem following the development of ORE. The governance structure for the SC-DMAP will also include a Marine Ecosystems and Ornithology Working Group, which will assist in monitoring the implementation of the SC-DMAP from an environmental perspective.

The Applicant is committed to defining parameters that are used on national monitoring programmes and in accordance with best practice.

3.5 Reporting

The design of monitoring programme and individual surveys will set out the reporting requirements including key indicators and intervals for reporting. All survey reports will be issued to the compliance authorities and stakeholders as required by conditions of consent and agreed as part of the survey design (i.e. frequency of reporting). The result of surveys will be discussed to determine any requirements to adapt monitoring or mitigation measures. Reports will be prepared and submitted on an annual basis, as required subject to agreement with the compliance authority and any consent conditions.

3.6 Implementation

As outlined under the ‘programme principles’, the Applicant is committed to implementing the monitoring programme. The Applicant is committed to putting resources in place to manage the development of the monitoring programme including the setting up of advisory group and appointment of Ecological Clerk of Works and specialists to develop the monitoring programme. The roles and responsibilities will be set out in detail in the monitoring programme.

3.7 Adaptive mitigation / monitoring

In the event that results in the monitoring report’s identify impacts which are beyond those predicted within the EIAR or identifies impacts that were not predicted, adaptive management/mitigation may be required to reduce impacts. An Adaptive Management/Mitigation Plan to reduce effects to within what was predicted within the EIAR will be prepared alongside proposals for monitoring reports to test effectiveness. This plan, which will be agreed with the relevant compliance authorities and the relevant stakeholders, will set out how to reduce effects to a suitable level for the Project. Following implementation, monitoring will continue to assess the effectiveness of adaptive measures, ensuring that impacts are brought within acceptable limits allowing for further adjustments if necessary. The monitoring programme outlined in section 4 includes ‘adaptive measures’ that will be reviewed on a regular basis to ensure best scientific data and knowledge is incorporated into any plans to adapt mitigation or monitoring.

3.8 Inform future decommissioning

EU policy on decommissioning offshore wind farms is an emerging and evolving area as the earliest generation of offshore wind farms in Europe approach the end of their life cycles. There is increasing consideration of partial decommissioning, where some structures may be left in place, potentially benefiting biodiversity and reducing environmental impact, but this raises questions about residual liability and regulatory frameworks (as outlined in “Science for Environment Policy”: European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol (2025)).

The monitoring programme will provide information on the environmental changes over the lifetime of the project. This information will be important in designing and informing the decommissioning of the Project that minimises the impact on the environment.

As part of the ongoing updates to the monitoring programme, the Applicant proposes to keep up to date with changes in policy and best practice for the decommissioning of offshore wind farms. The Applicant proposes to review the design of the decommissioning on a regular basis in the context of the baseline environment data to ensure that any decommissioning plan is sustainable and protects the environment.

4 MONITORING PROGRAMME

The following sections outline the Applicant monitoring commitments per topic. Topics which do not have monitoring commitments because there is no potential for likely significant effects are also listed as this monitoring programme is a live document and future monitoring/research may result in changes to monitoring.

For each topic where monitoring is proposed, a table is presented which details:

- The potential effects and receptor(s) for which monitoring is considered necessary;
- Monitoring objectives;
- The approach to monitoring;
- Links to other monitoring (if relevant);
- Method of securing monitoring – this will include relevant conditions of the grant of planning permission;
- Rationale; and
- Strategic approach – this will set out details on the approach to monitoring that requires strategic approach.

The tables are divided into sections for pre-construction monitoring, construction monitoring, operational monitoring and decommissioning. At this stage, no monitoring approaches are outlined for the decommissioning phase, however this phase will be included closer to the time of decommissioning and on review of monitoring data collected throughout the operational phase.

Monitoring of all receptors identified in the Guidance on Marine Baseline Ecological Assessments & Monitoring Activities for Offshore Renewable Energy Projects (2018) is provided including bats.

