Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects

Offshore In-principle Monitoring Plan (Revision C) (Tracked)

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Title: **Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects** **DCO Application** **Offshore In-Principle Monitoring Plan (Revision ~~B~~C) (~~Clean~~Tracked)**	
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Glossary of Acronyms

AEoI	Adverse Effect on Integrity
AIS	Automatic Identification System
ALARP	As Low as Reasonably Possible
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CFWG	Commercial Fisheries Working Group
CRM	Collision Risk Modelling
DCO	Development Consent Order
DDV	Drop Down Video
DEL	Dudgeon Extension Limited
DML	Deemed Marine Licence
DEP	Dudgeon Offshore Wind Farm Extension Project
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
FLCP	Fisheries Liaison and Co-existence Plan
FFC	Flamborough and Filey Coast
HRA	Habitat Regulations Assessment
HVAC	High-Voltage Alternating Current
IHO	International Hydrographic Organisation
IPMP	In-Principle Monitoring Plan
km	Kilometre
LAT	Lowest Astronomical Tide
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multibeam Echosounder
MCA	Maritime Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
NPS	National Policy Statement
OMP	Ornithological Monitoring Programme
ORJIP	Offshore Renewables Joint Industry Project
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries

OWEIP	Offshore Wind Enabling Actions Programme
OWSMRF	Offshore Wind Strategic Monitoring Research Forum
PAM	Passive Acoustic Monitoring
PSA	Particle Size Analysis
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SEL	Scira Extension Limited
SEP	Sheringham Shoal Offshore Wind Farm Extension Project
SIP	Site Integrity Plan
SPA	Special Protection Area
SSS	Side-Scan Sonar
UK	United Kingdom
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation

Glossary of Terms

Dudgeon Offshore Wind Farm Extension Project (DEP)	The Dudgeon Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
DEP offshore site	The Dudgeon Offshore Wind Farm Extension consisting of the DEP wind farm site, interlink cable corridors and offshore export cable corridor (up to mean high water springs).
DEP onshore site	The Dudgeon Offshore Wind Farm Extension onshore area consisting of the DEP onshore substation site, onshore cable corridor, construction compounds, temporary working areas and onshore landfall area.
DEP North array area	The wind farm site area of the DEP offshore site located to the north of the existing Dudgeon Offshore Wind Farm
DEP South array area	The wind farm site area of the DEP offshore site located to the south of the existing Dudgeon Offshore Wind Farm
DEP wind farm site	The offshore area of DEP within which wind turbines, infield cables and offshore substation platform/s will be located and the adjacent Offshore Temporary Works Area. This is also the collective term for the DEP North and South array areas.
Evidence Plan Process (EPP)	A voluntary consultation process with specialist stakeholders to agree the approach, and information to support, the EIA and HRA for certain topics.
Expert Topic Group (ETG)	A forum for targeted engagement with regulators and interested stakeholders through the EPP.
Grid option	Mechanism by which SEP and DEP will connect to the existing electricity network. This may either be an integrated grid option providing transmission infrastructure which serves both of the wind farms, or a separated grid option, which allows SEP and DEP to transmit electricity entirely separately.
Horizontal directional drilling (HDD)	Trenchless technique used to install cables – in this case referring to the installation of the export cables at the landfall.
Horizontal directional drilling (HDD) zones	The areas within the onshore cable route which would house HDD entry or exit points.
Infield cables	Cables which link the wind turbine generators to the offshore substation platform(s).
Interlink cables	Cables linking two separate project areas. This can be cables linking: 1) DEP South array area and DEP North array area

	2) DEP South array area and SEP 3) DEP North array area and SEP 1 is relevant if DEP is constructed in isolation or first in a phased development. 2 and 3 are relevant where both SEP and DEP are built.
Interlink cable corridor	This is the area which will contain the interlink cables between offshore substation platform/s and the adjacent Offshore Temporary Works Area.
Landfall	The point at the coastline at which the offshore export cables are brought onshore, connecting to the onshore cables at the transition joint bay above mean high water.
Offshore cable corridors	This is the area which will contain the offshore export cables or interlink cables, including the adjacent Offshore Temporary Works Area.
Offshore export cable corridor	This is the area which will contain the offshore export cables between offshore substation platform/s and landfall, including the adjacent Offshore Temporary Works Area.
Offshore export cables	The cables which would bring electricity from the offshore substation platform(s) to the landfall. 220 – 230kV.
Offshore scoping area	An area presented at Scoping stage that encompassed all planned offshore infrastructure, including landfall options at both Weybourne and Bacton, allowing sufficient room for receptor identification and environmental surveys. This has been refined following further site selection and consultation for the PEIR and ES.
Offshore substation platform (OSP)	A fixed structure located within the wind farm site/s, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Offshore Temporary Works Area	An Offshore Temporary Works Area within the offshore Order Limits in which vessels are permitted to carry out activities during construction, operation and decommissioning encompassing a 200m buffer around the wind farm sites and a 750m buffer around the offshore cable corridors. No permanent infrastructure would be installed within the Offshore Temporary Works Area.
Order Limits	The area subject to the application for development consent, including all permanent and temporary works for SEP and DEP.

Sheringham Shoal Offshore Wind Farm Extension Project (SEP)	The Sheringham Shoal Offshore Wind Farm Extension onshore and offshore sites including all onshore and offshore infrastructure.
SEP offshore site	Sheringham Shoal Offshore Wind Farm Extension consisting of the SEP wind farm site and offshore export cable corridor (up to mean high water springs).
SEP wind farm site	The offshore area of SEP within which wind turbines, infield cables and offshore substation platform/s will be located and the adjacent Offshore Temporary Works Area.
Study area	Area where potential impacts from the project could occur, as defined for each individual Environmental Impact Assessment (EIA) topic.
The Applicant	Equinor New Energy Limited. As the owners of SEP and DEP, Scira Extension Limited and Dudgeon Extension Limited are the named undertakers that have the benefit of the DCO. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.

OFFSHORE IN-PRINCIPLE MONITORING PLAN

1.1 Purpose of the Offshore In-Principle Monitoring Plan

1. This Offshore In-Principle Monitoring Plan (IPMP) has been produced in order to provide the basis for delivering the monitoring measures as required by the conditions contained within the Deemed Marine Licences (DML) for the Sheringham Shoal Offshore Wind Farm Extension Project (SEP) and Dudgeon Offshore Wind Farm Extension Project (DEP).
2. As the owners of SEP and DEP, Scira Extension Limited (SEL) and Dudgeon Extension Limited (DEL) are the named undertakers that have the benefit of the DCO. References in this document to obligations on, or commitments by, 'the Applicant' are given on behalf of SEL and DEL as the undertakers of SEP and DEP.
3. The Offshore IPMP 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 SEP and DEP will be formally controlled.
4. The Offshore IPMP provides a framework for further discussions post consent with the Marine Management Organisation (MMO), the relevant Statutory Nature Conservation Bodies (SNCB) and advisors (e.g. Maritime and Coastguard Agency (MCA) and The Wildlife Trusts (TWT) where relevant)) to agree the exact detail (timings, methodologies etc.) of the monitoring that is required. Due to the long lead in time for the development of offshore wind farms it is not desirable or effective to provide final detailed method statements prior to consent being granted. 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 closer to the time that the actual work will be undertaken.
5. The relevant topics and / or receptor groups discussed in this plan are as follows:
   - Marine Geology, Oceanography and Physical Processes;
   - Marine Water and Sediment Quality;
   - Benthic Ecology;
   - Fish and Shellfish Ecology;
   - Marine Mammals;
   - Offshore Ornithology;
   - Commercial Fisheries;
   - Shipping and Navigation; and
   - Offshore Archaeology and Cultural Heritage.
6. Monitoring requirements in relation to compensation and/or Measures of Equivalent Environmental Benefit (MEEB) are addressed in the compensation/MEEB plans. These are:
   - **Appendix 2 – Sandwich Tern Compensation Document** [APP-069];

- **Annex 2A – Outline Sandwich Tern Compensation Implementation and Monitoring Plan** [APP-070];
- **Appendix 3 – Kittiwake Compensation Document** [APP-072];
- **Annex 3A – Outline Kittiwake Compensation Implementation and Monitoring Plan** [APP-073];
- **Appendix 4 – Gannet, Guillemot and Razorbill Compensation Document (Revision B)** [REP3-021] (provided on a without prejudice basis);
- **Annex 4A – Outline Gannet, Guillemot and Razorbill Compensation Implementation and Monitoring Plan** [APP-075] (provided on a without prejudice basis); and
- **Appendix 1 – In-Principle Cromer Shoal Chalk Beds (CSCB) Marine Conservation Zone (MCZ) Measures of Equivalent Environmental Benefit (MEEB) Plan (Revision C)** [REP2-020] (provided on a without prejudice basis).

1.2 Background

7. The Applicant is seeking a Development Consent Order (DCO) for SEP and DEP which are extensions to the existing Sheringham Shoal Offshore Wind Farm (SOW) and Dudgeon Offshore Wind Farm (DOW), located in the southern North Sea off the north Norfolk Coast.

8. The SEP wind farm site will cover an area of approximately 97.0km^2 and the DEP wind farm site will cover an area of approximately 114.75km^2. The closest point to the coast is 15.8km from SEP and 26.5km from DEP. Depths range from 14m below Lowest Astronomical Tide (LAT) in the northwest of the SEP wind farm site to 36m in the northwest of the DEP North array area.

9. Water depths within the offshore export cable corridor range from 25-27m in the offshore part closest to SEP, shallowing to about 16m near the eastern tip of Sheringham Shoal sand bank and then decreasing progressively to 0m at the coast.

10. Once built, SEP and DEP would comprise the following offshore components:
    - The offshore wind turbines and their associated foundations;
    - Scour protection around foundations as required;
    - Offshore substation platform/s (OSP/s) supporting required electrical equipment, possibly also incorporating offshore facilities; and
    - Subsea cables comprising infield, interlink and offshore export cables and associated external cable protection as required.

11. The detailed design of SEP and DEP (e.g. numbers of wind turbines, layout configuration, foundation type and requirement for scour protection) will be determined post-consent. Therefore, the key parameters presented in **Table 1** are indicative based on current information and assumptions.

12. The earliest any offshore construction works would start is assumed to be 2027.

13. Offshore construction works would require up to two years per Project (excluding pre-construction activities such as surveys), assuming SEP and DEP were built at different times. If built at the same time, offshore construction could be completed in two years. There could be a gap of up to four years between the completion of offshore construction works on the first Project and the completion of offshore construction works on the second Project.

14. It should be noted that the construction programme is dependent on numerous factors including consent timeframes and funding mechanisms.

1.2.1 Key Relevant Parameters

Table 1: Key Relevant Parameters

Parameter	Details		
	SEP	DEP	Combined
Approximate offshore construction duration	2 years	2 years	2 to 4 years
Wind farm site area	97.0	114.75	221.75
Distance from wind farm site to coast (closest point) (km)	15.8	26.5	15.8
Number of wind turbines	13-23	17-30	30-53
Maximum length of export cable SEP to landfall (per cable) (km)	n/a	40	n/a
Maximum length of export cable DEP to landfall[1] (per cable) (km)	62	n/a	62
Maximum number of export cables and trenches	1 & 1	1 & 1	2 & 2
Maximum total length of all interlink cables (km)	66	n/a	154[2]
Maximum turbine rotor diameter (m)	300	300	300
Maximum tip height above Highest Astronomical Tide (HAT) (m)	330	330	330
Minimum clearance (air gap) above HAT (m)	30	30	30
Rotor swept area (km^2)	1.20-1.30	0.92-1.00	2.12-2.30
Indicative minimum and maximum separation between wind turbines (inter-row) (km)	1.05-3.3	1.05-3.3	1.05-3.3

[1] Applies either to a DEP in isolation development scenario, or for SEP and DEP with a separate OSP in the DEP North array area.
[2] Applies to the scenario with one OSP in the SEP wind farm site and assuming only the DEP North array area is developed – see **Chapter 4 Project Description** for further details.

