



**DOGGER BANK  
TEESSIDE A & B**

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# **Deadline IX Appendix 4 Offshore In Principle Monitoring Plan**

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Offshore In Principle Monitoring Plan

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# 1. Introduction

- 1.1.1. Dogger Bank Teesside A & B will be the second stage of development of the Dogger Bank Zone, and will comprise two wind farms (Dogger Bank Teesside A and Dogger Bank Teesside B), each with a generating capacity of up to 1.2GW (total generating capacity of up to 2.4GW). The two wind farms will connect to the existing National Grid substation at Lackenby in Teesside.
- 1.1.2. Forewind (“the Applicant”) made an application (“the Application”) to the Planning Inspectorate on 28 March 2014 for a Development Consent Order (DCO) for Dogger Bank Teesside A & B (“the Project”). The draft DCO includes four deemed marine licences (DMLs) for works below mean high water springs, relating to the two wind farm arrays and their transmission assets.
- 1.1.3. The Application was accepted for examination by the Planning Inspectorate on 23 April 2014. The examination commenced following the preliminary meeting, which was held on 5 August 2014, and is due to be completed by 5 February 2015.
- 1.1.4. The Applicant has reached agreement with the Marine Management Organisation (MMO) and Natural England on a number of issues and consultation is ongoing in order to resolve some remaining issues as a part of the ongoing examination process. Discussions are ongoing between the Applicant, Natural England and the MMO regarding the Dogger Bank SCI, and the results of these discussions may require updates to the IPMP.
- 1.1.5. In consultation with the MMO (who will be responsible for the enforcement of the DMLs), the Applicant has considered the requirement for monitoring as related to the existing conditions set out in the DMLs. All references to the DMLs in this document relate to version 7 submitted at Deadline IX. This document sets out the in principle monitoring proposals relevant to the offshore elements of the Project which will be the basis for discussion on monitoring requirements post consent.

## 2. Purpose of the In Principle Monitoring Plan

- 2.1.1. This In Principle Monitoring Plan (IPMP) has been produced following consultation with the MMO and other relevant Statutory Nature Conservation Bodies (SNCBs), and sets out the basis for delivering the monitoring measures as required by the conditions contained within the DMLs.
- 2.1.2. The IPMP provides the basis for further discussions post consent with the MMO and the relevant SNCBs to agree the exact detail (timings, methodologies etc.) of the monitoring that is required. It should be noted that the final detailed plans for monitoring work will not be produced until closer to the time that the actual work will be undertaken, and as set out in the DMLs. The relevant topics and/or receptor groups are as follows:
- Marine physical processes;
  - Marine and coastal ornithology;
  - Marine (benthic) ecology;
  - Fish ecology;
  - Marine mammals;
  - Underwater noise;
  - Commercial fishing;
  - Shipping and navigation; and
  - Marine and coastal archaeology.

## 3. General guiding principles for the proposed monitoring

### 3.1. Guiding principles

The guiding principles for monitoring and which apply in general to the in principle monitoring outlined in this document are as follows:

1. 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 206 of the National Planning Policy Framework and referred to as the ‘six tests’ (Department for Communities and Local Government 2014).
2. 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 (e.g. 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.
3. Monitoring will be targeted to address significant evidence gaps or uncertainty, which are relevant to the project and can be realistically filled, as well as those species or features considered to be the most sensitive to the project impacts, including those of conservation, ecological and/or economic importance. The presence of a significant impact should not, on its own, necessarily lead to the requirement for monitoring.
4. Proposals for monitoring will be based, where relevant, on the best practice and outcomes of the latest review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms (MMO 2014).
5. The scope and design of all monitoring work will be finalised and agreed following review of the results of any preceding survey and/or monitoring work (i.e. an adaptive approach), including those surveys conducted in support of the environmental impact assessment. This includes the potential for survey requirements to be adapted based on the results of the monitoring outlined in this document. Where it has been agreed that there are no significant impacts, and there is sufficient confidence in the assessment, monitoring need not be conditioned through the DCO and corresponding DMLs.