4.1 Marine Processes

4.1.1 Assessment conclusions

No marine processes monitoring to test the predictions made within the impact assessment are proposed as the assessment concluded that residual effects with be imperceptible to slight and therefore there is no potential for significant effects (see chapter 7: Marine Processes, EIAR volume 2B). However, the Applicant is committed to monitoring any changes to seabed hydromorphology as part of the ongoing monitoring and maintenance of the Project.

4.1.2 Approach to monitoring

Table 4-1 provides the information on the Applicant's commitments to monitoring any changes to seabed hydromorphology. Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following consultation with the compliance authorities and key stakeholders (including collaboration with other OWF developers).

Table 4-1 Monitoring proposed Marine Processes.

Potential effect	Receptor	Monitoring objectives	Monitoring approach including intervals	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction -								
Potential effect on seabed hydromorphology from the installation of inter array / interconnector cables	Sediment transport and sediment transport pathways	To monitor changes to seabed hydromorphology following the installation of inter array and export cables.	Data from the preconstruction hydrographic and side scan sonar surveys to establish a baseline on the presence and nature of seabed within the offshore wind farm area. The monitoring plan will be prepared post consent and submitted to the compliance authorities at least six months prior to the first pre-construction survey. Intervals: yearly geophysical survey along export cable and every five years in offshore wind farm area during the operational and maintenance phase.	Monitoring will adopt an adaptive approach in terms of reviewing the findings of the post consent surveys with the compliance authorities and relevant statutory advisors, with the need for further monitoring actions to be discussed	Benthic subtidal ecology (Table 4-2), Commercial fisheries (Table 4-7), Marine archaeology (Table 4-8).	Secured through conditions.	To validate predications made in the EIAR with regard to changes in physical environment and to provide information to be considered in the context of seabed mobility.	n/a
Construction								
n/a								
Operational and maintenance phase								
As above for pre-construction								
Decommissioning phase								
TBC								

4.2 Benthic Subtidal and Intertidal Ecology

4.2.1 Assessment conclusions

The assessment concluded that residual effects will be imperceptible to slight adverse and therefore there is no potential for significant effects and as such specific benthic monitoring is not proposed to test predictions of the EIAR.

However, the Applicant is committed to monitoring any changes in habitats and Table 4-2 below provides monitoring appropriate for benthic subtidal and intertidal receptors during the pre-construction, construction and operational and maintenance phases of the project. It should be noted that as set out in the EIAR and the EIAR Addendum, monitoring from offshore wind farms in other jurisdictions have not shown broadscale adverse effects on benthic subtidal and intertidal ecology. As such, the monitoring proposed is considered to be proportionate to the risk posed to these receptors, while allowing for an adaptive approach to monitoring where unexpected effects are detected in the monitoring programme (noting that the evidence from other jurisdictions indicates the risk of unexpected effects on benthic receptors is unlikely).

4.2.2 Approach to monitoring

Table 4-2 sets out the Applicant's monitoring commitments from chapter 8: Benthic Subtidal and Intertidal Ecology (EIAR volume 2B). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following consultation with the compliance authorities and key stakeholders.

Table 4-2 Monitoring proposed for Benthic Subtidal and Intertidal Ecology.