Parameter	Details		
	SEP	DEP	Combined
Maximum infield cable length (not incl. interlink cables) (km)	135	90	225
Number of OSP/s	One	One	Up to two
Wind turbine foundation type options	• Piled monopile; • Suction bucket monopile; • Piled jacket; • Suction bucket jacket; and • Gravity base structure (GBS).		
OSP foundation type options	• Piled jacket; or • Suction bucket jacket.		
Number of piles per foundation for wind turbines	Monopile = 1 Piled jacked = 4		
Maximum number of piles for wind turbines	Monopiles = 23 Piled jacket = 92	Monopiles = 30 Piled jacket = 120	Monopiles = 53 Piled jacket = 212
Maximum number of piles for OSPs	2 x 4 leg-jacket = 8 pin piles	2 x 4 leg-jacket = 8 pin piles	4 x 4 leg-jacket = 16 pin piles
Hammer energies (kilojoules) (kJ)	Maximum hammer energy for monopiles: • Up to 5,000kJ for 15 MW wind turbines • Up to 5,500kJ for 18+MW wind turbines Maximum hammer energy for pin-piles: up to 3,000kJ		
Maximum pile diameter (m)	• 3.5-4m for piled jackets • 13-16m for monopiles		

1.3 General Guiding Principles for the Proposed Monitoring

15. Throughout the ES and supporting documentation the Applicant has taken steps to avoid or reduce significant impacts either through the iterative process of project design ('embedded mitigation' e.g. the location of project boundaries) or by 'additional' mitigation measures which will be applied during the construction, operation and maintenance or decommissioning phases of SEP and DEP.

16. The Applicant notes the following Natural England comment provided at Section 42 consultation:

> *Natural England has concerns that SEP and DEP may be operational at different times which would have an effect on post-construction monitoring i.e. when would post-construction monitoring begin? Does the post-construction monitoring start when the last project becomes operational, or the first one? What if there are long periods of time (i.e. years) between this?*

17. Firstly, it is noted that the Applicant is seeking to coordinate the development of SEP and DEP as far as possible. The preferred option is a development scenario with an integrated transmission system, providing transmission infrastructure which serves both of the wind farms, where both Projects are built concurrently and therefore under this scenario post construction monitoring would be coordinated to begin in an appropriate manner once both Projects had completed construction.

18. However, it is recognised that due to the various development scenarios (see **Section 4.1.1** of **Chapter 4 Project Description** [APP-090] and the **Scenarios Statement** [APP-314], there could be a gap of up to four years between the completion of offshore construction works of each Project. As such careful consideration will need to be given to pre and post-construction monitoring timescales.

19. A key consideration is the potential for the effects from construction activities at SEP and DEP to interact since this could potentially influence monitoring results.

20. Since the development scenario and construction programme will not be determined until post-consent, the Applicant considers that details of the monitoring programme should be agreed through the development of topic specific monitoring plans that will be produced prior to the start of construction, as conditioned in the DMLs. This will enable those plans to take account of the nature of the impact in question and the monitoring that is proposed in relation to it. Notwithstanding this, where relevant, consideration has been given in the in-principle monitoring proposals included below as to whether the timing of construction activities between Projects is likely to be a relevant concern.

21. The Applicant notes that there is precedent for this approach, for example Dogger Bank Creyke Beck A & B and Dogger Bank Teesside A & B, which at the time that they were consented both featured two wind farms in single DCOs with each having a shared IPMP addressing the possibility of the projects being constructed concurrently or sequentially. In practice, offshore construction of the first three of these wind farms (collectively termed Dogger Bank Wind Farm) is being undertaken in three phases, although some construction works will overlap. The fourth project, which has been renamed Sofia Offshore Wind Farm, is being progressed by a different developer on its own timeframe although again some offshore construction works will overlap with phases of the Dogger Bank Wind Farm. In each case, the details of the monitoring programmes have been agreed at the post-consent stage to take account of the actual construction programmes and details of the works to be undertaken, accounting for the timings for the completion of construction on each project. The Applicant is proposing to take the same approach with respect to SEP and DEP.

22. 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, which would include those for monitoring, should be "*necessary, relevant to planning, relevant to the permitted development, enforceable, precise and reasonable in all other respects*" as set out in Paragraph 4.1.7 of the National Policy Statement (NPS) EN-1 and Paragraph 206 of the National Planning Policy Framework and referred to as the 'six tests' (Department for Communities and Local Government, 2012).

- In line with good practice, monitoring must have a clear purpose in order to provide answers to specific questions where significant environmental impacts have been identified (Cefas, 2012; Glasson *et al.* 2011; 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 (including on the effectiveness of mitigation), which are relevant to SEP and DEP and can be realistically filled, as well as those species or features considered to be the most sensitive to SEP and DEP impacts including those of conservation, ecological and/or economic importance.
- Proposals for monitoring should be based, as a starting point, on the best practice and outcomes of the latest review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms (MMO, 2014) and applying more recent best practice guidance and lessons learnt (including from the existing SOW and DOW monitoring programmes) where relevant.
- 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 monitoring approach), including those surveys conducted in support of the EIA. This includes the potential for survey requirements to be adapted based on the results of the monitoring outlined in this document, including in the event that unforeseen impacts arise, which may in turn give rise to the need for adaptive management measures to be considered. Where it has been agreed that there are no significant impacts, monitoring need not be conditioned through the DMLs.
- The Applicant is supportive of appropriate strategic monitoring studies. Where the Applicant is made aware of new strategic monitoring studies and they are aligned with the Applicant's business goals, they will discuss with the relevant authorities if they are appropriate to discharging specific SEP and DEP DML conditions. See **Section 1.6.2** for further details.

1.4 Consultation on this Document

23. **Table 2** summarises comments received from Natural England ~~in REP1-136~~ and the Applicant's response.

~~23.~~

Table 2: Natural England's comments on the Offshore In-Principle Monitoring Plan ~~provided in REP1-136~~ and the Applicant's response

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
2) Overarching Concerns with the IPMP				
1	3. In recognition of the emphasis currently being placed by projects in the post consent phase on the IPMP when setting the monitoring requirements and parameters; Natural England highlights the importance of the IPMP. Natural England is therefore not supportive of the Applicant's proposal to postpone fundamental discussions regarding the scope and purpose of the monitoring to the post consent phase.	As set out in **Section 1.3**, as an in-principle document, the Offshore IPMP is only intended to provide a framework for further discussions post consent to agree the exact detail (timings, methodologies etc.) of the monitoring that is required. This is the accepted and standard approach. However, where possible and relevant to do so, further detail has been added to this version of the document in response to the specific comments that have been made.	Natural England advises that there is a misunderstanding between the Applicant and Natural England on the purpose of the IPMP and in providing our advice Natural England is drawing on our wealth of experience of post-consent monitoring discussions and implementation. This includes our advice for more recent IPMPs than Dogger Bank. We strongly advise that rather than focusing on the exact details of the surveys as highlighted by the Applicant in the updated IPMP; the IPMP should set out the fundamental hypotheses/questions that will be tested by the monitoring based on the outcomes of the HRA, EIA and address issues of uncertainty and/or residual impacts. In addition, Natural England highlights that, while there is agreement that IPMPs are finalised post consent based on project design and timescales; we do not agree that the approach taken for the Dogger Bank project is a standardised approach. Lessons have been learnt since the development of the IPMP for those	The 'fundamental hypotheses/questions that will be tested by the monitoring based on the outcomes of the HRA, EIA and address issues of uncertainty and/or residual impacts' are set out throughout the IPMP tables under the heading 'headline reasons for monitoring'. Where possible and appropriate to do so the Applicant has added further detail describing the potential hypotheses/questions that will be tested, subject to development of the detailed monitoring plans. However fundamentally the position remains that the document is only intended to provide a framework for further discussions post consent for the reasons already set out. This approach is consistent with the final IPMP submitted for EA1N/2 [REP8-028, document reference 8.13] for which the consent has been granted. For the sake of clarify, the Applicant's reference to Dogger Bank is only made in relation to the development scenarios and

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
			projects, which are based upon ongoing and reoccurring post-consent disagreements with the developers on ecological monitoring requirements and survey effort required in order demonstrate key predictions of the Environmental Statement and/or HRA. Our advice on the content of the IPMP for SEP and DEP is consistent with that provided for the EA1N and EA2 examination [REP5-086].	construction programme (since there are similarities with SEP and DEP in that regard) and not the approach to the IPMP in general.
2	4. Overall, Natural England feels that much more detail is required than is provided in the IPMP in its current form. For example; • what are the hypotheses the monitoring will be testing? • how will the monitoring be designed to ensure that the desired outcomes can be achieved i.e. is the monitoring fit for purpose? • What are the indicative timings of the surveys? How will the various build-out scenarios be considered when designing the monitoring and will a construction gap of 2-4 years warrant additional monitoring? Also, will the construction of the second project skew or impact on the monitoring of the first?	As above. Also: • Information on how the build-out scenarios will be considered in the monitoring plans is provided in **Section 1.3**. • Reference to using any lessons learnt from the existing SOW and DOW monitoring programmes has been added to **Section 1.3**.	Natural England is content to leave fine tuning of the IPMP to post-consent in relation to the build out scenarios only. However, we do expect all of our other queries to be considered within the IPMP and highlight the risks with not considering possible implications for monitoring from the various build out scenarios at the consenting phase, including additional survey campaigns.. Natural England queries if the views of the MMO been sought as the regulator for the monitoring post-consent.	Refer to response at ID 1 above. With respect to the MMO, the draft Statement of Common Ground with MMO Revision B [REP3-078] confirms the MMO's position that "*this in-principle document is appropriate*".

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	• Can lessons be learnt from previous thematic surveys and how will modifications to surveys design be incorporated between survey campaigns? • What does 'success' look like to demonstrate that no further monitoring is required? • What happens if the results do not support the null hypothesis? Is further monitoring required (with/without modifications)? If impacts are greater than predicted, do actions need to be undertaken to address the impact? How will the further monitoring and actions be secured, is a change to the wording of the dML required? And if so, how will success of any action/s be monitored and what will be the success criteria before monitoring can cease?			
3	5. To answer the above, Natural England considers the IPMP should consider what the uncertainties and evidence gaps of the EIA/HRA are, rather than repeating the outcomes of the EIA/HRA. We consider that establishing the uncertainties and evidence gaps of the EIA/HRA is necessary to inform what monitoring should be undertaken. We also note	As set out in **Section 1.3**, one of the guiding principles of the Offshore IPMP is that "M*onitoring should be targeted to address significant evidence gaps or uncertainty, which are relevant to SEP and DEP and can be realistically filled, as well as those species or features considered to be the most sensitive to SEP and DEP impacts including*	Natural England does not agree with pushing the identification of key monitoring requirements to post consent. Many of the detailed discussions during pre-Application and examination are lost between examination and pre-construction such that the Applicant and regulators can only rely on the contents of the IPMP. It is our pre-	Refer to response at ID 1 above.

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	that this may be different depending on scale of development within any of the 3 areas included in the DCO boundary; and features present and/or utilising the area.	*those of conservation, ecological and/or economic importance*". This has been accounted for in the development of the in-principle proposals set out in **Section 1.6** and will inform the further development of the detailed monitoring plans at the post-consent stage.	construction experience across multiple projects, of monitoring requirements in which consent decisions are based, becoming open to challenge, and/or monitoring not being fully fit for purpose. Please see other responses provided within this response.	
4	6. Similarly, Natural England wishes to highlight the importance that all relevant monitoring proposals for SEP and DEP and/or associated DCO/dML conditions consider the aim of securing a mechanism for adaptive monitoring when unforeseen impacts are detected. Thus, ensuring remedial measures (i.e., adaptive management) are triggered should the results of monitoring demonstrate impacts are significantly greater than predicted and/or incorrect assumptions were concluded following review of the environmental statement and supporting documents. We advise the bulleted list in paragraph 20 of the Offshore IPMP [App-289] omits this key consideration, and that the potential for certain monitoring to trigger the development of countermeasures (with associated monitoring of those measures) should be clearly stated in relevant tables of the IPMP and incorporated into the DCO conditions where relevant.	As set out in **Section 1.3**, one of the guiding principles of the Offshore IPMP is that "*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 EIA. 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.*" (emphasis added). Reference to 'unforeseen impacts' and 'adaptive management' has been added to this section.	Natural England notes that the additional text allows for adaptive management measures to be considered. However, the text does not provide the necessary assurances that adaptive management measures 'will' be undertaken and does not included commitments to ongoing monitoring that would be required should design changes and /or unforeseen impacts occur. The wording within the DCO monitoring condition should be updated such that the regulator can require further mitigation measures and monitoring thereof should it deem it necessary.	The Applicant considers that such an amendment would not be necessary or appropriate. If monitoring work identified a potential need for adaptive management or remedial measures, then the Applicant would discuss with the relevant parties (i.e. Natural England and the MMO) at the relevant time what an appropriate course of action would be. Such measures may themselves require a separate consent or agreement before they could be implemented (e.g. a marine licence for works to the seabed). It will therefore not necessarily be within the Applicant's power to immediately undertake such works and therefore it is not appropriate to seek to impose such a requirement through the DML. However, the Applicant is able to commit to undertake additional monitoring where it is identified that

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
				there is an additional need for it. The DMLs within the **draft DCO (Revision J)** [document reference 3.1] have been amended by adding a new sub-paragraph (6) to condition 20 of Schedules 10 and 11 and condition 19 of schedules 12 and 13 as follows: "*(6) In the event that the reports provided to the MMO under sub-paragraph (4) identify a need for additional monitoring, the requirement for any additional monitoring will be agreed with the MMO in writing and implemented as agreed.*"
5	7. Natural England advises an approach mechanism in which the Applicant presents a clearly defined hypothesis or null hypothesis of no impact would be beneficial. Monitoring thereafter would aim to test this. We advise a review period during which SNCBs and regulatory bodies such as the Marine Management Organisation are consulted by the Applicant to assess the results of the first period of monitoring. For example, one mechanism that could be introduced for particular receptors would be a live document which is reflective of what the monitoring is observing.	Noted – the in-principle proposals for monitoring are provided in **Section 1.6** including the headline reason/s for monitoring and outline details of the monitoring proposed. As above, the exact details of the monitoring will be agreed at the post-consent stage as per the accepted and standard approach. The requirements for the carrying out of the agreed surveys and providing the agreed reports are included in the DMLs. The Applicant notes that in practice, the MMO consults with key stakeholders including Natural England on the results of the monitoring as it is undertaken and considers that this	Natural England draws your attention to our previous responses. Natural England highlights that, while there is agreement that in principle monitoring plans are finalised post consent based on project design and timescales; we do not agree that the approach taken for Dogger Bank is a standardised approach. Lessons have been learnt since the development of the IPMP for those projects, which are based upon ongoing and reoccurring post-consent disagreements with the developers on ecological monitoring requirements and survey effort required in order demonstrate key	Refer to response at ID 1 above.

