Outer Dowsing Offshore Wind

Outline Plans

8.03 Offshore In-Principle Monitoring Plan

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Acronyms & Definitions

Abbreviations / Acronyms

Abbreviation / Acronym	Description
AEZ	Archaeological Exclusion Zone
AIS	Automatic Identification System
ANS	Artificial Nesting Structure
DCO	Development Consent Order
dML	deemed Marine Licence
EIA	Environmental Impact Assessment
ES	Environmental Statement
FLCP	Fisheries Liaison and Co-existence Plan
INNS	Invasive Non-Native Species
IPMP	In-Principle Monitoring Plan
JNCC	Joint Nature Conservation Committee
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
MMOb	Marine Mammal Observer
MWSQ	Marine Water and Sediment Quality
NSIP	Nationally Significant Infrastructure Project
ODOW	Outer Dowsing Offshore Wind, trading name of GT R4 Limited
ORCP	Offshore Reactive Compensation Platform
PAD	Protocol for Archaeological Discoveries
PAM	Passive Acoustic Monitoring
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Body
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator

Terminology

Term	Definition
The Applicant	GTR4 Limited (a joint venture between Corio Generation (and its affiliates), TotalEnergies and Gulf Energy Development), trading as Outer Dowsing Offshore Wind
Array area	The area offshore within which the generating station (including wind turbine generators (WTG) and inter array cables), offshore accommodation platforms, offshore transformer substations and associated cabling will be positioned, including the ORBA.

Term	Definition
Baseline	The status of the environment at the time of assessment without the development in place.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
deemed Marine Licence (dML)	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (NSIP).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the sensitivity of the receptor, in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Regulations, including the publication of an Environmental Statement (ES).
Environmental Statement (ES)	The suite of documents that detail the processes and results of the EIA.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Intertidal	The area between Mean High-Water Springs (MHWS) and Mean Low Water Springs (MLWS)
Landfall	The location at the land-sea interface where the offshore export cables and fibre optic cables will come ashore.
Maximum Design Scenario	The project design parameters, or a combination of project design parameters that are likely to result in the greatest potential for change in relation to each impact assessed
Mitigation	Mitigation measures, or commitments, are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.
Invasive Non-Native Species (INNS)	A non-native species that causes ecological and/or socio-economic harm.
Offshore Reactive Compensation Station (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation
Onshore Infrastructure	The combined name for all onshore infrastructure associated with the Project from landfall to grid connection.
Outer Dowsing Offshore Wind (ODOW)	The Project.
Pre-construction and post-construction	The phases of the Project before and after construction takes place.
Preliminary Environmental Information Report (PEIR)	The PEIR was written in the style of a draft Environmental Statement (ES) and provided information to support and inform the statutory consultation process during the pre-application phase.

Term	Definition
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Statutory consultee	Organisations that are required to be consulted by the Applicant, the Local Planning Authorities and/or The Planning Inspectorate during the pre-application and/or examination phases, and who also have a statutory responsibility in some form that may be relevant to the Project and the DCO application. This includes those bodies and interests prescribed under Section 42 of the Planning Act 2008.
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation

1 Introduction

1.1 Background

1. GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop Outer Dowsing Offshore Wind ("the Project").
2. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm) located approximately 54km from the Lincolnshire coastline, export cables to landfall, Offshore Reactive Compensation Platforms (ORCPs), onshore cables, connection to the electricity transmission network, ancillary and associated development and areas for the delivery of up to two Artificial Nesting Structures (ANS) and the creation of a biogenic reef (if these compensation measures are deemed to be required by the Secretary of State) (see Volume 1, Chapter 3: Project Description (document reference 6.1.3) for full details).

1.2 Purpose of the In-Principle Monitoring Plan

3. This In-Principle Monitoring Plan (IPMP) has been produced to provide the basis for delivering the monitoring measures required by the conditions of the deemed Marine Licences (dMLs) contained within the draft Development Consent Order (DCO). The monitoring plan to be submitted to the Marine Management Organisation (MMO) for approval post consent must accord with this IPMP.
4. The IPMP therefore provides a key mechanism through which the relevant regulatory authorities can be assured that required offshore monitoring activities associated with the construction and operation of the offshore infrastructure for the Project will be formally controlled.
5. The IPMP provides a framework for discussions with the Marine Management Organisation (MMO) and the relevant Statutory Nature Conservation Bodies (SNCBs) to agree the exact detail (timings, methodologies etc.) of the monitoring proposed post consent.
6. Due to the long lead in time for the development of offshore wind projects, it is not desirable or effective to provide final detailed method statements prior to consent. However, agreeing guiding principles reinforces commitments made in the Environmental Statement (ES) and complements other requirements set out in the dMLs and will allow refinements to be made based on the best available knowledge and technology. Final detailed plans for monitoring work will be produced post consent closer to the time that the actual work will be undertaken, in line with the conditions proposed within the dMLs.
7. The relevant topics and/or receptor groups that will be discussed in this plan are as follows:
   - Marine Processes
   - Marine Water and Sediment Quality
   - Benthic Subtidal and Intertidal Ecology
   - Fish and Shellfish Ecology