Potential effect	Receptor	Monitoring objectives	Monitoring approach including intervals	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction -								
Long term subtidal habitat loss	Biogenic reef habitats	The objective of the survey will be to confirm the location and extent of any reef features so that it can, where possible, be avoided through micrositing of infrastructure.	Preconstruction survey (drop down video survey) to determine extent, distribution and quality/condition of reef habitats if present. See EIAR volume 2B Addendum, chapter 8 Addendum: Benthic Subtidal and Intertidal Ecology for further detail of scope. Interval: One survey during pre-construction	Presence of reef habitat will inform appropriate mitigation measures (e.g. layout refinement) to avoid biogenic reefs.	Pre-construction geophysical survey (see below) and Geophysical Survey completed as part of Foreshore Licence Application	Secured through conditions	To confirm presence of reef and if present to avoid reef through micrositing.	n/a
Potential effects on benthic subtidal ecology receptors	Seabed substrates and sediments and associated benthic ecology receptors	To establish a baseline for future monitoring of seabed, substrates/ sediments and hydromorphology.	Data from the pre-construction geophysical surveys to establish a baseline on the presence and nature of seabed within the offshore wind farm area and export cable corridor. The monitoring plan will be prepared post consent and submitted to the compliance authorities at least six months prior to the first pre-construction survey. Interval: one single pre-construction geophysical survey.	Monitoring will adopt an adaptive approach in terms of reviewing the findings of the post consent surveys with the compliance authorities and relevant statutory advisors, with the need for further monitoring actions to be discussed (see below).	Marine Processes (Table 4-1), Fish and Shellfish Ecology (Table 4-3), Commercial fisheries (Table 4-7).	Secured through conditions	To validate predications made in the EIAR with regard to recovery of sediments following construction operations.	n/a

Potential effect	Receptor	Monitoring objectives	Monitoring approach including intervals	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Construction								
Temporary term intertidal habitat loss	Intertidal habitat	The objective of the survey will be to supervise the reinstatement of the intertidal zone following cable installation to ensure habitat is reinstated by particle size.	Ecologist to supervise the reinstatement of the intertidal zone following cable installation. Any cut rock will be placed back on top of the cable to backfill the trench. Sediments/shingle removed will be reinstated by particle size.	No adaptive measures are proposed	n/a	Secured through conditions	To ensure correct reinstatement	n/a
Operational and maintenance phase								
Potential effects on benthic subtidal ecology receptors	Subtidal seabed substrates and sediments and associated benthic ecology receptors	To monitor recovery of seabed, substrates/ sediments and hydromorphology following the installation of inter array and export cables and potential changes to these during the operational and maintenance phase.	Data from the geophysical surveys post construction and during the operational and maintenance phase to monitor seabed recovery and potential changes to the seabed within the offshore wind farm area and export cable corridor. The monitoring plan will be prepared post consent and submitted to the compliance authorities at least six months prior to the first pre-construction survey. Intervals: yearly geophysical survey along export cable and every five years in offshore wind farm area during the operational and maintenance phase.	Monitoring will adopt an adaptive approach in terms of reviewing the findings of the post consent surveys with the compliance authorities and relevant statutory advisors, with the need for further monitoring actions to be discussed. Where geophysical surveys demonstrate a significant shift in broadscale sediment types, then further investigations (e.g. seabed imagery and grab sampling) would be required.	Marine Processes (Table 4-1), Fish and Shellfish Ecology (Table 4-3), Commercial fisheries (Table 4-7).	Secured through conditions	To validate predications made in the EIAR with regard to recovery of sediments following construction operations.	n/a

Potential effect	Receptor	Monitoring objectives	Monitoring approach including intervals	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Decommissioning phase								
n/a								

4.3 Fish and Shellfish Ecology

4.3.1 Assessment conclusions

No fish and shellfish monitoring to test the predictions made within the impact assessment are proposed as the assessment concluded that residual effects with be imperceptible to slight adverse and therefore there is no potential for significant effects.

However, the Applicant is committed to monitoring any changes for fish and shellfish and in line with the RFI (section 1) to provide details of the operational monitoring programme, Table 4-3 below provides monitoring appropriate for fish and shellfish receptors during the pre-construction, construction and operational and maintenance phases of the project. It should be noted that as set out in the EIAR and the EIAR Addendum, monitoring from offshore wind farms in other jurisdictions have not shown broadscale adverse effects on fish and shellfish ecology. As such, the monitoring proposed is considered to be proportionate to the risk posed to these receptors, while allowing for an adaptive approach to monitoring where unexpected effects are detected in the monitoring programme (noting that the evidence from other jurisdictions indicates the risk of unexpected effects on fish and shellfish receptors is unlikely).