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
		provides the appropriate mechanism to review and agree any necessary changes to the monitoring programmes going forward from that point.	predictions of the Environmental Statement and/or HRA. Our advice on the content of the IPMP for SEP and DEP is consistent with that provided for the EA1N and EA2 examination [REP5-086].	
6	8. We advise that monitoring should be effective in providing evidence on the effectiveness of mitigation measures, to ensure compliance with measures identified in assessments to mitigate significant impacts and provide evidence to assess the significance of adverse effects, evaluate the success of compensation measures and to help inform whether further remedial measures are required. Though we do recognise that in principle monitoring required for compensation packages may be set out in other documents and therefore this document should clearly signpost the sections of the relevant (DCO) named plans.	Agreed with respect to monitoring the effectiveness of mitigation measures. Monitoring requirements in relation to compensation and/or MEEB are addressed in the compensation/MEEB plans. As suggested, reference to the relevant documents has been added to **Section 1.1**.	Natural England would wish to see the monitoring of the effectiveness of mitigation measures included as a hypotheses to be tested through monitoring.	Reference to monitoring the effectiveness of mitigation measures has been added at Section 1.3 General Guiding Principles for the Proposed Monitoring. As such Natural England can be assured that this will be considered in the development of the detailed monitoring plans post-consent. However we would also note that monitoring of the effectiveness of mitigation is implicit in the outline proposals that have been developed. Where targeted monitoring may be required with respect to a specific mitigation measure the detail of this can either be agreed at the post-consent stage or has already been incorporated in the IPMP, for example for marine mammals: "*The purpose of this monitoring would be to research the behavioural response of marine mammals to different construction activities, including from mitigations (e.g. ADDs), in order to validate the conclusions of the*

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
				ES and RIAA." (Table 7 of the IPMP).
7	9. We draw the Applicants and other interested parties' attention to the fact that the MMO 2014 monitoring review is now 9 years old and based on evidence gathered from Round 1 and some Round 2 windfarms over 10 years ago. Since then, technology has progressed and the scale and number of offshore windfarm developments has considerably changed as has our understanding of the impacts. Therefore, we advise that the MMO review should be a starting place to understand potential monitoring, but more recent best practice guidance and lessons learnt should also be taken into account.	Noted, **Section 1.3** has been updated accordingly.	Noted and Natural England agrees with the update.	-
3) Thematic specific advice				
8	3.1 Section 1.4.2 Marine Physical Processes 10. It is unclear to Natural England what the purpose of the monitoring is. We request that further details are provided to answer the questions posed in our overarching comments.	The potential effects to be investigated by the monitoring, the headline reason/s for monitoring and outline details of the monitoring proposal are clearly set out in **Table 3~~Table 4~~**. In this case this includes monitoring any changes in sea bed level and the sediment transport regime, including scour processes. This will provide information on, for example, sand wave recovery and sand wave migration.	We welcome the proposed monitoring for Cromer Shoal Chalk Beds Marine Conservation Zone (CSCB MCZ) including sea bed level change and scour/secondary scour. However, we advise more detail is required. For ease of reference, Table 3 should be presented ahead of Table 4, or the table numbering could be amended.	Tables 3 and 4 have been reordered as suggested and cross references updated. With respect to the general request for 'more detail' the Applicant refers to its response at ID 1 above. With respect to the sand wave / bank recovery and migration, a suggested hypothesis has been added to Table 3 of the IPMP. The Applicant's position is that the intent of the monitoring as set out is

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
		As stated in Table 3~~Table 4~~, because the proposal includes full sea bed coverage swath bathymetric, MBES and SSS surveys, the monitoring will provide a full understanding of the recovery of the physical form of the seabed following construction, in the same manner that has been achieved on the existing SOW and DOW (and which confirmed the absence of any significant effects).	Natural England welcomes the inclusion of Table 3 which outlines a scope of work to support development of detailed plans for cable installation to maximise the chance of burial success for SEP and DEP (in the CSCB MCZ). We welcome the inclusion of sandwave/bank migration and recovery monitoring. We advise the hypothesis to be tested is outlined.	sufficiently clear for the purpose of the IPMP. As already explained in the response to REP1-136 (see Table 2 of the IPMP), because the proposal includes full sea bed coverage swath bathymetry, MBES and SSS surveys, the monitoring will provide a full understanding of the recovery of the physical form of the seabed following construction, in the same manner that has been achieved on the existing SOW and DOW (and which confirmed the absence of any significant effects).
9	3.2 Section 1.4.3 Water and Sediment Quality 11. In light of sediment disposal potentially across the construction area including Cromer Shoal MCZ, we consider pre-construction sediment contaminant monitoring will be required for the purposes of suitability for sediment disposal. We advise this must be agreed with the MMO/CEFAS and secured within the DCO/DML.	Further contaminants sampling and analysis will be undertaken post-consent to inform the licence for the disposal of sediment at sea, which will be applied for post-consent. Condition wording, as agreed with the MMO, to secure the requirement for post-consent contaminants sampling was included with the **Draft DCO (Revision F)** [REP3-009] at Deadline 3. The Applicant therefore proposes to withhold any further updates to the **Disposal Site Characterisation Report** [APP-300] until the post-consent stage when more accurate details on the design (e.g. foundation types) and therefore quantities of material that are required to be disposed of, are known. This will enable a more accurate assessment to be	-	-

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
		undertaken. This approach has been agreed with the MMO (see **Draft SoCG with MMO (Revision B)** [REP3-078]).		
10	3.3 Section 1.4.4 Benthic Ecology 12. Natural England highlights that unlike the original Dudgeon and Sheringham Shoal Projects, the extension projects have included a requirement for cable protection within the Cromer Shoal Chalk Beds MCZ. Thereby, the results can't be fully extrapolated. Natural England advises that a monitoring plan for any cable protection within the MCZ is included with the IPMP and secured within the DCO. 13. Natural England also advises that monitoring of any areas of priority habitats is undertaken pre and post construction to inform any mitigation measures and ensure the effectiveness of those measures. If it is found that measures have been insufficient then further measures and/or remediation may be required to ensure the projects remain beneficial to the environment.	12. Details of the proposals for monitoring cables, including cable protection, are required to be included with the construction method statement, as set out in the relevant DMLs. From an ecological perspective, the Applicant agrees that, in the event that external cable protection is installed in the MCZ, post-construction monitoring may be able to provide further useful information to help confirm the extent and nature of the impact. This monitoring is included in **Table 5**. 13. Monitoring requirements for priority habitats are included in the Offshore IPMP, see **Table 5** below.	We welcome the proposed monitoring for Cromer Shoal Chalk Beds Marine Conservation Zone (CSCB MCZ). Including seabed level change and scour/secondary scour However, we advise more detail is required.	Refer to responses at ID 1 and 8 above.
11	3.4 Section 1.4.5 Fish and Shellfish Ecology 14. Natural England advises that the undertaking of fish surveys could be considered as a secondary compensation measure for North Norfolk Sandwich terns by filling evidence gaps in relation to prey	14. The Applicant held a meeting on 23 February 2023 with Natural England, MMO and Cefas to discuss these opportunities. It is noted that the opportunity is relevant both to the requirement for compensatory measures for Sandwich tern, but also in more	Natural England's advice at Deadline 1 [REP1-136] in relation to undertaking fish surveys as secondary compensation measure and monitoring of fish availability for Annex I bird species will be required as this area is currently located in a	The Applicant has updated Table 8 of the IPMP to include further detail on proposals for monitoring of Sandwich tern prey availability, which reflects the discussions between the Applicant, Natural England, MMO and Cefas during

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	(namely sandeel, herring) availability which are potentially limiting colony size. This data could then inform appropriate site management measures and would be considered to be beneficial for nature conservation 15. Natural England advises that should DEP North be taken forwards then monitoring of impacts to fish availability for Annex I bird species will be required as this area is currently located in a foraging area for Sandwich terns.	general ecological terms. It should be noted that monitoring requirements in relation to compensation are addressed in the compensation plans (see **Section 1.1**). ~~However, in either case the Applicant considers that the discussions have not reached a suitable level of maturity in order to be able to include any specific requirement in the Offshore IPMP. For example, this includes the identification of a suitable monitoring technique and understanding whether this would actually enable a better understanding of prey availability. The Applicant remains committed to progressing these discussions for further consideration post consent.~~The Applicant has updated **Table 8** to include further detail on proposals for monitoring of Sandwich tern prey availability. 15. As above. For the avoidance of doubt, the Applicant's position on monitoring requirements is the same regardless of the development scenario in question.	foraging area for Sandwich terns remains unchanged.	Examination (meeting on 23 February 2023).
3.5 Section 1.4.6 Marine Mammals				
12	16. The Applicant has presented the conclusions of the Environmental Statement only. We advise that the Applications should also present:	**Section 1.6.7** has been updated to include the conclusions of the **Report to Inform Appropriate Assessment (RIAA)** [APP-059] and	The Applicant has provided further information in the IPMP that was specifically requested in relation to marine mammals (presenting	Refer to response at ID 1 above. Where possible and appropriate to do so the Applicant has added further detail describing the

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	a. The conclusions of the RIAA, include impacts that are approaching adverse effect; b. Where there are areas of "high uncertainty or low confidence" in the data and/or assessment; as these are also valid targets of post-consent monitoring. 17. We strongly advise that the IPMP is updated accordingly, to ensure that all current and residual concerns as outlined in our relevant and written representation [RR-63] are captured and can be considered for monitoring (see Annex A for best practice guidance on post consent monitoring).	**Marine Mammals Technical Note and Addendum** [REP3-115].	updated conclusions from the RIAA and ES; assumptions and knowledge gaps). They have also presented options that would evidence the impacts to marine mammals, and also demonstrate the effectiveness of mitigation. Nevertheless, as outlined in our response to the Offshore IPMP at Deadline 1 (see Paragraph 4), we consider that further detail is still required.	potential hypotheses/questions that will be tested, subject to development of the detailed monitoring plans.
13	18. Furthermore, the IPMP should be updated to reflect the conclusions of any impact assessment(s) that are revised in accordance with Appendix D to the Relevant Representations of Natural England [RR-063]. This will inform further potential targets for monitoring			
14	19. It is important to note that the underwater noise monitoring is aimed at validating the change in the marine environment (in terms of underwater noise levels); it does not monitor the response of animals to the noise. This monitoring is undertaken primarily to confirm that the mitigation measures in the MMMP are sufficient to minimise the risk of injury to animals. The	The proposed marine mammal monitoring for SEP and DEP (as provided in **Section 1.6.7**) has been updated accordingly.		