## 4. In principle proposals for monitoring

### 4.1. Introduction

- 4.1.1. The following sections set out the in principle proposals for monitoring in relation to those topics and/or receptor groups identified in Section 2.
- 4.1.2. The Applicant has identified all relevant parameters that may be subject to monitoring proposals, in the context of Dogger Bank Teesside A & B. Other conditions relating to monitoring, other than those referenced in this document, are not required in the DMLs.
- 4.1.3. However, it is also recognised that Round 3 Offshore Wind Farms are further offshore and in different environments, using larger turbines and larger or different foundations. Therefore, the monitoring that has previously been undertaken does not necessarily answer the questions in relation to these developments and some more targeted monitoring may be needed to answer questions and fill evidence gaps. It is recognised that the recent MMO report (MMO 2014) and its recommendations will help to focus requirements.
- 4.1.4. While accepting that this 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 the Project, as knowledge and understanding develops. 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. It is recognised that the MMO has the ability to vary the Deemed Marine Licence conditions in this regard.
- 4.1.5. This document has been submitted as a final version for Deadline IX on 27 January 2015, following consultation with the MMO and Natural England. References to the DML refer to the most recently submitted version of the DCO, version 7, also submitted at Deadline IX. However, it is acknowledged that the contents of this document will be used as a basis for further discussions post consent.

### 4.2. Note on engineering and design related studies

- 4.2.1. In addition to the survey and monitoring required as conditions of the DCO and corresponding DMLs, additional studies may be undertaken for engineering and design purposes. Some of these will overlap with the conditioned monitoring (as indicated in sections 4.2 to 4.10 below); however, **Table 1** provides an indication of the type of work that may be undertaken for engineering and design purposes. Wherever possible, the Applicant (and subsequently the lead operator(s) of Dogger Bank Teesside A & B) will look to combine surveys for monitoring purposes with those already being carried out for engineering purposes.
- 4.2.2. It should be noted that this list is indicative only, and its inclusion in this document does not form any commitment on behalf of the Applicant to undertake the surveys identified.

**Table 4.2.1 Indicative list of potential engineering related surveys**

<b>Pre-Construction</b>	<b>During Construction</b>	<b>Post-Construction</b>	<b>Operations</b>
<p><b>Site Investigation</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Foundation and cable locations, crossing points, utilities cables, pipelines, well heads or previous drilling locations (precise if known, or an envelope/corridor) – 1 or a small number of campaigns.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical and geotechnical, boreholes, cone penetration tests (CPTs), vibrocores, acoustic corers, grabs, high resolution geophysical, etc.</p>	<p><b>UXO</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Localised to construction works – ongoing campaign.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical, magnetometer, gradiometer, multi beam echo sounder, high resolution side scan sonar, remotely operated vehicle (ROV)/video.</p>	<p><b>As-Built Survey</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Scour protection, cables and cable protection, crossings, foundations, jack-up footprints – 1 or a small number of campaigns, but potentially separately for each type of component e.g. cables, scour protection, inter-tidal infrastructure, etc.</p> <p><u>Potential Methodologies:</u> Geophysical, bathymetry, visual/ROV camera, etc.</p>	<p><b>Cable survey</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Export, inter-platform and inter-array) – frequency likely to be variable across all cables and risk-based.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical, bathymetry.</p>
<p><b>UXO</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Localised to construction works – 1 or a small number of campaigns.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical, magnetometer, gradiometer, multi beam echo sounder, high resolution side scan sonar, ROV/video.</p>	<p><b>Footprint Survey</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Jack-up locations - frequency likely to be variable and risk-based.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical, bathymetry.</p>	<p><b>Dropped objects</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – 1 or a small number of campaigns)</p> <p><u>Potential Methodologies:</u> Bathymetry, high resolution geophysical, magnetometer, ROV-video, divers</p>	<p><b>Scour Protection &amp; Rock Placement Survey</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Any rock placement – frequency will vary with asset type and site conditions, potentially annually.</p> <p><u>Potential</u> <u>Methodologies:</u> Bathymetry, geophysical, ROV.</p>
<p><b>Bathymetry</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – 1 or a small number of campaigns.</p> <p><u>Potential</u> <u>Methodologies:</u> Multibeam, sidescan</p>	<p><b>Metocean</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Wave buoys, acoustic doppler current profilers (ADCPs), tide gauges, etc.</p>	<p><b>Bathymetry</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – 1 or a small number of campaigns.</p> <p><u>Potential Methodologies:</u> Multibeam, sidescan</p>	<p><b>Footprint Survey</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Jack-up locations - frequency likely to be variable and risk-based.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical, bathymetry.</p>
<p><b>Intertidal</b></p>	-	-	<p><b>Foundation Inspections</b></p>