4.3.2 Monitoring approach

Table 4-3 sets out the Applicant's monitoring commitments from chapter 9: Fish and Shellfish Ecology (EIAR volume 2B) and chapter 9 Addendum: Fish and Shellfish Ecology (EIAR volume 2B Addendum). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following consultation with the compliance authorities and key stakeholders.

Table 4-3 Monitoring proposed for Fish and Shellfish Ecology

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction								
Potential effects on herring spawning	Herring	The objective of the survey is to monitor egg/larval activity and better understand spawning activity.	Methodology to be agreed with key stakeholders in advance. Surveys could include either trawl surveys for adult herring (to see if they are spawning) or egg/larvae surveys to detect recent spawning activity. Interval: One survey during spawning period over one / two years prior to construction	Survey results will be used devise mitigation options for piling noise impacts on herring. Also, to explore potential initiatives which could aid herring spawning population, such as oyster beds (shells are used for laying eggs on) within final design of cable protection and scour protection.	n/a	Secured through conditions	To confirm presence of spawning habitat.	TBC
Potential effects on fish and shellfish receptors	Seabed substrates and sediments and associated fish and shellfish ecology receptors	To establish a baseline for future monitoring of seabed, substrates/ sediments and hydromorphology.	Geophysical surveys of seabed substrates and sediments. See Table 4-2 for benthic subtidal and intertidal ecology. As fish and shellfish community composition is usually highly correlated with seabed sediments, this monitoring would help to detect large scale environmental changes which may result in changes to community composition.	See Table 4-2 for benthic subtidal and intertidal ecology. Should unexpected broadscale changes to sediment/substrate composition occur, then further monitoring of fish and shellfish communities would be scoped and agreed with stakeholders.	See Table 4-2	See Table 4-2	See Table 4-2	See Table 4-2
Construction								
n/a								

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Operational and maintenance								
Potential effects on herring spawning	Herring	The objective of the survey is to monitor egg/larval activity and better understand spawning activity	Methodology to be agreed with key stakeholders in advance. Surveys could include either trawl surveys for adult herring (to see if they are spawning) or egg/larvae surveys to detect recent spawning activity. Interval: One survey during spawning period over a number of years to be agreed with key stakeholders	Survey results will be used to monitor effectives of measures and propose further measures if required.	n/a	TBC	To confirm effectiveness of measures.	TBC
Potential effects on fish and shellfish receptors	Seabed substrates and sediments and associated fish and shellfish ecology receptors	To monitor recovery of seabed, substrates/ sediments and hydromorphology following the installation of inter array / interconnector cables and potential changes to these during the operational and maintenance phase.	Geophysical surveys of seabed substrates and sediments. See Table 4-2 for benthic subtidal and intertidal ecology. As fish and shellfish community composition is usually highly correlated with seabed sediments, this monitoring would help to detect large scale environmental changes which may result in changes to community composition.	See Table 4-2 for benthic subtidal and intertidal ecology. Should unexpected broadscale changes to sediment/substrate composition occur, then further monitoring of fish and shellfish communities would be scoped and agreed with stakeholders.	See Table 4-2	See Table 4-2	See Table 4-2	See Table 4-2
Decommissioning phase								
n/a								

4.4 Marine Mammals and Megafauna

4.4.1 Assessment conclusions

No marine mammals and megafauna monitoring to test the predictions made within the impact assessment are proposed as the assessment concluded that residual effects with be imperceptible to slight adverse and therefore there is no potential for significant effects. However, monitoring is proposed in chapter 10 Addendum: Marine Mammals and Megafauna (volume 2B Addendum) for installation of the foundations. The Applicant is committed to undertaking subsea noise monitoring at the first four monopile installations (as a minimum) to confirm the noise abatement achieved by the proposed MODIGA casing technology.