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	relationship between underwater noise levels and the response of animals is still highly uncertain and could benefit from further monitoring. Natural England is concerned that no monitoring has been outlined that would evidence the impacts to marine mammals e.g., monitoring animal responses to impacts. Please note that if it is found that the mitigation measures are insufficient then it must be secured in the DCO or Marine Mammal Mitigation and Site Integrity plans that action must be taken to address the issues and further monitored			
15	20. Natural England does not consider that "compliance monitoring" in the MMMP e.g., monitoring of the mitigation zone prior to the commencement of noisy activities (piling) is monitoring for the purpose of the IPMP. Reference to this monitoring should be removed. If the Applicant is proposing additional monitoring to validate the effectiveness of mitigation measures in the MMMP, more details must be provided.	References to this type of monitoring has been removed.		
16	21. Similarly, reporting or recording that is done under the Site Integrity Plan does not constitute monitoring for the purpose of the IPMP. If the Applicant is proposing additional monitoring to validate the effectiveness of mitigation measures in the Site Integrity Plan,			

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	Natural England advises more details must be provided.			
17	22. To our knowledge the Offshore Wind Strategic Monitoring Research Forum is focussed on ornithological receptors (https://jncc.gov.uk/our-work/owsmrf/). Therefore, the applicability of this forum to develop and co-ordinate strategic marine mammal monitoring remains uncertain.	The Applicant will keep informed of any strategic monitoring projects (such as through the Offshore Renewables Joint Industry Project (ORJIP) or Defra's Offshore Wind Enabling Actions Programme (OWEAP) that could offer strategic monitoring opportunities and will discuss these with Natural England and MMO in preparing the detailed monitoring plans post consent.		
18	23. Further information on strategic monitoring options is needed to understand whether it could be considered for post-consent monitoring.			
3.5 Section 1.4.7 Offshore Ornithology				
19	24. Natural England notes that overall, the emphasis in the Offshore IPMP in relation to ornithology is focused on EIA rather than the HRA assessment. Natural England advises emphasis should be on species that have been at or close to adverse effect under HRA, or particular areas of uncertainty (e.g., apportioning, demographic parameters).	Additional species have been included within **Table 8** to address this comment.	Noted, NE agree with the species listed.	No further action needed.
20	25. The offshore ornithology monitoring section of the IPMP focuses solely on Sandwich tern for which it is noted the Applicant has submitted derogation proposals. For, Sandwich tern specific monitoring we advise that links to derogations case documents are provided for transparency and ease of	Monitoring requirements in relation to compensation are addressed in the compensation plans. As suggested, reference to the relevant documents has been added to **Section 1.1**.	No further action needed.	-

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	cross-referencing. Similarly for any other species where a derogations case is potentially required.			
21	26. We advise that the IPMP should consider collision risk impacts from the operational windfarm to a wider set of key species. These include great black-backed gull at the EIA scale, and the predicted impacts presented for Flamborough Filey Coast SPA for kittiwake as well as Sandwich tern for the North Norfolk Coast SPA.	These species have been added to **Table 8.**	We suggest it would be helpful to have a table setting out the quantified level of effect to the species under consideration (i.e., the number of collisions predicted for ST at NNC SPA, the number of collisions of GBBG, the range of displacement induced mortality for guillemot and razorbill at FFC SPA). We advise this compilation of values relevant to the monitoring should also refer to the level of compensation being offered (so in the case of ST and Kittiwake this should include the 95% CI), and/or be clearly linked to the integrity judgements reached by the Applicant and Natural England. This quantification should form the basis of an over-arching hypothesis for each species listed. Issues should be listed that contribute to the uncertainty for each species. As, an example for sandwich tern this may be - flight height, macro-avoidance (as CRM assumes no macro-avoidance in the case of ST), the AR etc. For Guillemot this may be - rate of displacement, mortality due to	The Applicant does not disagree with this suggestion, as such, but considers that this information would be more usefully provided when the final consented numbers for the predicted effects have become available. Therefore, it is proposed to provide the suggested table of predicted effects when the consented numbers are established.
22	27. In addition, it is noted that other receptors of concern i.e., auks and red-throated diver, are not mentioned. Natural England seeks further information regarding the rationale for this omission and advises monitoring for these species should be included in the IPMP at this stage of its development.	These species have been added to **Table 8.**		
23	28. As such, Natural England advises the following approach to offshore ornithology monitoring: a. Monitoring of species/impacts subject to compensation (kittiwake, Sandwich tern and potentially guillemots/razorbills and red-throated diver) should be conducted at the windfarm site as well as at the compensation sites. b. Other species that are close to adverse effect (under HRA) or	These have been added to **Table 8.**		The Applicant agrees with this suggestion to an extent only, as the purpose of the IPMP is to focus on the *key* uncertainties and facilitate the process of determining which are most appropriately addressed by a post-consent monitoring programme. The Applicant considers that the information provided in Table 8 provides this focus and that there is a limit to which additional detail will usefully add to this.

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
	moderate adverse (under EIA) to be included as targets for monitoring. We believe that this is likely to include great black-backed gull, as identified by the Applicant, but might also include other species identified through the course of the Examination. c. Any other key areas of uncertainty that feed into the impact assessment should be included, for example Sandwich tern flight speed/flight height, survival rates etc.		displacement, connectivity with FFC, number of adults present). For RTD this may be - level of extent of displacement due to arrays, , disturbance response to vessels. Hypotheses should be formed based on these uncertainties. For example; 'Sandwich tern flight speed is as presented in Fijn and Gyemesi (2018)' Proposals should be outlined that specifically address these hypotheses, noting that not all will be possible to be addressed by SEP and DEP. There will also be uncertainty regarding the level of impact to the population in question arising from the effect (in the case of integrity judgements based on population level impacts). For example - HPAI, survival and productivity rates, apportioning. These should also be clearly listed, and where possible hypotheses formed that describe the assumptions made to reach integrity judgements. Again, recognising that not all hypotheses can be addressed. It is important that the SEP and DEP post-construction monitoring	Therefore, text has been added to Table 8 which outlines some of the hypotheses associated with key uncertainties that could be tested for each 'monitoring headline reason' that is identified in the table. It should also be noted that for certain topics it is not particularly useful to try to frame the key uncertainties in terms of specific hypotheses. Rather, it is more practical to set out what the monitoring would actually seek to test or determine (e.g. in relation to displacement rates for the key species). Furthermore, for some issues identified by Natural England, project-level monitoring is highly unlikely to be a feasible route to addressing them (e.g. determining whether displacement results in increased mortality rates and, if so, the magnitude of such increases). On the topic of resulting population-level impacts, whilst it is recognised that there is uncertainty, it does not necessarily follow that this is a practical (or suitable) avenue for a project-level post-consent monitoring programme. Therefore, unless these issues relate directly to potential avenues for post-consent monitoring, the Applicant does not agree that it is useful to go into

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
			supplements the existing work already being done in the area rather than conflicting with this. A summary of monitoring undertaken by DOW has been provided, which is welcomed; this is relevant to the development of a coherent and robust post-consent plan for SEP and DEP. However, we note there are many offshore windfarms with the Greater Wash area, all of which have/or will have had post consent monitoring in place, and for many the focus will be on the same suite of species as relevant to SEP and DEP. For example, Race Bank is using Digital surveys to look at distribution changes and lidar to measure sandwich tern flight height, Triton Knoll is installing collision monitoring equipment and Lincs conducted a comprehensive survey regime to look at changes in distribution. Therefore, we advise that when developing the specific methodological proposals to address the hypotheses identified, it will be crucial to review the past and current post consent monitoring underway in the Greater Wash (and other projects of relevance further afield), along with all other relevant data sources (such as the Greater	detail on these uncertainties in the IPMP. The relevant elements of this are already captured within Table 8 (e.g. by setting out what is feasible by way of monitoring of the relevant SPA Sandwich tern populations and by including possible options for the origins of kittiwake using the Project sites). In relation to the monitoring that is being, or will be, undertaken across the various wind farms within the Greater Wash area (and beyond), the Applicant agrees with Natural England that it will be essential for the SEP / DEP monitoring proposals to be developed within the context of this wider work and to aim to complement and build upon it. Therefore, the Applicant will seek to engage with Natural England in identifying monitoring proposals that address key uncertainties associated with SEP/DEP whilst most effectively complementing the monitoring that is being undertaken by these other projects.

ID	Natural England Comment (REP1-136)	Applicant's Response	Natural England Comment (REP5-090)	Applicant's Response
			Wash SPA condition monitoring surveys).	
24	29. The above approach is subject to Natural England's final position regarding these species and their associated adverse impacts. We advise the detailed plan is subject to agreement with Natural England.	Noted. **Table 8** sets out options for in-principle monitoring. As set out in **Section 1.6.8.3**, the Applicant expects that not all measures would be taken forward to implementation, but that these will form the basis of discussion with Natural England to agree those most appropriate to take forward. Detailed plans can be developed for agreement with Natural England.	To clarify – Natural England has provided final positions on gannet at FFC SPA, kittiwake at FFC SPA, Sandwich tern at NNC/GW SPA (alone and in combination) and guillemot, razorbill and the seabird assemblage at FFC SPA (alone). Natural England has yet to provide final positions on guillemot, razorbill and the seabird assemblage at FFC SPA in combination, RTD at GW SPA (alone and in-combination) and RTD at OTE SPA (in-combination). These positions are summarised in Table 2 of our Deadline 5 response.	Noted

1.5 SEP and DEP Residual Impacts

24. The EIA predicts the residual impact to receptors taking into account:
    - Linkages using the source > pathway > receptor model;
    - Embedded / Additional Mitigation;
    - Sensitivity to the effect;
    - Magnitude of the effect; and
    - Ecological / economic importance / value.

25. The significance of the residual impact should not in its own right necessarily lead to the requirement for monitoring. Monitoring should be targeted to address significant evidence gaps or uncertainty, which are relevant to SEP and DEP and can be realistically filled.

26. For each receptor the residual impacts and major areas of uncertainty as predicted within the SEP and DEP ES, **Stage 1 Cromer Shoal Chalk Beds (CSCB) Marine Conservation Zone (MCZ) Assessment (Revision B)** [~~APP-077~~document reference 5.6] and **RIAA** [APP-059] (and any updated assessments as indicated throughout) are detailed. Monitoring has been deemed necessary and required as part of the DML where moderate or major adverse impacts are predicted in the assessment or where uncertainty remains at an industry-wide level.

1.6 In-Principle Proposals for Monitoring

27. The following sections set out the in-principle proposals for monitoring in relation to each of the topics and / or receptor groups covered in the ES.

28. While accepting that this Offshore IPMP represents the best approach to monitoring available at the time of writing, it is recognised that the outcomes of the survey work discussed could influence future monitoring requirements, methodologies, focus and effort for SEP and DEP, as knowledge and understanding develops. For example, where appropriate, and in consultation with the MMO and its advisors, these scopes may be refined to consider other relevant studies carried out by the existing SOW and DOW or other neighbouring projects in the region. This is a key principle for an adaptive approach to monitoring and will be the subject of ongoing consultation between the Applicant, the MMO and its advisors, as discussed under guiding principles (see **Section 1.3**).

29. This document has been submitted with the DCO application and will be used as a basis for further discussions post consent.

1.6.1 Engineering Related Monitoring

30. In addition to the environmental survey and monitoring required as conditions of the DMLs within the DCO, additional studies will be undertaken for engineering purposes. Some of these will overlap with the conditioned monitoring and wherever possible the Applicant will look to combine surveys for monitoring purposes with those already being carried out for engineering purposes. These are:
    - Geophysical;
    - Geotechnical;

- Unexploded Ordnance (UXO) survey;
- Remotely Operated Vehicle (ROV) survey; and
- Cable burial survey.

31. Other relevant Plans required under the DML with commitments to monitoring (linked to those listed above) are:
    - A cable specification and installation monitoring plan (CSIMP) in accordance with the **Outline CSCB MCZ CSIMP (Revision B)** [document reference 9.7~~APP-291~~];
    - A scour protection and cable protection plan (monitoring of scour and protection measures);
    - A cable specification and installation and monitoring plan (cable burial monitoring); and
    - An offshore operations and maintenance plan (OOMP) in accordance with the **Outline OOMP** (Revision C) [REP3-058].

1.6.2 Strategic Monitoring

32. Equinor is actively involved with the following strategic initiatives:
    - The Offshore Wind Strategic Monitoring Research Forum (OWSMRF), which is addressing wider knowledge gaps and industry priorities, focussed on marine birds.
    - ORJIP, of which Equinor is a Stage 2 partner.
    - Defra's OWEAP.
33. As noted in **Section 1.3**, where appropriate strategic monitoring studies are available, the Applicant will discuss with the relevant authorities if they are appropriate to discharging specific SEP and DEP DML conditions. This is considered to be particularly relevant to marine mammals and ornithology as reflected in **Sections 1.6.7** and **1.6.8** below.
34. Equinor is also running a number of ongoing offshore wind monitoring initiatives which will be considered for relevance to SEP and DEP monitoring requirements. These include, for example:
    - Ornithological monitoring for the Dogger Bank Wind Farm including:
        - Photographing seabirds at sea to determine the age class of birds present (gannet, kittiwake, razorbill and guillemot), using plumage/moult patterns. This will be used to assist the understanding of the proportion of adult birds present at the OWF sites, and hence potential use of the site by birds from FFC SPA.