- Marine Mammals
- Offshore and Intertidal Ornithology
- Marine and Intertidal Archaeology
- Commercial Fisheries
- Shipping and Navigation

1.3 General Guiding Principles for the Proposed Monitoring

8. The Project has taken steps to avoid or reduce significant impacts through project design ('embedded mitigation') or by 'additional' mitigation measures which will be applied during the construction, operation and maintenance or decommissioning phases of the Project.
9. The guiding principles for monitoring and which apply in general to the in-principle monitoring outlined in this document are as follows:
   - All consent conditions, including those for monitoring, should be "necessary, relevant to planning, relevant to the development to be consented, enforceable, precise and reasonable in all other respects" as set out in Paragraph 4.1.16 of the National Policy Statement (EN-1).
   - In line with good practice, monitoring must have a clear purpose in order to provide answers to specific questions (e.g. Cefas, 2012, OSPAR, 2008). As such, monitoring proposals should have an identified end date and confirmed outputs, which provide statistically robust data sets, as applicable to the hypothesis being tested.
   - Monitoring should be targeted to address significant evidence gaps or uncertainty, where there is potential for a significant environmental impact.
   - Proposals for monitoring should be based, where relevant, on the best practice and outcomes of the latest review of environmental data associated with post-consent monitoring of licence conditions of offshore windfarms (MMO, 2014).
   - The scope and design of all monitoring work should be finalised and agreed following review of the results of any preceding survey and/or monitoring work (i.e. an adaptive approach), including those surveys conducted in support of the environmental impact assessment. This includes the potential for survey requirements to be adapted based on the results of the monitoring outlined in this document. Where it has been agreed that there are no significant impacts, monitoring need not be conditioned through the dMLs.

1.4 Consultation

10. Consultation with statutory consultees, including Natural England and the MMO, is fundamental to agreeing that the monitoring adopted for the Project is proportionate, effective and secured. As previously described, this document is intended to form a framework for engagement on monitoring proposed. Details of relevant consultation will be provided within the individual monitoring plans to be developed post-consent.

2 Outer Dowsing Offshore Wind Impacts

11. The Environmental Impact Assessment (EIA) predicts the impact to receptors taking into account:
    - Linkages using the source > pathway > receptor model;
    - Embedded/Additional Mitigation;
    - Sensitivity to the effect; and
    - Ecological/economic importance/value.
12. The significance of the impact should not in its own right lead to the requirement for monitoring. Monitoring may also be targeted to address significant evidence gaps or uncertainty relevant to the project.

2.1 In-Principle Proposals for Monitoring

13. The following sections set out the in-principle proposals for monitoring in relation to those topics and/or receptor groups assessed in the ES and listed in paragraph [7] above.
14. This IPMP represents the most appropriate approach to monitoring available at the time of writing, however it is acknowledged that the outcomes of the survey work discussed could influence future monitoring proposed, methodologies, focus and effort for the Project, as knowledge and understanding develops. For example, where appropriate, and in consultation with the MMO and relevant SNCBs, these scopes may be refined to consider other relevant studies carried out by neighbouring projects and/or changes to best-practice or publication of new guidance on monitoring. This is a key principle for an adaptive approach to monitoring and will be the subject of ongoing consultation between the Project, the MMO and relevant SNCBs.
15. This document has been submitted with the DCO application and will be used as a basis for further discussions post consent.
16. Relevant survey and monitoring data and/or reports will be subject to regular submission to the Marine Data Exchange and/or relevant Local Environmental Record Centres.

2.2 Engineering Related Monitoring

~~16.~~17. In addition to the environmental survey and monitoring required as conditions of the dMLs within the DCO, additional studies will be undertaken for engineering and design purposes. Some of these will overlap with the conditioned monitoring and wherever possible the Project will look to combine surveys for monitoring purposes with those already being carried out for engineering purposes. Examples of these surveys are:
    - Geophysical;
    - Geotechnical; and
    - Unexploded ordnance (UXO) survey.