4.4.2 Monitoring approach

Table 4-4 sets out the Applicant's monitoring commitments from chapter 10: Marine Mammals & Megafauna (EIAR volume 2B). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following collaboration with other OWF developers and consultation with key stakeholders and relevant compliance authorities.

Table 4-4 Monitoring proposed for Marine Mammals and Megafauna.

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction								
n/a	Marine mammals	To define updated pre-construction populations	Digital Aerial Surveys (DAS)	No adaptive measures are proposed	n/a	TBC	To update the baseline and provide further data in the Irish Sea	Yes, TBC
Construction								
Injury and disturbance from elevated underwater sound levels during impact piling and drilling operations.	Marine mammals	To ensure the level of underwater sound generated from installation is not greater than predicted, and estimate the error of the modelled predictions. To establish the effect of the "MODIGA" installation system against modelled source levels and received levels. ("source levels" understood here as equivalent point sources, as back-calculated from measurements as opposed to line sources or sound fields next to the pile).	As the offshore wind farm area is generally of uniform depth the installation method is similar for all piles, only a small number of installations will have to be monitored to obtain a representative sample of noise emissions from the construction. Measurements of underwater sound generated by the installation of foundations in the shallowest (c. 20 m) and deepest part (c. 30 m) of the offshore wind farm area will provide sufficient information. To establish the actual mitigation performance of the MODIGA system a "high-SPL" (low sensitivity) logger should be placed within 100 m of the installation. To aide in validating and potentially adjusting the modelled effect ranges additional loggers should be placed at ranges of c. 500 m and 1,000 m from the installation site. Having at least three loggers positions in a single transect line enables good estimation of true noise propagation losses. The logging should capture the whole installation procedure from the setup of the MODIGA system	The results of the initial underwater sound measurements will be provided to the compliance authorities within eight weeks of the installation of the monitored piles. The assessment of this report by the compliance authorities will determine whether any further underwater sound monitoring is required, or indeed if any further mitigation is required.	n/a	TBC A deployment plan for the monitoring campaign will be produced to identify risks and challenges and lay out suitable solutions and actions to ensure timely completion of this task.	To ensure mitigation measures are adequate, and to estimate the efficacy of the MODIGA system adding to the accuracy of future assessments.	TBC

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
			on the installation site until impact piling and drilling has completed for that pile. Given the uniform depths and sediments, transmission losses will be invariant of heading and a single set of 3x logging positions will be sufficient for each monitored installation. Thus, a minimum of 3 logger positions are needed for at least two installation sites. Subject to review of site conditions and risk of equipment and/or data loss due to human activities (e.g. fishing) or logger failure, more than one logger per position might be required and loggers might need to be protected either with physical barriers (e.g. scour protection) or by deploying them with no surface markers (to avoid ship collision and surface interference/entanglement).					
Operational and maintenance								
n/a								
Decommissioning phase								
TBC								

4.5 Ornithology

4.5.1 Assessment conclusions

Continual collection of abundance and distributional data in years 0, 1, 3, 5 and 15 post construction. The Year 0 survey is proposed so that an updated pre-construction population can be defined. No impacts are predicted to be significant in EIA terms, so this monitoring is proposed to be undertaken to help provide extra evidence within the Irish Sea to confirm the conclusions of this EIAR.

This monitoring requirement is set out in DCCAE's guidance to inform ecological monitoring (DCCAE, 2018).

The Applicant is also aware of recent research automating data analysis in digital aerial surveys to enhance wildlife protection and survey efficiency (Ecological Informatics 90 (2025) 103242). These and other research papers will be referred to in developing the programme.