<b>Pre-Construction</b>	<b>During Construction</b>	<b>Post-Construction</b>	<b>Operations</b>
<p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Geophysical utilities survey (outfalls, cables, pipes etc.)</p>			<p><u>Potential</u> <u>Locations/Frequencies:</u> Foundation structures - Rolling multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Divers or ROVs.</p>
<p><b>Meteorological - Wind</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Masts, fixed or floating lidars</p>	-	-	<p><b>Bathymetry</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – post major storm events.</p> <p><u>Potential</u> <u>Methodologies:</u> Multibeam, sidescan</p>
<p><b>Metoccean</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Wave buoys, ADCPs, tide gauges, etc.</p>	-	-	<p><b>Meteorological - Wind</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Masts, fixed or floating lidars</p>
-	-	-	<p><b>Metoccean</b></p> <p><u>Potential</u> <u>Locations/Frequencies:</u> Whole site – multi-year programme.</p> <p><u>Potential</u> <u>Methodologies:</u> Wave buoys, ADCPs, tide gauges, etc.</p>

### 4.3. Marine physical processes

#### Specific considerations for marine physical processes (in addition to those set out in Section 3)

4.3.1. The following table provides information on the monitoring requirements for marine physical processes. The proposed monitoring has been discussed and agreed with Natural England and the MMO.

4.3.2. Those surveys detailed in the table below, which will take place during the pre-construction phase of the project, will be used to inform the baseline in considering the monitoring of impacts on the Dogger Bank SCI.

Table 4.3.1 In principle monitoring proposed – marine physical processes

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Changes in seabed topography, including scour processes	Physical environment and linked receptor groups e.g. marine ecology	Pre-construction	<ul style="list-style-type: none"> <li>Engineering and design purposes</li> <li>Input to benthic and other related ecological survey and monitoring requirements as agreed with the MMO and relevant SNCBs</li> <li>Inform the Intelligent Scour Management Plan and calculations of potential scour protection required.</li> <li>Regional seabed monitoring to identify suitable areas within the array boundaries, for disposal of drill arisings/spoil should it be required</li> </ul>	Appropriate high resolution bathymetric (undertaken to IHO Order 1A) and side-scan surveys 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.)	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.	DML 1&2 condition 21(2)(b)  DML 3&4 condition 17(2)(b)
		Post-construction	<ul style="list-style-type: none"> <li>Structural integrity/engineering (scour)</li> </ul>	Appropriate high resolution bathymetric surveys undertaken to IHO Order 1A standard and side scan sonar surveys around appropriate samples of adjacent infrastructure to assess any changes in seabed topography. For this purpose the undertaker will, prior to the first such survey, submit a desk based assessment (which takes account of		DML 1&2 condition 23(2)(b)  DML 3&4 condition 19(2)(a)

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
				all factors which influence scour) to identify the sample of adjacent infrastructure with greatest potential for scour. The survey will be used to validate the desk based assessment: further surveys may be required if there are significant differences between the modelled scour and recorded scour. The quantity of infrastructure locations subject to monitoring will be confirmed following the completion of detailed design studies and in consultation with the MMO and relevant SNCBs.		
		Post-construction	<ul style="list-style-type: none"> <li>Structural integrity/engineering and related potential risks to cables</li> </ul>	Cable specification and installation plan will include details of likely installation techniques and associated anticipated burial depth.	Cable specification and installation plan will include details of any surveys required post installation to confirm burial depth, including locations where this is considered most necessary. Surveys will also identify any areas where additional remedial protection is required.	DMLs 1&2 condition 16(1)(f) and DMLs 3&4 condition 12(1)(f)
		Post-construction	<ul style="list-style-type: none"> <li>Monitoring of any disposal mounds, generated through the deposition of drill arisings, to determine changes in size and form of mounds through the lifetime of the project, in order to inform any decommissioning</li> </ul>	Appropriate surveys to determine change in size and form of the disposal mounds over the lifetime of the authorised scheme.  Note: this monitoring is repeated in Section 4.4 (marine ecology).	Survey will only be required should drilling be employed. The survey would be carried out to inform any actions/management	DML 1&2 condition 23(2)(e) DML 3&4 condition 19(2)(c)

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
			requirements (Natural England and JNCC requirement)		<p>response required in relation to the disposal mounds at the point of decommissioning. Scope and timings to be agreed post consent but survey should consider a sample of disposal mounds where any mud or clay arisings are anticipated. This may require monitoring at years 1, 2, 3, 5, 10, 15 and 20 of the operational life of the project unless otherwise agreed with the MMO in consultation with the relevant SNCB. However, survey results will be reviewed with the MMO and relevant SNCBs and subsequently may not be required throughout the life of the project, depending on the persistence of any mounds produced.</p> <p>Depending on the</p>	

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
					amount of drilling undertaken, it is expected that the maximum number of locations monitored will be an agreed sample based/informed on/by the final project design and the environmental parameters, selecting locations across the range of different water depths and site conditions experienced.	