~~17.~~18. Other relevant plans required under the dMLs that identify engineering related monitoring needs are:

- A Scour Protection and Cable Protection Management Plan (monitoring of scour and cable protection measures);
- A Cable Specification and Installation Plan (cable burial monitoring); and
- An Offshore Operations and Maintenance Plan.

3 Monitoring Proposals

3.1 Physical Processes

3.1.1 Conclusions of the Environmental Statement

~~18.~~19. The potential impacts of the Project on physical processes have been assessed within Volume 1, Chapter 7: Marine Physical Processes (document reference 6.1.7) No significant adverse effects greater than minor significance were predicted for the Project.

3.1.2 In-Principle Monitoring

~~19.~~20. Table 3.1 provides information on the monitoring proposed for physical processes. The proposed monitoring will be discussed and agreed with Natural England and the MMO.

3.1.3 Hypotheses

~~20.~~21. The following hypotheses have been developed for the purposes of this IPMP, to provide an indication of the hypotheses which may be tested as part of any monitoring. Final hypotheses and the precise wording will be proposed within the final monitoring plans submitted for approval to the MMO prior to construction.

~~21.~~22. Hypothesis 1 - Change in distribution and extent of bedforms including sandwaves within the Order Limits

- H^1 – The installation of Project infrastructure results in a significant, long-term change to the distribution and extent of bedforms within the survey area.
- H^0 – The installation of Project infrastructure does not result in a significant, long-term change to the distribution and extent of bedforms within the survey area.

~~22.~~23. Hypothesis 2 – Change in seabed level including scour processes within the Order Limits

- H^1 – The installation of Project infrastructure results in a significant change to the seabed level due to formation of scour during the operational phase.
- H^0 – The installation of Project infrastructure does not result in a significant change to the seabed level due to formation of scour during the operational phase.

24. ~~Table 3.1~~Hypothesis 3 – Westward migration of the Inner Dowsing sandbank

- H^1 – Westward migration of the Inner Dowsing sandbank results in a significant interaction between the sandbank and the ORCP structures.
- H^0 – Westward migration of the Inner Dowsing sandbank does not result in a significant interaction between the sandbank and the ORCP structures.

25. Hypothesis 4 – Change in longshore sediment transport due to the installation of nearshore cable protection

- H^1 – The installation of cable protection in the nearshore area results in a significant, long-term change to longshore sediment transport.
- H^0 – The installation of cable protection in the nearshore area does not result in a significant, long-term change to longshore sediment transport.

26. In the event that the survey reports listed in Table 3.1 below identify impacts which support H^1 for hypotheses 1 to 4 at paragraphs 22 to 25 above, an adaptive management plan to reduce effects to within what was predicted within the Environmental Statement and the Habitats Regulations Assessment, unless otherwise agreed by the MMO in writing, must be submitted alongside the monitoring.
27. The adaptive management plan must be agreed by the MMO in consultation with the relevant statutory nature conservation bodies to reduce effects to an agreed suitable level for the Project.
28. Any such agreed and approved adaptive management or mitigation should be implemented and monitored in full to a timetable first agreed in writing with the MMO.
29. In the event that this adaptive management or mitigation requires a separate consent, the relevant consents must be applied for. Where a separate consent is required to undertake the agreed adaptive management or mitigation, the Project is only required to undertake the adaptive management or mitigation once the relevant consent is granted.

Table 3.1: In-Principle Monitoring Proposed for Physical Processes

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Changes in seabed level and the sediment transport regime, including scour processes.	Physical environment and linked receptor groups.	Pre-Construction	▪ Engineering and design purposes. ▪ Input into benthic and related ecological surveys. ▪ Monitoring of seabed and bedform presence, including sandwaves and sandbanks. ▪ Monitoring the location of the western flank of the Inner Dowsing sandbank. ▪ Monitoring of the nearshore environment.	A single survey within the agreed array and cable corridor survey areas using full seabed coverage swath-bathymetric and a Side Scan Sonar survey (to meet the requirements of Marine Guidance Note (MGN) 654 and its Annexes) of the area(s) within the Order Limits in which it is proposed to carry out construction works. Data from the survey will be used to establish a baseline ~~on~~of: ▪ the presence and characteristics of sandwaves within the area(s) within the Order Limits in which it is proposed to carry out construction works~~.~~; ▪ the position of the western flank of the Inner Dowsing sandbank; and ▪ the nearshore environment including the coastal frontage.	Scope of surveys and programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval in accordance with the timescales required by the dMLs.
		Post-Construction	▪ Structural integrity/	A full sea floor coverage swath-bathymetry survey that meets the requirements of MGN654 and its	