4.5.2 Monitoring approach

Table 4-5 sets out the Applicant’s monitoring commitments from chapter 11: Offshore Ornithology (EIAR volume 2B). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following collaboration with other OWF developers and consultation with key stakeholders and relevant compliance authorities.

The Applicant is committed to post-construction monitoring including review of requirement and optioneering of on-turbine detection systems to improve understanding of risks to migrating birds and to inform adaptive management. Technologies under consideration include automated avian radar, thermal/infrared and high-resolution camera systems, passive acoustic monitoring (PAM) and real-time detection/identification algorithms. Results from monitoring will be used to evaluate the need for, and the effectiveness of, adaptive measures (for example, targeted curtailment during periods of elevated risk) and to refine operational protocols where justified.

Table 4-5 Monitoring proposed for Offshore Ornithology.

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction								
n/a	Birds	To define updated pre-construction populations	Digital Aerial Surveys (DAS)	No adaptive measures are proposed	n/a	TBC	To update the baseline and provide further data in the Irish Sea	Yes, TBC
Construction								
n/a								
Operational and maintenance								
Displacement	Key bird species including guillemot, razorbill and divers	To establish any significant change from baseline conditions to test key predictions	Digital Aerial Surveys (DAS	No adaptive measures are proposed	n/a	TBC	To add to the data of birds in the marine environment and monitor the impact of the Project.	Yes, TBC
Displacement, collision	Key bird species including gannet, kittiwake, common gull, herring gull, great black-backed gull	To establish any significant change from baseline conditions to test key predictions	Deployment of systems such as radar and camera - based systems, Passive Acoustic Monitoring (PAM) and other systems (e.g. LiDAR) for monitoring of key receptors Monitoring will be reviewed annually until decommissioning. Systems to be adapted based on the results. Interval: continuous	Optioneering Turbine curtailment criteria based on a combination of conditions (i.e. ideal conditions for birds) to stop or slow down the turbines during peak migration periods. Bird data will be collected from the turbine, and upon agreement with the compliance authorities, any optioneering of a curtailment criteria will be based on the results of bird migration records during the first year of operation.	n/a	TBC	To add to the data of birds in the marine environment and monitor the impact of the Project.	Yes, TBC
Decommissioning phase								
TBC								

4.6 Bats

4.6.1 Assessment conclusions

No bat monitoring to test the predictions made within the impact assessment are proposed as the assessment concluded that residual effects will be imperceptible to slight adverse and therefore there is no potential for significant effects. However, due to limitations in undertaking bat surveys in the marine environment and also because bat usage of the marine environment (either for foraging or migration) is an emerging science, monitoring during the operational phase is proposed.

4.6.2 Monitoring approach

Table 4-6 sets out the Applicant's monitoring commitments from chapter 31: Bats in the Marine Environment (EIAR volume 2C). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following collaboration with other OWF developers and consultation with key stakeholders and relevant compliance authorities.

Table 4-6 Monitoring proposed for Bats in the Marine Environment

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction								
No effect being monitored – baseline data to be collected.	Bats	Gather information on the usage of the offshore wind farm area by migrating bats.	Vessel survey using two onboard bat detectors will be employed. Data will be collected weekly during both peak bat migration periods (spring and autumn).	n/a	n/a	TBC	To provide further data on bats in the marine environment.	Yes, TBC
Construction								
n/a								
Operational and maintenance								
Injury and/or fatality.	Bats - Nathusius' pipistrelle, common pipistrelle, soprano pipistrelle and Leisler's bat.	Monitor bats during peak migration periods and the success of mitigation measures.	Deployment of thirty static bat detectors evenly across fifteen wind turbines within the offshore wind farm area (one at the lowest blade tip height; and one at the nacelle). Monitoring will be carried out annually until decommissioning unless otherwise agreed with the NPWS.	Turbine curtailment criteria will be established based on a combination of conditions (i.e. ideal conditions for bats) to stop or slow down the turbines during peak bat migration periods. Bat data will be collected at the lowest blade tip height and at the nacelle height, and upon agreement with the NPWS, an adjustment to the curtailment criteria may be made based on the results of bat migration records during the first year of operation.	n/a	TBC	To add to the data of bats in the marine environment and monitor the success of mitigation measures.	Yes, TBC
Decommissioning phase								
n/a								