## 4.4. Marine and coastal ornithology

### Specific considerations for marine and coastal ornithology (in addition to those set out in Section 3)

- 4.4.1. Discussions are currently underway with Natural England in order to confirm the anticipated impacts on marine and coastal ornithology with respect to a number of bird species and the corresponding European Sites. As such, the in principle proposals for monitoring will be confirmed once this process is complete.
- 4.4.2. In line with the general guiding principles set out in Section 3, and with respect to the absence of significant impacts in relation to the export cable corridor, ornithological monitoring is not required in relation to the export cables, and therefore the corresponding condition in DMLs 3 and 4 (DCO/DMLs Version 7 as submitted at Deadline IX) has been removed.
- 4.4.3. Monitoring will focus on those species identified as likely to be significantly affected by the Project (as detailed below), as well as being confined to the seasons/periods of greatest concern for those species.
- 4.4.4. It is recognised that the outcomes of the survey work discussed in this document could influence future survey requirements as current proposals are based on knowledge and understanding of the likely impacts of the project at the time of writing.
- 4.4.5. Novel techniques such as tracking and tagging will be considered in relation to uncertainty on the foraging range of birds at the Flamborough and Filey Coast pSPA and Farne Islands SPA (details to be agreed at the appropriate time following further discussions with Natural England).
- 4.4.6. Industry wide solutions relating to the monitoring of impacts on marine and coastal ornithology (e.g. the ORJIP project – see below) should be considered in preference to site specific programmes, where it is practicable and efficient to do so and where it can be shown that the outcome of an industry wide approach is likely to produce more useful information for the hypothesis being tested, and can be incorporated within the Project timeframes. Where it is agreed that species-specific or strategic programmes are more suitable than site specific programmes, these should, in agreement with the relevant SNCB, focus on one or a number of the key species of concern; razorbill (*Alca torda*), guillemot (*Uria aalge*), northern gannet (*Morus bassanus*), black-legged kittiwake (*Rissa tridactyla*), great black-backed gull (*Larus marinus*) and lesser black-backed gull (*Larus fuscus*).

Table 4.4.1 In principle monitoring proposed – marine and coastal ornithology

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Displacement	Razorbill ; Guillemot ; and Gannet	Pre-construction	<ul style="list-style-type: none"> <li>Validate the predictions made in the Environmental Statement and HRA and address areas of uncertainty (Natural England and JNCC requirement)</li> </ul>	Appropriate surveys of ornithological activity pre construction inside the area(s) within the Order limits in which it is proposed to carry out construction works, and any wider area(s) where appropriate, which is required to validate predictions in the Environmental Statement concerning key ornithological interests of relevance to the authorised scheme. The requirement for during construction monitoring will be dependent on the outcomes of the pre-construction ornithological surveys and will be discussed and agreed with the MMO in consultation with the relevant SNCBs.	The methodologies for the pre-construction surveys and any subsequent monitoring are subject to agreement on the: <ol style="list-style-type: none"> <li>Nature and level of the anticipated effects; and</li> <li>Designated European Sites affected.</li> </ol>	DML 1&2 21(2)(c)
Collision	Gannet; Great Black-Backed Gull; Lesser Black Backed Gull and Kittiwake		<ul style="list-style-type: none"> <li>As above</li> </ul>			
Displacement	Razorbill; Guillemot; and Gannet	Construction	<ul style="list-style-type: none"> <li>As above</li> </ul>	Appropriate surveys of ornithological activity inside the area(s) within the Order limits in which it is proposed to carry out construction works, and any wider area(s) where appropriate, dependent upon the outcomes of the pre-construction surveys, as agreed with the MMO in consultation with the relevant statutory nature conservation body.	With respect to collision, it is noted that the monitoring of collisions offshore, and thus validation of the avoidance rates used in models, is the subject of an Offshore Renewables Joint Industry Programme (ORJIP) project, to which the	DML 1&2 22(2)(c)
Collision	Gannet; Great Black-Backed Gull; Lesser Black Backed Gull and Kittiwake		<ul style="list-style-type: none"> <li>As above</li> </ul>			