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
			engineering (scour). ▪ Cable burial. ▪ Monitoring of seabed and bedform recovery, including sandwaves and sandbanks. ▪ Monitoring the location of the western flank of the Inner Dowsing sandbank. ▪ Monitoring of the nearshore environment.	annexes, and side scan sonar, of the area(s) within the Order limits in which construction works were carried out to assess any changes in bedform topography and such further monitoring or assessment as may be agreed to ensure that cables have been buried or protected. For this purpose, the undertaker will, prior to the first such survey, submit a desk-based assessment (which takes account of all factors which influence scour) to identify the sample of adjacent wind turbines with greatest potential for scour. The survey will be used to validate the desk-based assessment: further surveys may be required if there are significant differences between the modelled scour and recorded scour. The quantity of turbines subject to monitoring will be confirmed following the completion of detailed design studies and in consultation with the MMO. Data from the survey will be used to:	

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				▪ establish the change to/recovery of a representative sample of bedforms following sandwaves clearance and cable installation activity. The survey will be used to validate the desk based assessment: Further surveys ~~may~~will be required at a frequency to be agreed with the MMO (e.g. 3 years non-consecutive i.e. 1, 3 and 6 years or 1, 5 and 10 years~~).~~) if data from the first post-construction survey does not indicate full recovery of bedforms following sandwave clearance and cable installation; ▪ establish the change to the position of the western flank of the Inner Dowsing sandbank in order to validate the desk based assessment. Further surveys are expected to be required, the frequency of which will be discussed with Natural England and agreed with the MMO; ▪ establish the change to/recovery of the nearshore bedload transport regime and nearshore	

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				seabed morphology following the installation of concrete mattresses in the nearshore area (if this is required). This survey will be used to validate the desk based assessment. Further surveys may be required at a frequency to be discussed with Natural England and agreed with the MMO.	

3.2 Marine Water and Sediment Quality

3.2.1 Conclusions of the Environmental Statement

~~23.~~30. The potential impacts of the Project on MWSQ have been assessed within Volume 1, Chapter 8: Marine Water and Sediment Quality (document reference 6.1.8). No significant adverse effects greater than minor significance were predicted for the Project.

3.2.2 In-Principle Monitoring

~~24.~~31. As stated in Section 1.3, monitoring must have a clear purpose in order to provide answers to specific questions. Monitoring should be targeted to address significant evidence gaps or uncertainty, where there is potential for a significant environmental impact.

~~25.~~32. In this instance no monitoring or independent surveys are required.

3.3 Benthic and Intertidal Ecology

3.3.1 Conclusions of the Environmental Statement

~~26.~~33. The potential impacts of the Project on benthic and intertidal ecology have been assessed within Volume 1, Chapter 9: Benthic Subtidal and Intertidal Ecology (document reference 6.1.9). No impact would be greater than minor adverse for the project alone or cumulatively.

3.3.2 In-Principle Monitoring

~~27.~~34. Table 3.2 provides information on the monitoring proposed for Benthic and Intertidal Ecology. The proposed monitoring will be discussed and agreed with Natural England and the MMO.

~~28.~~35. The final methodology for any pre-construction surveys will be submitted to the MMO for approval prior to the pre-construction surveys being carried out. This will include full details of the proposed survey locations and type of equipment to be used at each location. Furthermore, in line with industry best-practice, existing data will be reviewed to aid in the proposed locations for any surveys, including any data previously acquired on the Project, such as areas where *Sabellaria spinulosa* tubes were previously recorded.

~~29.~~36. Timing of the surveys will be discussed and finalised during the development of final plans to ensure that timing of data collection is appropriate for the features of interest and to effectively test hypotheses (Section 3.3.3).

~~30.~~37. It should also be noted that advances in innovative monitoring techniques for offshore renewable energy are progressing rapidly, with robotic and autonomous systems delivering enhanced results for feature characterisation. Consequently, the latest technologies will be reviewed when proposing the final methodologies.

3.3.3 Hypotheses

~~31.~~38. The following hypotheses have been developed for the purposes of this IPMP, to provide an indication of the hypotheses which may be tested as part of any monitoring. Final hypotheses and the precise wording will be proposed within the final monitoring plans submitted for approval to the MMO prior to construction.

Hypothesis 1 – Effects on Annex I *S. spinulosa* reef or reef listed under Section 41 of the Natural Environmental and Rural Communities (NERC) Act, 2006.