- Catching seabirds at sea to collect feather samples from kittiwakes and gannets for stable isotope/elemental analysis. This will be used to seek to determine the breeding colony origin of birds present at the OWF sites. This, together with the photographic monitoring above, will improve our knowledge of utilisation of offshore areas by seabirds during the breeding season, which will assist our understanding of the extent to which SEP and DEP are likely to be used by birds from FFC SPA.
- Pre- and post-construction digital aerial surveys to estimate displacement effects on guillemot and razorbill.
- Monitoring of sandeel abundance/distribution, and analysis of evidence of effects of sandeel densities on the displacement rates of seabird species.

- Monitoring activities for seabirds/migratory birds on Hywind Tampen in the Norwegian North Sea (radar, CCTV) through the Marcis project and through Equinor's own initiatives.
- WindSys – a large project with many sub activities including an observation platform which will be installed on Hywind Tampen for approximately three years to collect data using various mounted sensors (hydrophones, echolocation, cameras etc.). The primary focus is fish and fish behaviour in a wind farm, particularly from a noise/sound perspective.
- Technology development for monitoring biodiversity and biomass in wind farms (e.g. using eDNA techniques), which follows pilot projects undertaken at Hywind Scotland.
- A PhD project in the UK which will map marine mammals in wind farm areas (Hywind Scotland) to investigate possible barrier effects.

1.6.3 Marine Geology, Oceanography and Physical Processes

1.6.3.1 Conclusions of the Environmental Statement

35. No residual impacts greater than negligible were predicted within the ES. The Applicant would wish to survey areas using appropriate geophysical surveys including high resolution bathymetric, multibeam echosounder (MBES) and side-scan sonar (SSS) surveys of the area(s) within the Order limits for engineering purposes. This information would also help inform the interpretation of the benthic monitoring results (see **Section 1.6.5**).

1.6.3.2 In-Principle Monitoring

36. Table 3~~Table 4~~ provides information on the monitoring requirements for marine, geology, oceanography and physical processes. The proposed monitoring will be discussed and agreed with Natural England and the MMO.

37. Regarding the timing of construction activities depending on the build out scenario for SEP and DEP, this is not considered to be a relevant concern since the only monitoring activities for which there is potential for interaction would be in relation to sand wave levelling within the export cable corridor however since there are no sand waves within the shared portion of the export cable corridor for SEP and DEP (see **Figure 4.9** of **Chapter 4 Project Description** [APP-090]) there is no potential for interaction.

38. Regarding monitoring within the CSCB MCZ, Table 4~~Table 3~~ (taken from the **Outline CSCB MCZ CSIMP (Revision B)** [document reference 9.7~~APP-291~~]) outlines a scope of work that the Applicant will carry out in the development of the detailed plans for installation and burial of cables in the MCZ. This forms a comprehensive evidence base providing confidence that execution of the installation and burial strategy will meet the relevant burial requirements. In the case of SEP and DEP this uniquely benefits from the experience that the Applicant has in undertaking the SOW and DOW export cable installation campaigns, providing direct evidence that lessons learnt have been accounted for and that, in the case of DOW, similar design approaches, installation methods and tools have been used to achieve successful outcomes. Details of these lessons learnt are provided in Section 1.6.3.1 of the **Outline CSCB MCZ CSIMP (Revision B)** [document reference 9.7].

39. It is proposed that as the tasks outlined in Table 4~~Table 3~~ are progressed, the specific details and requirements for monitoring are discussed and agreed with Natural England and the MMO, once the detailed design, installation techniques and programme for SEP and DEP are confirmed. Consideration will be given to how monitoring within the MCZ can build on that undertaken for SOW and DOW rather than repeating what was undertaken for those projects. This approach would also apply to any related benthic ecology monitoring.

~~*Table 3: Proposed Scope of Work to Support Development of Detailed Plans for Cable Installation to Maximise the Chance of Burial Success for SEP and DEP*~~

~~Task~~	~~Details~~
~~Lessons learnt from the SOW export cable installation~~	~~Identify key areas of success and under-performance, primary causes of any under-performance. Recommendations to maximise chance of success for SEP and DEP.~~ ~~See **Section 1.6.3.1** of the **Outline CSCB MCZ CSIMP** [APP-291].~~
~~Lessons learnt from the DOW export cable installation~~	
~~Learning from other projects~~	~~As above.~~
~~Pre-construction survey campaign~~	~~Detailed geophysical and geotechnical surveys to:~~ ~~• Establish sub-sea bed (0-2m) soil conditions;~~ ~~• Identify sea bed anomalies, debris, magnetic targets (UXO), fishing gear, out of service cables etc.; and~~ ~~• Confirm sea bed mobility.~~ ~~Geotechnical survey brought forward to 2021 to inform consents process.~~
~~CBRA (**Appendix 2** of the **Outline CSCB MCZ CSIMP** [APP-291])~~	~~Defining burial depths – update as required pre-construction to take account of latest information.~~

~~Task~~	~~Details~~
~~Cable Burial Study (CBS)~~	~~Likelihood of burial success based on geophysical, geotechnical and environmental information. Suitability of trenching tools. Informed by ICBS.~~
~~Burial tool capability study~~	~~Assess burial tools used on SOW and DOW and their performance and limitations. Included in CBRA and summarised in the ICBS and updated where necessary pre-construction to take account of latest tools available on the market.~~
~~Development of flowchart to map out the decision-making process for any unexpected events e.g. bad weather~~	~~To assist in dealing with unexpected events without compromising the success of the cable burial process.~~
~~Establish metocean design basis along the export cable corridor~~	~~To feed into the decision making process for unexpected events and the detailed design plan.~~
~~Prepare for potential cable repair~~	~~Contingency plan in the event of cable fault or damage during installation to minimise any further sea bed disturbance.~~
~~Contractor selection~~	~~Select experienced contractor with well proven vessel and burial tools.~~
~~Make use of Fisheries Liaison Officer (FLO) onboard cable installation vessel/s~~	~~To reduce the risk of fishing activities affecting the performance of the cable installation and burial works.~~

Table 3: In-Principle Monitoring Proposed – Marine Geology, Oceanography and Physical Processes

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Changes in sea bed level and the sediment transport regime, including scour processes	Physical environment and linked receptor groups e.g. marine ecology	Pre-construction	• Engineering and design purposes • Input to benthic and other related ecological surveys and monitoring requirements as agreed with the MMO. • Sand wave / bank characterisation • Inform scour modelling	A single survey within the agreed SEP and DEP wind farm site and offshore cable corridor survey areas using full sea bed coverage swath-bathymetric, MBES and SSS surveys (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, including a 500m buffer area around the site of each works. (The "site of each works" being the area within the order limits which is actually taken forwards to construction noting that it is possible that certain areas within the order limits may not be developed.). Where possible, alignment with the post-construction monitoring undertaken by DOW will be undertaken.	Scope of surveys and programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to the commencement of any survey works. Surveys carried out for up to 3 years post-construction, which could be non-consecutive years, with provision of the agreed reports in the agreed format in accordance with the agreed timetable, unless otherwise agreed in writing with the MMO in consultation with the relevant SNCBs
		Post-construction	• Structural integrity / engineering (scour) • Sand wave / bank recovery and migration including considerations of elevation, topography and extent – testing the hypothesis that sand wave / bank recovery takes place (and migration continues) under natural processes as predicted in the ES	Surveys within the agreed SEP and DEP wind farm site and offshore cable corridor survey areas using full sea bed coverage swath-bathymetric surveys undertaken to meet the requirements of MGN 654 and its Annexes. For this purpose the undertaker will, prior to the first such survey, submit a desk based assessment (based on detailed pre-construction survey data and 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 (to be undertaken pre-construction) and recorded	

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
			• Sediment mounds in shallow areas – testing the hypothesis that any such mounds will be reworked by natural processes as predicted in the ES • Address secondary scour evidence gap	scour. The quantity of turbines subject to monitoring will be confirmed following the completion of detailed design studies and in consultation with the MMO. This will also include consideration of secondary scour i.e. scour around the perimeter of installed scour protection. Monitoring will also include consideration of the recovery of any dredged or partially dredged sand waves using methods outlined in Larsen et al. (2009) (if required and with full recovery expected) and any movement of sand waves since the pre-construction phase. Geophysical monitoring of any sediment mounds created during sea bed preparation for GBS foundations will also be undertaken where the mounds are in waters less than 15m deep. Where possible, alignment with the post-construction monitoring undertaken by DOW will be undertaken.	

Table 4: Proposed Scope of Work to Support Development of Detailed Plans for Cable Installation to Maximise the Chance of Burial Success for SEP and DEP

Task	Details
Lessons learnt from the SOW export cable installation	Identify key areas of success and under-performance, primary causes of any under-performance. Recommendations to maximise chance of success for SEP and DEP. See **Section 1.6.3.1** of the **Outline CSCB MCZ CSIMP** [APP-291].
Lessons learnt from the DOW export cable installation	
Learning from other projects	As above.
Pre-construction survey campaign	Detailed geophysical and geotechnical surveys to: • Establish sub-sea bed (0-2m) soil conditions; • Identify sea bed anomalies, debris, magnetic targets (UXO), fishing gear, out of service cables etc.; and • Confirm sea bed mobility. Geotechnical survey brought forward to 2021 to inform consents process.
CBRA (**Appendix 2** of the **Outline CSCB MCZ CSIMP** [APP-291])	Defining burial depths – update as required pre-construction to take account of latest information.
Cable Burial Study (CBS)	Likelihood of burial success based on geophysical, geotechnical and environmental information. Suitability of trenching tools. Informed by ICBS.
Burial tool capability study	Assess burial tools used on SOW and DOW and their performance and limitations. Included in CBRA and summarised in the ICBS and updated where necessary pre-construction to take account of latest tools available on the market.
Development of flowchart to map out the decision-making process for any unexpected events e.g. bad weather	To assist in dealing with unexpected events without compromising the success of the cable burial process.
Establish metocean design basis along the export cable corridor	To feed into the decision making process for unexpected events and the detailed design plan.
Prepare for potential cable repair	Contingency plan in the event of cable fault or damage during installation to minimise any further sea bed disturbance.
Contractor selection	Select experienced contractor with well proven vessel and burial tools.
Make use of Fisheries Liaison Officer (FLO) onboard cable installation vessel/s	To reduce the risk of fishing activities affecting the performance of the cable installation and burial works.

1.6.4 Marine Water and Sediment Quality

1.6.4.1 Conclusions of the Environmental Statement

40. No residual impacts greater than **minor adverse** were predicted within the ES.

1.6.4.2 In-Principle Monitoring

41. As stated in **Section 1.3**, monitoring must have a clear purpose in order to provide answers to specific questions where significant environmental impacts have been identified. Monitoring should be targeted to address significant evidence gaps or uncertainty, which are relevant to SEP and DEP and can be realistically filled, as well as those species or features considered to be the most sensitive to the potential impacts including those of conservation, ecological and / or economic importance.

42. In this instance no monitoring or independent surveys are required although as noted in **Table 2**, contaminants sampling and analysis will be undertaken post-consent to inform the licence for the disposal of sediment at sea, which will be applied for post-consent.

1.6.5 Benthic Ecology

1.6.5.1 Conclusions of the Environmental Statement

43. No impact was greater than **minor adverse** for the project-alone or cumulatively. However, the SEP and DEP offshore export cable corridor transits through the CSCB MCZ.

1.6.5.2 In-Principle Monitoring

44. The following table provides information on the monitoring requirements for benthic ecology. Where it is possible, synergies with monitoring commitments made in **Section 1.6.1** would be explored in interpreting geophysical data.

45. Consideration has been given to habitats / species of principal importance. As noted in **Chapter 8 Benthic Ecology** [APP-094], pre-construction surveys will be undertaken to determine if potential Annex I / UK BAP Priority Habitat *S. spinulosa* reef[3] and UK BAP priority habitat 'peat and clay exposures with piddocks' are present within the proposed wind turbine locations or offshore cable routes.

46. The pre-construction survey methodology would be agreed with the MMO in consultation with Natural England. The survey design would be based on best practice at the time and is anticipated to consist of a mixture of geophysical, drop down video (DDV) and grab surveys (as applicable) to ensure a comprehensive ground-truthing of the proposed final wind turbine locations and cable route design.