4.7 Commercial Fisheries

4.7.1 Assessment conclusions

No commercial fisheries monitoring to test the predictions made within the impact assessment is considered necessary. However, it is recognised that static gear fisheries can be particularly affected by offshore wind development, due to their strong fidelity to specific sites (Roach et al., 2022). Therefore, on a precautionary basis, a study will be undertaken in collaboration with local fishers to monitor the static (pot) fisheries before and after construction of the Project.

Further to the above, the Applicant commits to work in collaboration with the Marine Institute and the fishing industry to support the proactive implementation of inshore Vessel Monitoring Systems (iVMS) on selected fishing vessels operating in and around the development areas. This initiative will:

- Enable real-time and long-term monitoring of fishing patterns, both within the array areas and cable corridor areas, as well as in neighbouring grounds;
- Provide essential baseline data ahead of construction, against which future displacement or redistribution of fishing effort during construction and operation can be compared;
- Be implemented through voluntary participation, targeting a representative spread of vessel sizes and fishing methods, particularly those not currently mandated to carry VMS;
- The Marine Institute's existing scheme for the provision of free iVMS units will be utilised to support uptake, and the Applicants will facilitate outreach and coordination through Company Fisheries Liaison Officers.

This is in line with the '*next steps'* outlined in the Seafood ORE Working Group's annual report.

Table 4-7 below also sets out monitoring of seabed sediments/substrates in line with fish and shellfish receptors (see section Table 4-3) during the pre-construction, construction and operational and maintenance phases of the project.

4.7.2 Monitoring approach

Table 4-7 sets out the Applicant's monitoring commitments from chapter 12: Commercial Fisheries (EIAR volume 2B). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following collaboration with other OWF developers and consultation with key stakeholders and relevant compliance authorities.

Table 4-7 Monitoring proposed for Commercial Fisheries.

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction								
n/a – monitoring to inform baseline of fisheries	Static (pot) fisheries	A study will be undertaken in collaboration with local fishers to monitor static (pot) fisheries and establish a baseline dataset.	Monitoring of fisheries is likely to involve the following: Vessel monitoring and fishing effort tracking including inshore Vessel Monitoring Systems (iVMS); Gear interaction surveys - including direct inspections of gear, fisher reports and underwater video monitoring; Catch and effort monitoring; Fishers engagement; and Review of environmental monitoring data.	TBC	See fish and shellfish ecology (Table 4-3)	TBC	To ensure minimal impact on static fisheries	N/A
Potential effects on fish and shellfish receptors	Seabed substrates and sediments and associated fish and shellfish ecology receptors	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3
Construction								
n/a								
Operational and maintenance								
Displacement of static gear fisheries	Static (pot) fisheries	A study will be undertaken in collaboration with local fishers to monitor static (pot) fisheries against the baseline dataset.	Monitoring of fisheries is likely to involve the following: Vessel monitoring and fishing effort tracking; Gear interaction surveys - including direct inspections of gear, fisher reports and underwater video monitoring; Catch and effort monitoring; Fishers engagement; and Review of environmental monitoring data.	TBC	See fish and shellfish ecology (Table 4-3)	TBC	To ensure minimal impact on static fisheries	N/A
Potential effects on fish and shellfish receptors	Seabed substrates and sediments and associated fish and shellfish ecology receptors	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3	See Table 4-3
Decommissioning phase								
n/a								

4.8 Marine Archaeology

4.8.1 Assessment conclusions

No marine archaeology monitoring to test the predictions made within the impact assessment are proposed as the assessment concluded that residual effects with be slight adverse and therefore there is no potential for significant effects. However, monitoring of marine archaeological receptors is incorporated as a measure included in the Project, as outlined below.