- H^1 – The cable installation and use of cable protection from the Project results in direct significant impacts to extant Annex I *S. spinulosa* reef[1] or reef listed under Section 41 of the Natural Environmental and Rural Communities (NERC) Act, 2006 as identified in the pre-construction surveys.
- H^0 – The cable installation and use of cable protection from the Project does not result in direct significant impacts to extant Annex I *S. spinulosa* reef[1] or reef listed under Section 41 of the Natural Environmental and Rural Communities (NERC) Act, 2006, as identified in the pre-construction surveys.

Hypothesis 2 – Effects on supporting habitat for Annex I *S. spinulosa* reef.

- H^1 – The use of cable protection from the Project results in direct significant impacts to supporting habitat for Annex I *S. spinulosa* reef, as identified in the pre-construction surveys.
- H^0 – The use of cable protection from the Project does not result in direct significant impacts to supporting habitat for Annex I *S. spinulosa* reef, as identified in the pre-construction surveys.

Hypothesis 3 – Effects on Annex I Sandbank communities.

- H^1 – The cable installation and use of cable protection from the Project results in direct significant impacts to Annex I Sandbank communities, as identified in the pre-construction surveys.
- H^0 – The cable installation and use of cable protection from the Project does not result in direct significant impacts to Annex I Sandbank communities, as identified in the pre-construction surveys.

Hypothesis 4 – Introduction and/or spread of marine Invasive Non-Native Species (INNS).

- H^1 – The development of Project WTG foundation infrastructure results in the introduction and/or spread of marine INNS to artificial hard substrate within the Project array area.
- H^0 – The development of Project WTG foundation infrastructure does not result in the introduction and/or spread of marine INNS to artificial hard substrate within the Project array area.

[1] *S. spinulosa* 'reefiness' defined by criteria developed by JNCC (Gubbay 2007) and Hendrick and Foster-Smith (2006).

Table 3.2: In-Principle Monitoring Proposed - Benthic and Intertidal Ecology

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Effects on habitats of principal importance or Annex I habitat	Annex I habitat	Pre-construction	Determine the location, extent and composition of any habitats of principal importance constituting Annex I habitat.	A detailed pre-construction survey will be completed post-consent to determine the location, extent and composition of any habitats of principal importance constituting Annex I habitat. This is likely to include a full seabed coverage swath-bathymetric and a Side Scan Sonar survey (to meet the requirements of Marine Guidance Note (MGN) 654 and its Annexes) of the area(s) within the Order Limits in which it is proposed to carry out construction works and ground-truthing using drop down video of the data where *S. spinulosa* reef has previously been recorded or is expected based on a detailed review of the geophysical campaign, in line with industry best-practise.	Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for approval. The Applicant will review all advice in relation to methodologies for assessing *S. spinulosa* reef habitat, including taking 'the patch-based approach'. Where significant impacts are observed, an adaptive management process may need to be implemented to ensure that so far as possible, the effects are brought back within the range of those predicted.
		Post-construction	The requirement for post-construction monitoring	In the event that habitats of principal importance constituting Annex 1 habitat are identified in the pre-construction survey; post-	

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
			will be dependent on the findings of the pre-construction surveys.	construction monitoring will also be carried out with focus on these identified habitats.	
Effects on supporting habitat for Annex I *S. spinulosa* reef	Supporting habitat for Annex I reef	Pre-construction	Determine the location, extent and quality of supporting habitat for Annex I *S. spinulosa* reef.	A detailed pre-construction survey will be completed post-consent to determine the location, extent and quality of any supporting habitat for Annex I *S. spinulosa* reef across the section of the offshore ECC that crosses the Inner Dowsing, Race Bank and North Ridge Special Area of Conservation (SAC). This is proposed to include a grab sampling campaign. Grab samples will undergo particle size analysis to confirm 'habitat suitable for Annex I *S. spinulosa* reef'.	Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for approval. Where significant impacts are observed, an adaptive management process may need to be implemented to ensure that so far as possible, the effects are brought back within the range of those predicted.
		Post-construction	Determine any changes in the extent and quality, and the recovery of supporting habitat for Annex I *S. spinulosa* reef.	Post-construction monitoring is likely to consist of a repeat of the pre-construction grab sampling campaign across areas that have been identified as supporting habitat for Annex I *S. spinulosa* reef across the section of the offshore ECC that crosses the IDRBNR SAC.	