[3] Note any Annex I *S. spinulosa* reef identified would not be associated with an SAC for which *S. spinulosa* reef is a qualifying feature since the SEP and DEP offshore sites do not overlap with any SACs.

47. Initial geophysical surveys will be reviewed with DDV ground-truthing surveys to confirm presence as appropriate. This shall then be used to inform detailed layout design in the design plan and will inform the mitigation scheme requirements. If potentially sensitive benthic features are identified, the results of the survey will be discussed at that time with the MMO and Natural England to agree whether the features constitute Annex I / UK BAP priority habitat features and whether they are required to be avoided through micro-siting.

Table 5: In-Principle Monitoring Proposed - Benthic Ecology

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Effects on *Sabellaria* reef and piddocks	*Sabellaria* reef and piddocks	Pre-construction	Determine the location and extent of any *Sabellaria* reef and piddocks within areas of the Order Limits in which it is proposed to carry out construction works to inform the appropriate mitigation if found	• Undertake geophysical survey to inform engineering design options and analyse results for potential *Sabellaria* reefs and sediments where piddocks may be present (and other potential constraints such as archaeology). • Undertake ground-truthing of potential *Sabellaria* reefs and piddocks through DDV (or grab sample where visibility prevents confirmation through video) against the methodology to be agreed with the MMO.	• Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to the commencement of the first survey. • Surveys must be undertaken no longer than 12-18 months prior commencement of construction. • Unless commencement of construction occurs within 18 months of the survey being undertaken, a second survey and report will be required prior to construction commencing.
		Post-construction	The requirement for post-construction monitoring will be dependent on the findings of the pre-construction surveys and would be focussed on providing information on condition and recovery.	• Where no *Sabellaria* reef or piddocks is identified by the pre-construction survey of the proposed works area or where reef or piddocks has been identified but is avoided (including associated buffers to be agreed post-consent), no post-construction surveys will be undertaken;	• If required, survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to completion of construction / commissioning. • If significant impacts are observed, the potential requirement for further surveys will be agreed with the MMO following review of the post-construction survey.

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				• Where *Sabellaria* reef or piddocks is identified during the baseline survey and has not been able to be avoided (avoidance defined 50m for construction activities), post-construction surveys, the number of which are to be agreed with the MMO post consent, specifically targeting those reefs and piddocks identified in the baseline survey which were affected by the works will be undertaken to check their condition and monitor their recovery using the same methodology set out for pre-construction monitoring.	
Long term habitat loss from external cable protection installation in the CSCB MCZ / Colonisation of cable protection in	Benthic habitats and species	Pre-construction	Determine the baseline environment in areas within the CSCB MCZ anticipated to potentially require external cable protection installation (including at HDD exit pits).	• Undertake geophysical and geotechnical surveys to inform engineering design options and analyse results to identify potential locations where external cable protection could be required. • Following identification of the above, DDV surveys would be undertaken to characterise the baseline benthic environment.	• Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to the commencement of the first survey. • Surveys must be undertaken no longer than 12-18 months prior commencement of construction.

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
the CSCB MCZ					• Unless commencement of construction occurs within 18 months of the survey being undertaken, a second survey and report will be required prior to construction commencing.
		Post-construction	Monitor potential changes in the benthic community on and in the vicinity of any external cable protection installed within the MCZ (including at HDD exit pits) – characterising any epifauna that may have colonised the cable protection and testing the hypothesis that effects are localised to where the cable protection has been installed (adding to the evidence base from the Year 5 post-construction monitoring conducted at DOW).	• Undertake DDV surveys during the operational phase	• Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to completion of construction / commissioning. • If significant impacts are observed, the potential requirement for further surveys will be agreed with the MMO following review of the post-construction survey.

1.6.6 Fish Ecology

1.6.6.1 Conclusions of the Environmental Statement

48. No impact was greater than **minor adverse** for the project-alone or cumulatively for SEP and DEP.

1.6.6.2 In-Principle Monitoring

49. **Table 6** provides information on the monitoring requirements for fish ecology. Where it is possible, synergies (e.g. collection of any required grab samples) with monitoring commitments made in **Section 1.6.5** would be explored.

Table 6: In-Principle Monitoring Proposed – Fish Ecology

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Habitat loss	Sandeel	Pre- and post-construction	• Determine the suitability of the wind farm site as sandeel habitat – testing the hypothesis that any effects on habitat suitability from the construction of the wind farm are in line with those assessed in the ES.	Grab samples (number to be agreed with the MMO post-consent) to be taken at locations to be agreed with the MMO post-consent. Subsequent PSA of the samples to determine a likely preference or avoidance of the area by sandeels.	• Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 4 months prior to the commencement of any survey works. • It is anticipated that post-construction surveys would be undertaken 1 to 2 years following completion of construction of the Project.

1.6.7 Marine Mammals

1.6.7.1 Conclusions of the Environmental Statement

50. At a project-alone level, the residual impacts from SEP and DEP are assessed as **minor adverse** at worst during construction for harbour porpoise, bottlenose dolphin, white-beaked dolphin, minke whale, grey seal and harbour seal from the following activities:
    - Piling (physical and auditory injury and disturbance impacts);
    - Other construction activities (physical and auditory injury);
    - Underwater noise and disturbance from construction vessels (physical and auditory injury);
    - Barrier effects from underwater noise;
    - Increased risk of collision with vessels;
    - Disturbance at seal haul-out sites;
    - Changes to prey availability; and
    - Changes to water quality.

51. During operation, **minor adverse** impacts at worst are assessed for grey and harbour seal and harbour porpoise from the following activities:
    - Underwater noise from operational turbines (physical and auditory injury);
    - Underwater noise from operation and maintenance activities (disturbance);
    - Underwater noise from operation and maintenance vessel disturbance;
    - Displacement of harbour porpoise due to changes in prey resource during; operation and maintenance is also assessed to be **minor adverse**;
    - Disturbance at seal haul-out sites;
    - Changes to prey availability; and
    - Changes to water quality.

52. The conclusions of the assessment are based on varying levels of confidence in the data used in the assessment. However, the conclusions of the assessment are of a precautionary nature where there is high uncertainty or low confidence in the data.

53. All potential cumulative residual impacts were determined to be **minor adverse** (not significant). Project-specific Site Integrity Plans (SIPs) for the Southern North Sea Special Area of Conservation (SAC) are proposed which will give due consideration to mitigation and monitoring, if deemed required.

1.6.7.2 Conclusions of the Report to Inform Appropriate Assessment (RIAA) [APP-059]

54. At the project-alone level, the assessments of effect from SEP and DEP conclude that there would be no potential for adverse effect for any of the assessed SACs for marine mammals, during construction or operation.

55. The assessments for SEP and DEP in-combination concluded that there was the potential for an adverse effect on integrity of the Southern North Sea SAC (for harbour porpoise), the Humber Estuary SAC (for grey seal), and The Wash and North Norfolk Coast SAC (for harbour seal) due to in-combination disturbance effects. However, with mitigation in place for UXO clearance events, and the implementation of the SIP, there would be no adverse effect on integrity.

1.6.7.3 Conclusions of the Marine Mammals Technical Note and Addendum (Revision B) [document reference 16.14~~REP3-115~~]

Updates to the Environmental Statement

56. At the project-alone level, the residual impacts from SEP and DEP are assessed as **minor adverse** at worst during construction for harbour porpoise, grey seal and harbour seal for disturbance impacts from piling, based on a dose response curve approach.

57. The **Marine Mammals Technical Note and Addendum (Revision B)** [document reference 16.14~~REP3-115~~] also provides results of population modelling for harbour porpoise, grey seal and harbour seal, which concludes that there would be no population level effect due to disturbance as a result of piling at SEP and DEP alone.

58. For the assessment of disturbance impacts to harbour porpoise and grey seal cumulatively with other projects, the assessments show there was the potential for a significant effect due to disturbance from other offshore wind farm piling projects, or due to the disturbance from all noisy activities and projects for harbour porpoise, grey seal and harbour seal. However, population modelling for all three species concluded that this would not result in a population level effect. All potential cumulative impacts were therefore determined to be **minor adverse** (not significant). Project-specific Site Integrity Plans (SIPs) for the Southern North Sea Special Area of Conservation (SAC) are proposed which will give due consideration to mitigation and monitoring, if deemed required.

59. For harbour porpoise, it should also be noted that the contribution of SEP and DEP to the cumulative assessments is a very small proportion, with a worst-case of up to 0.4% of the reference population (North Sea Management Unit) assessed as being potentially at risk of disturbance from cumulative exposure from all noisy activities and projects.

60. For grey seal, the contribution of SEP and DEP to the cumulative assessment is a worst-case of up to 1.2% of the reference population, and for harbour seal the overall contribution is up to 2.6% of the population. For both seal species, SEP and DEP are also contributing a small proportion of the overall cumulative effect.

Updates to the Report to Inform Appropriate Assessment

61. At a project-alone level, the updated assessments of effect from SEP and DEP show that there would no potential for adverse effect for any of the assessed SACs for marine mammals, during construction or operation.

62. The updated assessments for SEP and DEP in-combination concluded that while there was the potential for an adverse effect on integrity of the site for the Southern North Sea SAC (for harbour porpoise), the Humber Estuary SAC (for grey seal), and The Wash and North Norfolk Coast SAC (for harbour seal) due to in-combination disturbance effects, there would be no population level consequences to the SAC populations for each site, and therefore there would be no adverse effect on integrity.

1.6.7.4 Monitoring Undertaken for Dudgeon Offshore Wind Farm (DOW)

63. The main focus of the marine mammal monitoring at DOW related to the potential disturbance to harbour seal during the construction phase as a result of pile driving noise. DOW agreed with the MMO and Natural England that tagging of harbour seal was not the most efficient way to monitor the potential impacts at DOW as was originally proposed in the DOW Marine Licence. Due to the location of the DOW project (and the (at the time) limited number of harbour seal being present within the site boundary), a large number of seals would have to be tagged in order to collect any meaningful results. In addition, it is difficult to predict where seals that may be present in the DOW site would come from (i.e. their key haul-out site for tagging at), and therefore the number of seals that would require tagging would be further increased.

64. The alternative approach therefore focused on additional monitoring of The Wash and North Norfolk SAC harbour seal population during the breeding season (June to July) with a specific aim of providing robust estimates of pup production using established methods employed by the Sea Mammal Research Unit (SMRU) (Thompson, Onoufriou and Patterson, 2016). The survey approach supported the pup production monitoring program part-funded by Natural England which is based on single annual counts with the occasional more intensive surveys (e.g. every five years, a series of four or five surveys to re-estimate birth curve parameters) to provide data to be combined with the annual total population index surveys in August to allow more responsive and sensitive management of the harbour seal population.

65. A series of aerial surveys (five in each year of survey) of the harbour seal population along the English east coast between Donna Nook in Lincolnshire and Scroby Sands off the Suffolk coast were undertaken during the breeding seasons from 16th June to 17th July 2015 and 19th June to 16th July 2016. The survey results showed wide inter-annual variation which is not unusual in a long term time series. Additionally, pup production was found to have increased at around 7.4% per annum since surveys began in 2001.

1.6.7.5 In-Principle Monitoring

66. It is recognised that monitoring is an important element in the management and verification of the actual SEP and DEP impacts. The **Draft MMMP** (Revision B) [REP1-013] and **In Principle Site Integrity Plan (SIP) for the Southern North Sea (SNS) SAC** [APP-290] contain key principles that provide the framework for any mitigation that could be required. As secured through the DMLs in the **Draft DCO (Revision J)** [document reference 3.1], 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.

67. A number of assumptions were made in the marine mammal assessments which Natural England have requested [RR-063] the Applicant to consider in this IPMP. These assumptions include:

- The effectiveness of mitigation measures proposed e.g. effectiveness of ADD at displacing beyond Permanent Threshold Shift (PTS) / Temporary Threshold Shift (TTS) distances;
- The nature of the fleeing response (straight line, onset at distance, flee speeds);
- Behavioural disturbance ranges due to piling;
- Displacement around vessels prior to pile driving; and
- Underwater noise levels associated with UXO clearance with bubble curtains, and the level of noise reduction bubble curtains can achieve.

68. There are also some knowledge gaps in relation to the baseline environment, namely, the seal usage of the SEP and DEP sites as well as the cause of the current harbour seal population decline within The Wash and North Norfolk Coast SAC. Other knowledge gaps include the usage of operational wind farm sites by marine mammal species, their behaviour within operational sites (i.e. if they actively forage within a wind farm), and whether there is any increased foraging due to an artificial reef effect.

69. Potential monitoring in order to validate these assumptions has been included as a proposal for in-principle monitoring in **Table 7**.