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Displacement	Razorbill; Guillemot; and Gannet	Post-construction	<ul style="list-style-type: none"> <li>As above</li> </ul>	Appropriate surveys of ornithological activity inside the area(s) within the Order limits in which construction works were carried out, and any wider area(s) where appropriate, which is required to validate predictions in the Environmental Statement concerning key ornithological interests of relevance to the authorised scheme.	<p>Applicant through all four of its partner companies, is committed.</p> <p>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.</p>	DML 1&2 23(2)(a)
Collision	Gannet; Great Black-Backed Gull; Lesser Black Backed Gull and Kittiwake					

## 4.5. Marine (benthic) ecology

### Specific considerations for benthic ecology (in addition to those set out in Section 3)

- 4.5.1. The following tables provide information on the monitoring requirements for marine (benthic) ecology. The first table provides an overview of the type of survey being undertaken, the justification for this and the relevant DML conditions. The second table provides further detail on the reason for the monitoring and the nature of the proposed monitoring. The proposed monitoring has been discussed and agreed with Natural England and the MMO.
- 4.5.2. Objectives and methodologies for benthic ecology survey and monitoring will be agreed with Natural England and MMO post consent but are anticipated to be required to follow Cefas 2012 (Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects), including the specific guidance referred to within that document including, but not limited to, Ware and Kenny 2011 (benthic grabbing) and NMBAQC 2011 (particle size analysis). Forewind acknowledges that where benthic ecology surveys are conducted at a zonal level (e.g. in collaboration with Dogger Bank Creyke Beck), the approach and methodology will also be in consultation and agreement with Natural England and the MMO (consultation with Natural England and the MMO will also be carried out on any project-specific surveys, i.e. “non-zonal” surveys).
- 4.5.3. In line with the “Disposal Scenario Statement”, should Forewind be required to identify appropriate areas for disposal of spoil/drill arisings, this will be informed by regional seabed monitoring, or a suitable alternative.

**Table 4.5.1 Overview of proposed approaches to benthic ecological monitoring**

Survey type	Reason	Relevant DML conditions	
		Pre-construction	Post-construction
Benthic survey	To consider species composition and identify presence of non-native species	DML 1&2 condition 21 (2)(a); DML 3&4 condition 17(2)(a)	DML 1&2 condition 23(2)(c) and DML 3&4 condition 19 (2)(b)
Geophysical survey (MBES and SSS)	To review seabed form and features	DML 1&2 condition 21 (2)(b); DML 3&4 condition 17(2)(b)	DML 1&2 condition 23 (2)(b) and DML 3&4 condition 19 (2)(a)
Specific surveys for the disposal mounds	To review the physical form of the mounds and any subsequent colonisation/species composition	N/A	DML 1&2 conditions 23 (2)(e) DML 3&4 conditions 19(2)(c)
Regional seabed monitoring or suitable alternative	To identify suitable areas within the array boundaries, for disposal of drill arisings/spoil should it be required	DML 1 and 2 condition 16(1)(c)(i); DML 3 and 4 condition 12(1)(c)(i)	N/A