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Effects on Annex I Sandbank communities	Annex I habitat	Pre-construction	Identify the spatial distribution and assess the community dynamics of Annex I sandbank habitats.	A detailed pre-construction survey will be completed post-consent to identify the spatial distribution and assess the community dynamics of Annex I sandbank habitats, across the section of the offshore ECC that crosses the IDRBNR SAC. This is proposed to include a grab sampling campaign. Grab samples will undergo faunal and particle size analysis.	Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for approval. Where significant impacts are observed, an adaptive management process may need to be implemented to ensure that so far as possible, the effects are brought back within the range of those predicted.
		Post-construction	Determine any changes in the spatial distribution and assess the community dynamics of Annex I sandbank habitats.	Post-construction monitoring is likely to consist of a repeat of the pre-construction grab sampling campaign.	
Introduction and/or spread of marine INNS	Benthic ecology	Post-construction	Determine the location, extent and abundance of any INNS.	A detailed post-construction survey will be completed post-consent to determine the presence and abundance of any INNS on foundation infrastructure. Options for INNS monitoring may include: ▪ Settlement panels: Panels of material that are hung from marine structures on a piece of	Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for approval. Where the introduction and/or spread of INNS is observed:

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				rope and are periodically pulled up for the identification of fouling species; ▪ Environmental DNA (eDNA): The analysis of DNA in water or sediment for the rapid assessment of the indicative presence or absence of INNS. ▪ Remote Video: The use of a Remote Operated Vehicle (ROV) or Drop-Down Video (DDV) to video footage underwater to survey the turbine foundations and immediate surrounding area of seabed (out to approximately 50 m).	▪ The monitoring plan should be reviewed and updated if required (e.g., to increase focus on a specific invaded habitat or detected INNS). ▪ Responsive actions as outlined in the INNS Biosecurity Management Plan may be implemented if appropriate.

3.4 Fish and Shellfish Ecology

3.4.1 Conclusions of the Environmental Statement

~~32.~~39. The potential impacts of the Project on fish and shellfish ecology have been assessed within Volume 1, Chapter 10: Fish and Shellfish Ecology (document reference 6.1.10). No significant adverse effects greater than minor significance were predicted for the Project.

3.4.2 In-Principle Monitoring

~~33.~~40. As stated in Section 1.3, monitoring must have a clear purpose in order to provide answers to specific questions. Monitoring should be targeted to address significant evidence gaps or uncertainty, where there is potential for a significant environmental impact.

~~34.~~41. In this instance no monitoring or independent surveys are required.

3.5 Marine Mammals

3.5.1 Conclusions of the Environmental Statement

~~35.~~42. The potential impacts of the Project on marine mammals have been assessed within Volume 1, Chapter 11: Marine Mammals (document reference 6.1.11). No significant adverse effects greater than minor significance were predicted for the Project.

3.5.1.1 Underwater Noise from Piling

~~36.~~43. To minimise the risk of auditory injury to marine mammals from the underwater noise from piling activities, there is a suite of mitigation measures that the Project could implement. The Outline Marine Mammal Mitigation Protocol (MMMP) for piling (document reference 8.6.1) details the potential ~~contingency~~mitigation measures which could be used by the Project to ~~manage~~reduce the risk of permanent threshold shift (PTS) auditory injury to marine mammal species arising from piling activities associated with the installation of monopile and pin-pile foundations to a negligible level.

3.5.2 In-Principle Monitoring

~~37.~~44. Table 3.3 provides information on the monitoring proposed for marine mammals. The proposed monitoring will be discussed and agreed with Natural England and the MMO.

45. The Outline MMMP for Piling (document reference 8.6.1) contains key principles that provide the framework for any mitigation that could be required, including relevant monitoring.

~~38.~~46. If piled foundations are used in the final project design, underwater noise monitoring of the first four piles of each piled foundation type will be undertaken with the methods agreed with the MMO and relevant SNCBs in the pre-construction period. The purpose of this monitoring will be to validate the predictions made within the ES, but also to validate the impact ranges used to inform the MMMP and the specific mitigation measures set out therein.

~~39.~~47. In relation to the Southern North Sea Special Area of Conservation (SAC) designated for harbour porpoise, an In-Principle Southern North Sea Special Area of Conservation Site Integrity Plan (SIP) (document reference 8.9) has been submitted alongside the DCO application.