70. Natural England also advised [RR-063] that seal usage of the SEP and DEP sites before, during and after construction should be considered for post-consent monitoring. As noted in **Section 1.6.7.4** with respect to DOW, the use of tagging methods was not considered a suitable approach to monitoring; this is also considered to be the case for SEP and DEP, and therefore alternative approaches to monitoring seals are likely to be required.

71. It is anticipated that the focus on marine mammal monitoring for SEP and DEP would be for grey seal and harbour seal, due to the location of the projects in relation key haul-out sites and designated sites (SACs) for both species. There are also a number of key knowledge gaps regarding seal species which the monitoring at SEP and DEP could provide information for to further understanding. The marine mammal monitoring for SEP and DEP will therefore likely focus on visual survey methods (rather than acoustic methods which have been more commonly used in offshore wind farm monitoring projects). This would be confirmed post-consent, and agreed with the relevant regulator and SNCBs.

72. **Table 7** includes options for potential monitoring of marine mammals. Details of this potential monitoring will be dependent upon the requirements of the final approved plan and protocol.

73. The Applicant is also supportive, in principle, of joint industry projects or alternative site based monitoring of existing marine mammal activity inside the area(s) within the Order Limits in which it is proposed to carry out construction works and would welcome collaboration opportunities from SNCBs, Non-Government Organisations (NGOs) or other developers in strategic monitoring programmes. This would likely be managed outwith the IPMP, through for example OWEAP.

Table 7: In-Principle Monitoring Proposed – Marine Mammals

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Potential auditory injury resulting from underwater noise due to piling	Harbour porpoise, bottlenose dolphin, white-beaked dolphin, minke whale, and grey seal, harbour seal	Construction	Determine that the maximum piling energies assessed within the ES are not being breached, and therefore the mitigation as outlined in the final MMMP is appropriate and effective.	Noise measurements taken from the first four piled foundations of each piled foundation type at each of the wind farm sites will be undertaken to validate the assessments within the ES, **RIAA** (APP-059) and **Marine Mammals Technical Note and Addendum** [REP3-115]. One of each of the first four piles will be at a location anticipated to generate the greatest underwater noise emissions.	The final design and scope of monitoring will be agreed with the relevant stakeholders and included within the final Monitoring Plan submitted for approval. In the event that the monitoring shows noise levels which are significantly different to those assessed in the ES, all piling activity must cease until an update to the marine mammal mitigation protocol and further monitoring requirements have been agreed.
Potential disturbance resulting from underwater noise during piling activities	Grey seal and harbour seal as focus species (could also collect data on all other marine mammal species)	Construction	Validation of assumptions used in the assessments and testing the hypothesis that any disturbance effects on grey and harbour seal from construction works are in line with those assessed in the ES and HRA. Could include consideration of: • Effectiveness of mitigation measures proposed;	The purpose of this monitoring would be to research the behavioural response of marine mammals to different construction activities, including from mitigations (e.g. ADDs), in order to validate the conclusions of the ES and RIAA. This could be undertaken through either acoustic methods (e.g. an array of FPODs) or through visual methods (e.g. drone aerial surveys). However, the use of FPODs as an acoustic monitoring method is best for monitoring for harbour porpoise and dolphin species, and would not collect data	The final design and scope of any monitoring will be agreed with the relevant stakeholders and included within the final monitoring plan submitted for approval.

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
			• The nature of the fleeing response from both ADD activation and piling; • Behavioural disturbance ranges due to piling and other construction activities; and • Displacement around vessels prior to pile driving.	on seal and whale species, while visual methods (such as drone aerial surveys) would be best for monitoring for seal species (although would also collect data on all marine mammal species). To investigate the behavioural response of marine mammals to the listed noise sources and activities at SEP and DEP, monitoring could be designed to either use set transect lines, or follow specific individuals to monitor their behaviour and movement. Due to the location of the SEP and DEP sites, it is expected that the focus of this monitoring would be for both seal species.	
Usage of the SEP and DEP sites	Grey seal and harbour seal as focus species (could also collect data on all other marine mammal species)	Pre-construction, construction, operation	Investigate the usage of the SEP and DEP sites by both seal species to determine; a) The baseline usage of the sites, including movements through the sites and foraging activities b) The usage of the sites during construction activities (including piling), including movements through the	Monitoring of both grey seal and harbour seal through the use of visual survey methods to determine the usage of the sites, and whether there is any change through different project phases. As noted above, due to the location of the SEP and DEP sites, it is expected that the focus of this monitoring would be for both seal species. Therefore, it is anticipated that visual survey methods would be required (such as the use of drones for aerial surveys). This	The final design and scope of any monitoring will be agreed with the relevant stakeholders and included within the final monitoring plan submitted for approval.

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
			site and any foraging activity c) The usage of the sites once operational, including movements through the site and any foraging activity This would test the hypothesis that the construction and operation of the wind farm does not significantly and adversely alter the usage of the SEP and DEP sites by grey and harbour seal.	method would also collect data on other marine mammal species. It is expected that set transect design would be developed and surveyed for a specific period each month, and that this monitoring would continue for an extended period of time to monitor any change in usage (from pre-construction to operation).	

1.6.8 Offshore Ornithology

1.6.8.1 Conclusions of the Environmental Statement

74. The impacts that could potentially arise during the construction, operation and decommissioning of SEP and DEP have been discussed with Natural England, Royal Society for the Protection of Birds (RSPB) and the MMO as part of the Evidence Plan Process (EPP) (see **Chapter 11 Offshore Ornithology** of the ES [APP-097])~~.~~.

75. At the SEP and DEP project-alone level, during the construction phase and operation and maintenance phases no impacts have been assessed to be greater than **minor adverse** for any bird species.

76. During construction and operation phases, disturbance, displacement and barrier effects on Sandwich tern (operation only), red-throated diver (including within the offshore export cable corridor), gannet (operation only), razorbill and guillemot is assessed as **minor adverse** significance.

77. Collision risk with wind turbines from SEP and DEP is assessed as **minor adverse** significance for Black-headed gull, common tern, gannet, great black-backed gull, herring gull, kittiwake, lesser black-backed gull, little gull, Sandwich tern, common gull and non-breeding waterbirds when considered for all biological seasons against the most appropriate population scale.

78. Potential plans and projects have been considered for how they might act cumulatively with SEP and DEP and a screening process carried out. The cumulative assessment identified that most impacts would be temporary, small scale and localised. Given the distances to other activities in the region (e.g. other offshore wind farms) and the highly localised nature of the impacts the assessment concluded that there is no pathway for interaction between most impacts cumulatively.

79. The risk to birds from cumulative collisions with wind turbines across all wind farms considered is assessed as no greater than **minor adverse** significance for all species except Sandwich tern and great black-backed gull which are assessed as **moderate adverse**. Therefore, it is proposed that any required monitoring should focus on the operational period when there is a pathway to the risk (collision with turbines) and, where possible, on Sandwich tern and great black-backed gull.

80. Conclusions of the **RIAA** [APP-059] / **Apportioning and HRA Updates Technical Note (Revision D~~B~~)** [document reference 13.3~~REP2-036~~]

81. The Applicant's assessments conclude that a project-alone adverse effect on integrity (AEoI) at all sites screened into the assessment can be ruled out. This is agreed with Natural England (see Appendix B.2 of **Appendix B - Supporting documents to the Applicant's Responses to the Examining Authority's Second Written Questions** [REP3-103]).

82. The Applicant's assessments conclude that an in-combination AEoI cannot be ruled out for the Sandwich tern feature of the Greater Wash SPA and North Norfolk Coast SPA and the kittiwake feature of the Flamborough and Filey Coast (FFC) SPA. This is agreed with Natural England (see REP3-103). The Applicant's assessments conclude that an in-combination AEoI on all other sites and features can be ruled out.

83. Natural England do not agree that an in-combination AEoI of the guillemot and razorbill features of the FFC SPA or the red-throated diver feature of the Greater Wash SPA can be ruled out. Regarding the red-throated diver feature of the Outer Thames Estuary SPA, the AEoI conclusion remains under consideration by Natural England. ~~Other than the common scoter feature of the Greater Wash SPA (for which the Applicant has provided a screening assessment which screens out this feature for the requirement for assessment, and which is anticipated to be accepted by Natural England – see the **HRA Screening Matrices (Revision B)** [document reference 5.4.2]), t~~These are understood to be the only points of contention between Natural England and the Applicant i.e. all other in-combination effect conclusions are agreed (see [REP3-103]).

1.6.8.2 Monitoring Undertaken for DOW

84. The DOW Ornithological Monitoring Programme (OMP) is currently being implemented and has the following objectives:

- Identification of foraging ranges and key foraging areas for Sandwich terns breeding in the North Norfolk Coast SPA to investigate use of the DOW area.
- To identify whether Sandwich terns breeding in the North Norfolk Coast SPA use the Dudgeon wind farm area.
- To investigate potential avoidance of the offshore wind farm area (macro-avoidance).
- If distribution data reveal that birds do use the wind farm area to then consider flight heights in future years

85. Sandwich tern tracking was undertaken by Bureau Waardenburg during the 2016-2019 breeding seasons as part of the DOW OMP. The DOW OMP clearly demonstrates functional linkage between SEP and DEP, and Sandwich terns breeding at the North Norfolk Coast SPA. The DOW OMP also calculated nocturnal activity rates.

86. Tracking data collected during the DOW OMP indicates that the area around SOW is largely used for commuting between breeding sites and foraging grounds by Sandwich terns.

1.6.8.3 In-Principle Monitoring

87. It is the position of the Applicant that any ornithological monitoring proposal should be targeted to address impacts, evidence gaps or uncertainty of most relevance to SEP and DEP and the specific species. **Table 8** outlines the potential in-principle monitoring. It should be emphasised that SEP and DEP could not address all evidence gaps and areas of uncertainty, and the Applicant would not expect that the Projects would deliver all of the potential measures identified in **Table 8**. Rather, the identified measures will form the basis of discussion with Natural England in order to determine those most appropriate to take forward to implementation.

88. In order to take monitoring measures forward to implementation, they should address matters identified as:

- Being of key importance in the assessments for the project;
- Associated with particularly high uncertainty; and

- Can be addressed effectively at the project sites.

89. It is therefore important that priorities should be set not only to improve understanding of key aspects of uncertainty in the project impact assessments, but also to make the most effective use of opportunities afforded by the location and design of SEP and DEP. This will allow the Projects to contribute as much as possible to tackling areas of uncertainty that are not already being investigated elsewhere, and to avoid topics where conditions at the wind farms make particular studies less feasible and less likely to provide clear results.

90. The Applicant is supportive, in principle, of joint industry projects or alternative site based monitoring of existing seabird activity inside the area(s) within the Order Limits and would welcome collaboration opportunities from SNCBs, NGOs or other developers in strategic monitoring programmes. This would likely be managed outwith the IPMP. In some cases, it may be more appropriate to undertake monitoring at a strategic level or at more suitable OWF site(s), and the Applicant would expect that such considerations will inform the selection of measures that could be implemented at SEP and DEP (including, for example, the work being undertaken at Dogger Bank of which the Applicant is a delivery partner, as set out in **Section 1.6.2**).

91. It is also noted that the Applicant has submitted derogation proposals for kittiwake and Sandwich tern (see **Section 1.1**) and will therefore implement compensatory measures of which monitoring will be a necessary part of the proposals.