4.8.2 Monitoring approach

Table 4-8 sets out the Applicant's monitoring commitments from chapter 15: Marine Archaeology (EIAR volume 2B). Should the Project receive consent, the details in this table will be updated to include relevant conditions, and any monitoring requirements following collaboration with other OWF developers and consultation with key stakeholders and relevant compliance authorities.

Table 4-8 Monitoring proposed for Marine Archaeology

Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
Pre-construction								
Removal or disturbance of sediment in various locations.	Undiscovered marine archaeological features.	To record archaeological remains that may be affected by pre-construction operations.	Protocols for monitoring will be included in the Marine Archaeological Management Plan. Where appropriate, the archaeologist will carry out watching briefs of work. ROV/ diver surveys may be required. Archaeological monitoring will be licensed by the Department of Housing, Local Government and Heritage. If any archaeological features or material are uncovered, work will cease in order for the Archaeologist to inspect any such material. Full archaeological recording will be undertaken. Full excavation will be undertaken if it is not possible for works to avoid the material. The National Museum of Ireland (NMI) Advice notes will be followed should archaeological objects require exportations.	Micrositing to avoid the material and if not full excavation will be undertaken if it is not possible to avoid works.	n/a	TBC	To avoid impacts on unrecognised archaeological sites and/or to improve understanding of identified sites of potential archaeological importance.	n/a
Impacts to sites of important archaeological potential.	Sites of important archaeological potential within Archaeological Exclusion Zones (AEZ).	To monitor the AEZs and ensure that that the potential for direct impacts on site with important archaeological potential is avoided and therefore sites are preserved.	Ongoing monitoring of known archaeological receptors through the acquisition of relevant spatial survey data and possibly periodic reporting on adherence to exclusion zones and the results of watching briefs.	TBC	n/a	TBC	Monitoring AEZs will ensure that any impacts are identified at an early stage.	n/a
Construction								
Removal or disturbance of sediment in	Undiscovered marine archaeological features.	To record archaeological remains that may be affected by	Protocols for monitoring will be included in the Marine Archaeological Management Plan.	TBC	n/a	TBC	To avoid impacts on unrecognised archaeological sites and/or to improve	n/a

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Potential effect	Receptor	Monitoring objectives	Monitoring approach	Adaptive measure	Links to other monitoring	Method of securing monitoring	Rationale	Strategic Approach Required
various locations.		construction operations. To undertake watching briefs of any works associated with the project that may result in seabed disturbance.	Where appropriate, the archaeologist will carry out watching briefs of work. A licensed archaeologist will be onboard construction vessels engaged in activities impacting on the seabed including geotechnical investigation, foundation installation and cable laying. ROV/ diver surveys may be required. Archaeological monitoring will be licensed by the Department of Housing, Local Government and Heritage. If any archaeological features or material are uncovered, work will cease in order for the archaeologist to inspect any such material. Full archaeological recording will be undertaken. Full excavation will be undertaken if it is not possible for works to avoid the material. The National Museum of Ireland (NMI) Advice notes will be followed should archaeological objects require exportations.				understanding of identified sites of potential archaeological importance.	
Damage to sites important archaeological potential.	Sites of important archaeological potential within Archaeological Exclusion Zones (AEZ).	To monitor the AEZs and ensure that that the potential for direct impacts on site with important archaeological potential is avoided and therefore sites are preserved.	Ongoing monitoring of known archaeological receptors through the acquisition of relevant spatial survey data. May include methods such as periodic reporting on adherence to exclusion zones and the results of watching briefs.	TBC	n/a	TBC	Monitoring AEZs will ensure that any impacts on sites of important archaeological potential are identified at an early stage.	n/a
Operational and maintenance								
n/a								
Decommissioning phase								
n/a								

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