Table 3.3: In-Principle Monitoring Proposed - Marine Mammals

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Auditory injury to marine mammals from underwater noise during pile driving.	Marine Mammals	Construction	Managing risk of auditory injury to marine mammals from underwater noise during pile driving.	▪ Marine Mammal Observer (MMOb) ▪ Passive Acoustic Monitoring (PAM) ▪ Measurements of noise generated by the installation of the first four piled foundations of each piled foundation type, unless otherwise agreed in writing by the MMO. Results of the initial noise measurements must be provided to the MMO within six weeks of the installation of the first four piled foundations of each piled foundation type (unless otherwise agreed with the MMO). The assessment of this report by the MMO will determine whether any further noise monitoring is required. If, in the opinion of the MMO in consultation with the statutory nature conservation body, the assessment shows impacts significantly in excess of those assessed in the environmental statement or failures in mitigation (as set out within the MMMP), all piling activity must cease until an update to the marine mammal mitigation	▪ **MMOb:** As per Joint Nature Conservation Committee (JNCC) guidelines (JNCC, 2010) MMOb roles pertain to: ▪ Piling for minimising piling noise-related risks to marine mammals. Specific details on MMObs and methods will be included in the Piling MMMP, considering relevant guidance available at that time. ▪ **PAM:** Specific details on PAM and methods will be included in the Piling MMMP, considering any available guidance at that time. All relevant noise monitoring data will be

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				protocol and further monitoring requirements have been agreed.	submitted to the JNCC UK Marine Noise Registry.
Auditory injury to marine mammals from underwater noise			To validate the underwater noise modelling	▪ Marine Mammal Observer (MMOb) ▪ Passive Acoustic Monitoring (PAM)	▪

3.6 Offshore and Intertidal Ornithology

3.6.1 Conclusions of the Environmental Statement

~~40.~~48. The potential impacts of the Project on ornithology have been assessed within Volume 1, Chapter 12: Offshore and Intertidal Ornithology (document reference 6.1.12). No significant adverse effects were predicted for the Project.

3.6.2 In Principle Monitoring Proposals

Monitoring of compensation measures

49. Monitoring will also be undertaken for each of the proposed compensation measures, including artificial nesting structures (ANS), predator control, and disturbance reduction. This monitoring will assess the effectiveness of these measures as they are implemented, providing evidence of the benefits delivered and informing any necessary adaptive management to ensure that the overall coherence of the National Site Network is maintained.

Coordination with Sector Initiatives

~~41.~~50. In addition to the options discussed above there may be other initiatives or strategic monitoring underway across the sector. The Applicant will review which of these are available at the relevant point in time and seek to contribute where deemed appropriate. This approach supports a more coordinated and efficient use of resources, while also helping to ensure that monitoring efforts are aligned with sector-wide good practice and targeted to address ~~significant~~shared evidence gaps ~~or uncertainty, where there is potential for a significant environmental impact~~.

~~In this instance no monitoring or independent surveys are required.~~

3.7 Commercial fisheries

3.7.1 Conclusions of the Environmental Statement

~~42.~~51. The potential impacts of the Project on commercial fisheries have been assessed within Volume 1, Chapter 14: Commercial Fisheries (document reference 6.1.14). No significant adverse effects were predicted for the Project.

3.7.2 In Principle Monitoring Proposals

~~43.~~52. A Fisheries Liaison and Co-existence Plan (FLCP) (document reference 8.14) will be submitted to the MMO for approval prior to commencement of offshore works, the purpose of which will be to ensure relevant fishing fleets are notified of commencement of activities and to address the interaction of the Project's activities with fishing activities. The FLCP will accord with the Outline FLCP (document 8.14) submitted alongside the DCO Application.

~~44.~~53. Due to the lack of significant effects on commercial fisheries receptors attributable to the Project, no monitoring has been proposed. It should be noted that the Applicant has committed to following a Dropped Objects Procedure, whereby dropped objects will be reported and will be recovered where they pose a potential hazard to other marine users.

~~45.~~54. The Applicant will apply for Safety Zones post consent. Safety Zones of up to 500m will be sought during construction, maintenance, and decommissioning phases.

3.8 Shipping and Navigation

3.8.1 Conclusions of the Environmental Statement

~~46.~~55. The potential impacts of the Project on shipping and navigation have been assessed within Volume 1, Chapter 15: Shipping and Navigation (document reference 6.1.15). No significant adverse effects were predicted for the Project.