Table 4.5.2 Detailed in principle monitoring proposed – marine (benthic) ecology

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Effects on Annex I habitats	Annex I habitats and linked receptor groups e.g. fish	Pre-construction	<ul style="list-style-type: none"> <li>Establish location and extent of benthic Annex I habitats within the order limits (outside of the Dogger Bank SCI) and validate associated predictions made in the Environmental Statement (Natural England and JNCC requirement)</li> <li>To potentially microsite project infrastructure away from Annex I habitats, where required</li> <li>Regional seabed monitoring to identify suitable areas within the array boundaries, for disposal of drill arisings/spoil should it be required</li> </ul>	Appropriate surveys (likely to be SSS/AGDS/DDV/Grab) to determine the location and reasonable extent of any benthic habitats of conservation, ecological and/or economic importance (including Annex I habitats) in whole or in part inside the area(s) within the Order limits in which it is proposed to carry out construction works.	To include a pre-construction survey to confirm whether Annex I habitats (cobble reef) are identified in the export cable corridor. Appropriate consideration shall be given to monitoring the presence of any invasive non-native species (INNS) and wider community type/structure, to identify changes that may affect site integrity.	DML 1&2 condition 21(2)(a) DML 3&4 condition 17(2)(a)
		Post-construction	<ul style="list-style-type: none"> <li>Validate the predictions made in the Environmental Statement and HRA with respect to potential effects on benthic Annex I habitats and linked receptor groups as relevant (Natural England and JNCC requirement) and to identify the presence of any non-native species and wider community/type structure</li> </ul>	Dependent on the outcome of the surveys undertaken in condition 13(2)(a) above, appropriate surveys to determine the effects of construction activity on any benthic Annex I habitat in whole or in part inside the area(s) within the Order limits to validate predictions made in the Environmental Statement.	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.  Surveys undertaken will inform any mitigation plan in	DML 1&2 condition 23(2)(c) DML 3&4 condition 19(2)(b)

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
					relation to habitats of conservation, ecological and/or economic importance (including Annex I habitats).	
		Post-construction	<ul style="list-style-type: none"> <li>Monitoring of any disposal mounds, generated through the deposition of drill arisings, to determine changes in size and form of mounds through the lifetime of the project, in order to inform any decommissioning requirements (Natural England and JNCC requirement)</li> </ul>	<p>Appropriate surveys to determine change in size and form of the disposal mounds over the lifetime of the authorised scheme.</p> <p>Note: this monitoring is repeated from Section 4.2 (marine physical processes).</p>	<p>Survey will only be required should drilling and subsequent <i>in situ</i> disposal be employed. The survey would constitute an adaptive management measure and would inform requirements for the mounds at the point of decommissioning, should this be required. Scope and timings to be agreed post consent but survey should consider a sample of disposal mounds where any mud or clay arisings are anticipated. This may require monitoring at years 1, 2, 3, 5, 10, 15 and 20 of the operational</p>	<p>DML 1&amp;2 condition 23(2)(e) DML 3&amp;4 condition 19(2)(c)</p>

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
					<p>life of the project unless agreed otherwise with the MMO in consultation with the relevant SNCB. However, survey results will be reviewed with the MMO and relevant SNCBs and subsequently may not be required throughout the life of the project, depending on the persistence of any mounds produced.</p> <p>Depending on the amount of drilling undertaken, it is expected that the number of locations monitored will be an agreed sample based/informed on/by the final project design and the environmental parameters, selecting locations across the range of different water depths and seabed habitat types experienced.</p>	

## 4.6. Fish ecology

- 4.6.1. Industry standards and requirements in relation to fish ecology impacts associated with Electro-Magnetic Fields (EMF) will be monitored post-consent and will be discussed as necessary with the SNCBs and the MMO should new requirements emerge in relation to monitoring of this impact.
- 4.6.2. It is agreed that the use of existing VMS and DTU AQUA survey data to monitor sandeels within the Dogger Bank Teesside A & B project areas are appropriate, and further independent surveys or monitoring is not required.

## 4.7. Marine Mammals

- 4.7.1. As cited in 10.4.42 of Chapter 14 Marine Mammals, abundance of harbour seal within the Dogger Bank zone is relatively low and the contribution of the Dogger Bank projects to the overall cumulative total is minimal. For grey seal, again, abundance is much lower relative to sites in Scottish territorial waters, and hence the qualitative assessment predicts a moderate adverse impact for PTS. Given such low contributions to the overall cumulative effect, and that Forewind is already committed to the DEPONS project it is Forewind's view that it should focus its efforts on monitoring potential impacts/increasing the understanding of potential impacts on harbour porpoise and not have such requirements on grey or harbour seal. This has been agreed with Natural England.