Table 8: In-Principle Monitoring Proposed – Offshore Ornithology

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Collision risk	Sandwich tern, kittiwake, great black-backed gull	Post-construction	Increase certainty of collision risk modelling (CRM) parameters and verify outputs presented in EIA/HRA.	Review of existing monitoring at other offshore wind farm projects and development of appropriate additional survey / monitoring. If implemented, this could comprise on-site monitoring to determine flight behaviours and/or collision rates. The feasibility and practicality of such monitoring would require careful consideration, in terms of both the technical challenges and whether the bird abundances on site are likely to be sufficient to generate sufficient sample sizes. It is likely that more suitable sites exist for undertaking such monitoring, given that the project sites are far from any kittiwake breeding colonies and that Sandwich tern may show high levels of macro-avoidance of operational wind farms (as indicated by the findings from the DOW OMP, as well as other studies – Leemans et al. 2022). If any such monitoring was focussed on investigating flight behaviour (as opposed to collision rates directly), key hypotheses to be tested *could* include: • Flight heights for key species are as estimated for the input values used in the collision risk predictions for the SEP/DEP assessment and are unaffected by the presence of operational turbines • Flight speeds for key species are as estimated for the input values used in the collision risk predictions for the	To be confirmed

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
				SEP/DEP assessment and are unaffected by the presence of operational turbines • Avoidance rates (inclusive of macro-avoidance) for key species are as applied to the ~~collision risk modelling~~CRM outputs for the SEP/DEP assessment (noting that for testing of this hypothesis some data on actual collision rates is likely to be required)	
Collision risk	Sandwich tern	Post-construction	Monitoring of breeding populations at North Norfolk Coast SPA colonies within foraging range of SEP and DEP.	Suitable monitoring (Sandwich tern breeding numbers and productivity) is currently undertaken by wardening staff at the Scolt Head and Blakeney Point colonies. It is therefore expected that SEP and DEP would be able to utilise these data to identify any relevant population changes. It is not, therefore, expected that the Projects would be required to undertake additional monitoring, but would need to ensure that existing activity continued.	To be confirmed
Collision risk	Sandwich tern (potentially also kittiwake and great black-backed gull)	Post-construction	Determination of key flight behaviour parameters affecting collision risk of key species (e.g. flight height and flight speed).	This could potentially be undertaken via broad-based surveys (e.g. using laser range finders or LiDAR to measure flight heights) or tracking studies. However, it is noted that a substantive amount of tracking data has already been collected on Sandwich terns from the North Norfolk Coast SPA through the DOW OMP. Therefore, additional monitoring would need to be carefully considered to ensure meaningful benefit. Such monitoring could be focussed on testing a series of hypotheses relating to flight behaviour attributes that are key to the	To be confirmed

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
				prediction of collision mortality and which *could* include those identified above for the monitoring requirements to *Increase certainty of ~~collision risk modelling (~~CRM~~)~~ parameters and verify outputs presented in EIA/HRA.*	
Collision risk	Kittiwake	Post-construction	Determine age classes and breeding colony origins of birds using the project sites during the breeding period.	This could be undertaken to determine the veracity of the assumption that the majority of birds present on the project sites during the breeding period derive from the Flamborough and Filey Coast SPA. Such data could be collected via a combination of photography from vessels (to determine plumage/moult characteristics to indicate the age of birds) and catching of birds at sea to collect feather samples for stable isotope/elemental sampling (which can be used to determine the location of an associated breeding colony, although it should be noted that the efficacy of such methods remains to be established). Monitoring undertaken for this objective would focus on testing the hypothesis that kittiwake using the waters in and around the Project sites during the breeding season are not from breeding sites at the Flamborough and Filey Coast SPA.	To be confirmed
Adverse effects on the NNC and GW SPA Sandwich tern population	Sandwich tern (and potentially other seabird species)	N/A	Understand Sandwich tern prey availability at varying times of the breeding season. Test the hypothesis that prey availability is a limiting factor in NNC/GW SPA breeding success.	Determine a time-series of abundances of different Sandwich tern prey species. **Sandeel** survey methods to be agreed with stakeholders post-consent could include:	To be confirmed ~~As set out in **Table 2** (point 11) this is subject to~~

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
			Fill prey availability assessment evidence gap. The need for this monitoring would be dependent on a review of the available information at the time of planning the surveys. This review will be undertaken by the Applicant and agreed with the MMO in consultation with Natural England.	• eDNA monitoring during the winter period to ascertain sandeel presence and 'hotspots' in the NNC region. • Acoustic surveys on sandbanks in spring/summer to determine sandeel 'hotspots' and abundance. • Dredge surveys to ascertain abundance • Other novel survey methods as part of a trial **Herring** larval studies: • International Herring Larval Study (IHLS) surveys are no longer conducted in the ICES rectangles relevant to SEP and DEP. Therefore, a project-specific herring larvae survey in autumn / winter which is the predominate spawning season of North Sea herring would be required. • Discussions with the MMO / Cefas and Natural England will determine that the spatial and temporal distribution of sampling is designed to ensure adequate coverage. For example, a higher resolution survey could be proposed that targets areas closer to SEP and DEP, or the survey could replicate the historic IHLS survey stations.	~~further ongoing discussions with MMO, Cefas and Natural England.~~

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
				• Sampling would occur during daylight hours in line with MMO/Cefas requirements, using a high speed plankton sampler (e.g. Gulf VII Plankton Sampler). • The larvae would be analysed by experienced specialists. Any fish larvae, post-larvae and juveniles present will be removed, measured (total length, mm) and speciated using appropriate keys and literature. • Herring larvae age will be estimated for each length of herring larvae encountered in all tows. Minimum age would be based on a larger hatch size and faster growth rate, while maximum age would be based on the reverse. These data can then be used to determine estimated timings of the adult spawning aggregations. • A herring larval survey will provide data on individual herring larvae length in areas relevant to SEP and DEP from which estimates of larvae age can be calculated. This would result in estimated spawning dates, and distances, for the spawning adult herring thus informing of the potential upon which NNC/GW SPA Sandwich terns are reliant upon herring in their diet.	

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Displacement	Guillemot, razorbill, red-throated diver (potentially also Sandwich tern)	Post-construction	Determine effects of SEP and DEP on site usage by, and displacement of, key species.	This could be undertaken through pre-and post-construction aerial surveys to determine changes in abundance and distribution of birds within the OWFs. This could be extended for red-throated diver to include areas within Greater Wash SPA considered at risk of displacement effects. Tracking studies for Sandwich tern could also inform the understanding of displacement effects, although, as noted above, the substantial amount of data from Dudgeon OWF exists. Such monitoring could be designed to test a series of hypotheses which *could* focus on one or more of the following: • Determination of displacement rates from the array area for key species during key seasonal periods • Determination of displacement effects amongst key species during key seasonal periods from individual wind turbine generators within the array area • Determining the distance from the array areas over which displacement effects on key species are detectable A critical element of understanding the effects of displacement is the extent to which (if at all) displacement (and barrier effects) result in increased mortality rates amongst affected species. However, there are limitations ~~it is not apparent~~in how such effects can be elucidated on the basis of project based monitoring programmes.	To be confirmed

1.6.9 Commercial Fisheries

1.6.9.1 Conclusions of the Environmental Statement

92. The impacts on commercial fisheries during the construction, operation and decommissioning phases of SEP and DEP found that there will be impacts of **negligible** to **minor adverse** significance on commercial fishing fleet receptors, and moderate adverse impacts (in the absence of further mitigation) on the UK potting fleet during construction, operation and decommissioning phases of SEP and DEP. However, the moderate adverse impacts on the UK potting fleet will be mitigated through justifiable disturbance payments to reduce the significance of residual impacts to **minor adverse**.

1.1.1.1 Cumulative impacts were assessed to be **minor adverse** to all mobile fleets and **moderate adverse** to UK potters driven by the inclusion of potential management measures within MPAs that could lead to restrictions to the UK potting fleet. The cumulative effect of the MPAs is unmitigable by the Applicant. Even if the cumulative contribution from SEP and DEP to this impact is *de minimis* the assessment of significance would remain the same as a result of the inclusion of the MPAs.

1.6.9.2 In-Principle Monitoring

93. No monitoring in relation to commercial fisheries is considered necessary, other than the standard arrangements for fisheries liaison, which will be agreed in the Fisheries Liaison and Co-existence Plan (FLCP) prior to the start of construction. The FLCP will be produced in accordance with the **Outline FLCP** [APP-295] submitted with the DCO application.

1.6.10 Shipping and Navigation

1.6.10.1 Conclusions of the Environmental Statement

94. The effects of SEP and DEP have been assessed in **Chapter 13 Shipping and Navigation** of the ES [APP-099] with impacts ranging from broadly acceptable to tolerable. All impacts are assessed to be as low as reasonably possible (ALARP).

1.6.10.2 In-Principle Monitoring

95. **Table 9** provides information on the vessel traffic monitoring requirements for shipping and navigation.

Table 9: In-Principle Monitoring Proposed – Shipping and Navigation

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Effects on the levels of marine traffic across the offshore development area	Marine traffic	Construction	Validate the predictions made in the Environmental Statement and Navigational Risk Assessment with respect to potential effects on the levels of shipping traffic.	Construction monitoring shall include vessel traffic monitoring by Automatic Identification System (AIS), including the provision of reports on the results of that monitoring periodically as requested by the Maritime Coastguard Agency (MCA).	During construction, vessel traffic monitoring using AIS will be conducted, with the detailed requirements for this being agreed with the MMO and MCA six months before commencement of construction. Post-construction vessel traffic monitoring would be in line with the Marine Traffic Monitoring Strategy and would consist of AIS monitoring for a maximum of 28 days (but not consecutively) and will take account of seasonal variation of traffic patterns over a year. This will be done at a suitable time as agreed with the MMO and MCA following the commencement of commercial operation.
		Post-construction		Vessel traffic monitoring in line with the Marine Traffic Monitoring Strategy by AIS, totalling a maximum of 28 days taking account of seasonal variations in traffic patterns over one year, following the commencement of commercial operation. A report will be submitted to the MMO and the MCA following the end of the monitoring and periodically, if required, as requested by the MCA.	
Effect on marine traffic routing and safety.	Marine Traffic	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.

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Effect on marine traffic routing and safety.	Marine Traffic	Post - construction	To ensure charted depth remains in line with that agreed in consultation with the MCA and nautical charts remain up to date.	A swath bathymetric survey to IHO Order 1a of the installed cable corridor (post construction and decommissioning).	A swath bathymetric survey to IHO Order 1a of the installed cable corridor (post construction and decommissioning). Data is to be supplied to the MCA, UKHO and survey report to the MMO.
Effect on marine traffic routing and safety.	Marine Traffic	Post-Construction	To ensure charted depth remains in line with that agreed in consultation with the MCA and nautical charts remain up to date. To ensure that cables do not become exposed and present a snagging risk to fishing or anchoring vessels.	Periodic monitoring of cable burial / protection.	Periodic monitoring of cable burial / protection with a risk-based approach to the management (this work will be undertaken for engineering and asset integrity purposes, with the frequency determined by need).

1.6.11 Offshore Archaeology and Cultural Heritage

1.6.11.1 Conclusions of the Environmental Statement

96. The construction, operation and decommissioning phases of SEP and DEP will result in a range of potential effects upon the marine archaeological and cultural heritage environment. At the SEP and DEP project-alone level, the effects that have been assessed are anticipated to be reduced to a **minor adverse** residual significance or are considered to be negligible on the basis of embedded mitigation and best practice, including further interpretation / assessment of geophysical and geotechnical data post consent. Furthermore, known archaeological receptors are not considered to be subject to significant cumulative impacts on the basis that they should be avoided due to appropriate mitigation.

1.6.11.2 In-Principle Monitoring

97. **Table 10** provides information on the monitoring requirements for offshore archaeology and cultural heritage. The principle mechanism for delivery of monitoring for offshore archaeology and cultural heritage is through agreement on the Written Scheme of Investigation (WSI) (Offshore) (in accordance with the **Outline WSI (Offshore)** [APP-298]) and / or further activity specific method statements to be agreed with the MMO in consultation with Historic England.

Table 10: In-Principle Monitoring Proposed – Offshore Archaeology and Cultural Heritage

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
All direct and indirect effects on the archaeological resource	All Archaeology 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.	• An **Outline WSI (offshore)** [APP-298] has been compiled which makes provision for all archaeological mitigation that might be required in the light of pre-construction investigations, including field investigation, post-fieldwork activities, archiving and dissemination of results. The WSI includes provision to update the document as the project design is refined and as the results of further archaeological assessment become available. With the final agreed WSI acting as a 'point-in-time' document and submitted to the MMO four months in advance of the licensed activities. • Full sea floor coverage swath-bathymetric surveys undertaken to International Hydrographic Organisation (IHO) Order 1A standard, geotechnical, magnetometer, geophysical and SSS of the area(s) within the Order limits in which it is proposed to carry out construction works, including a 500m buffer area around the site of each works. This should include the identification of sites of historic or archaeological interest (around the whole feature for A1 receptors and 100m around centre point for A3 receptors) and any unidentified anomalies to agreed dimensional criteria (A2 receptors), which may require the refinement, removal or introduction of archaeological exclusion zones and to confirm project specific micro-siting requirements (for A2 receptors).	The Applicant has submitted an **Outline WSI (Offshore)** [APP-298] with the DCO application. A WSI will be in place prior to licensed activities.
All direct and indirect effects on the archaeological resource					

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
All direct and indirect effects on the archaeological resource	All Archaeology receptors	Construction	Validate the predictions made in the ES, where reasonable, with respect to potential effects on the archaeological resource and to inform selection of appropriate mitigation (Historic England requirement)	• Specific requirements relating to monitoring during post-construction (including a conservation programme for finds) as detailed in the WSI. Notably the Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) shall be followed during all intrusive works.	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 forward through archaeological method statements produced under the umbrella of the WSI and agreed with the archaeological curator. Survey and work package specific archaeological objectives will be established on a case-by-case basis

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