Table 3.4: In-Principle Monitoring Proposed - Shipping and Navigation

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Effect on marine traffic routing and safety	Marine traffic	Construction	The ability to characterise changes to routeing patterns.	Vessel traffic monitoring will be undertaken throughout the construction phase to characterise changes to routeing patterns.	Automatic Identification System (AIS) Vessel Traffic Survey - During construction, vessel traffic monitoring using AIS will be conducted, with the detailed requirements for this being agreed with the (MMO) and Maritime and Coastguard Agency (MCA) prior to commencement of construction.
			Ensure temporary aids to navigation are functional and fit for purpose.	Aids to Navigation Management plan that remains functional throughout the lifetime of the Project with reporting to Trinity House.	Aids to Navigation and Aids to Navigation Management Plan to be agreed with Trinity House prior to commencement of construction.
		Post-construction	Ensure aids to navigation are functional and fit for purpose.		Aids to Navigation Management Plan for the life of the project to be agreed with Trinity House prior to commencement of construction.
			To ensure cable burial and protection remains effective mitigation for vessel anchors	Cable burial and protection will be monitored so it remains effective mitigation for vessel anchors.	Post construction geophysical monitoring will be carried out with any necessary remedial works. This will be done at a suitable time as agreed with the MMO and MCA following the commencement of commercial operation.
Under keel clearance			Reduction of under keel clearance		

3.9 Marine Archaeology

3.9.1 Conclusions of the Environmental Statement

~~47.~~56. The potential impacts of the Project on marine archaeology have been assessed within Volume 1, Chapter 13: Marine and Intertidal Archaeology (document reference 6.1.13). No significant adverse effects were predicted for the Project.

3.9.2 In Principle Monitoring Proposals

~~48.~~57. Whilst the assessment did not predict any significant effects, it is recognised that there are commitments (as embedded mitigation measures) which are secured through the Outline Marine Written Scheme of Investigation (WSI) (Document 8.5).

~~49.~~58. These aim to identify any marine archaeological features that require mitigation, and secondary monitoring post-construction to establish the effectiveness of Archaeological Exclusion Zones (AEZs) implemented prior to construction.

~~50.~~59. Table 3.5 provides information on the monitoring proposed for Marine Archaeology. The proposed monitoring will be discussed and agreed with the MMO.

Table 3.5: In-Principle Monitoring Proposed - Marine Archaeology

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
All direct and indirect effects on the archaeological resource	All archaeological receptors	Pre-construction	Validate the predictions made where reasonable in the ES with respect to potential effects on the archaeological resource and to inform selection of appropriate mitigation.	Offshore geophysical surveys (including UXO surveys) and offshore geotechnical campaigns undertaken pre-construction will be subject to full archaeological review, where relevant, in consultation with Historic England. Areas with geoarchaeological potential will be targeted during the geotechnical sampling campaigns and results published will aim to enhance the paleogeographic knowledge and understanding of the area. All Archaeological assessment of available data must be in association with a WSI produced in consultation with Historic England. An Outline Marine WSI document has been produced to accompany the ES to outline defined mitigation measures necessary for this stage and further archaeological	An Outline Marine WSI will be submitted with the DCO application. A WSI will be in place prior to licenced activities.

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				campaigns for the Project which builds on the baseline characterisation completed to date for the entire proposed development. The methodological approaches to survey data capture standards and analysis that will best support archaeological analysis and interpretation. The use of in-situ mitigation measures such as AEZs, as are presently spatially identified, with clear instruction that the Outline Marine WSI provides the basis for steering the Project post-consent and a draft final Marine WSI is to be produced pre-construction in accordance with the dMLs.	
All direct and indirect effects on the archaeological resource		Post-construction	To inform selection and undertaking of appropriate mitigation.	A post-construction monitoring plan as per the Outline Marine WSI will be produced. The post-construction monitoring plan will monitor areas or sites deemed to be of high archaeological significance recommended for further investigation and outline how	The WSI produced pre-construction will be a 'point-in-time' document, with the specific methodology for each subsequent package of archaeological works (i.e. construction or operation) to be taken

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				post-construction monitoring campaigns will collect and assess findings in order to report on changes to Historic Environment receptors that may have occurred during the construction phase.	forward through archaeological method statements produced under the umbrella of the WSI and agreed with the archaeological curator.

60. The need for and scope of monitoring associated with the historic environment will be set out within the Marine Written Scheme of Investigation (WSI), including an appended Protocol for Archaeological Discoveries (PAD). The document will be monitored and updated throughout the post-consent process, prior to the commencement of offshore construction (in consultation with Historic England) to ensure that the WSI remains appropriate to the final design of the scheme and to incorporate the results of any relevant pre-construction monitoring surveys (such as, for example, high resolution swath bathymetric pre-construction surveys). Prior to construction, the Marine WSI will be finalised and submitted to the MMO for approval in consultation with Historic England.

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