Table 4.7.1 In principle monitoring proposed – marine mammals

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Disturbance effects on harbour porpoise	Harbour porpoise	Pre-construction	<ul style="list-style-type: none"> <li>Validate the predictions made in the Environmental Statement and HRA with respect to disturbance effects on harbour porpoise (Natural England and JNCC requirement). The Applicant will follow the relevant guidelines at the time in relation to a strategic approach to construction and monitoring in development of the MMMP.</li> </ul>	Appropriate surveys (i.e. such as those included within the Disturbance Effects on Harbour Porpoise of the North Sea (DEPONS) project or agreed alternative monitoring) of existing marine mammal activity inside the area(s) within the Order limits in which it is proposed to carry out construction works or any wider area(s) as appropriate which is required to test predictions in the environmental statement concerning key marine mammal interests of relevance	<p>The Applicant considers its contribution to the DEPONS project to provide the necessary monitoring measures for harbour porpoise.</p> <p>Where they are required, survey</p>	DML 1&2 condition 16(1)(e) DML3&4 condition 12(1)(e)

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
				to the authorised scheme.		
		Construction	<ul style="list-style-type: none"> <li>As above</li> </ul>	Appropriate surveys (i.e. such as those included within the Disturbance Effects on Harbour Porpoise of the North Sea (DEPONS) project or agreed alternative monitoring of existing marine mammal activity inside the area(s) within the Order limits in which it is proposed to carry out construction works or any wider area(s) as appropriate which is required to test predictions in the environmental statement concerning key marine mammal interests of relevance to the authorised scheme.	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.	DML 1&2 condition 16(1)(e) DML3&4 condition 12(1)(e)
		Post-construction	<ul style="list-style-type: none"> <li>As above</li> </ul>	Appropriate surveys (e.g. those included within the Disturbance Effects on Harbour Porpoise of the North Sea (DEPONS) project or agreed alternative monitoring) of existing marine mammal activity inside the area(s) within the Order limits in which it is proposed to carry out construction works or any wider area(s) as appropriate which is required to test predictions in the environmental statement concerning key marine mammal interests of relevance to the authorised scheme.		DML 1&2 condition 16(1)(e) DML3&4 condition 12(1)(e)

## 4.8. Underwater Noise

Table 4.8.1 In principle monitoring proposed – underwater noise

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Increased noise levels	Marine mammals and fish	Construction	Validate the predictions made in the Environmental Statement and HRA with respect to noise propagation and potential effects on marine mammals and fish (JNCC and Cefas requirement)	Monitoring, where driven or part-driven pile foundations are proposed to be used, will include measurements of noise generated by the installation of one pile from each of the first four structures with piled foundations (for each specific foundation type), following which the MMO will determine whether further noise monitoring is 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 the commencement of any survey works.	DML 1&2 condition 22(2)(a) DML 3&4 condition 18(2)

## 4.9. Commercial fisheries

Table 4.9.1 In principle monitoring proposed – commercial fisheries

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Complete loss or restricted access to traditional fishing grounds. Displacement of fishing activity.	Inshore crab and lobster fishery	Construction	Validate the predictions made in the Environmental Statement with respect to potential effects on the inshore fisheries and offshore seine net fishery and to inform the measures to be included in the fisheries liaison plan (FLP)	The Applicant intends to work with the affected fishermen to explore the options for monitoring the effects on commercial fisheries should it be required.  Agreed measures to be included in the FLP. The FLP to include information on liaison with the fishing industry (including the fisheries liaison officer) and a coexistence plan.	Final scope to be developed and agreed following further consultation with the affected fishermen and the MMO.	DML 3&4 Condition 12(1)(d)(v)
	Inshore trawlers and <i>Nephrops</i> fishery					
	Seine net fishery (offshore)					
	Seine net fishery	Operation phase				

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
	(offshore)					

## 4.10. Shipping and navigation

Table 4.10.1 In principle monitoring proposed – shipping and navigation

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
Effects on the levels of marine traffic across the project	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 MCA.	Post-construction vessel traffic monitoring using AIS will be undertaken for a maximum of but not consecutively, 28 days, 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.	DML 1&2 condition 22(2)(b)
		Post-construction	As above.	Vessel traffic monitoring by Automatic Identification System, 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.		DML 1&2 condition 23(2)(d)

## 4.11. Marine and coastal archaeology

Table 4.11.1 In principle monitoring proposed – marine and coastal archaeology

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
All direct and indirect effects on the archaeological resource	All archaeological receptors	Pre-construction	<ul style="list-style-type: none"> <li>Validate the predictions made in the Environmental Statement with respect to potential effects on the archaeological resource and to inform selection of appropriate mitigation (English Heritage requirement)</li> </ul>	Appropriate high resolution bathymetry surveys undertaken to IHO Order 1A standard and side-scan surveys 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 (A1 and A3 receptors) and any unidentified anomalies larger than 5m in diameter (A2 receptors), which may require the refinement, removal or introduction of archaeological exclusion zones and to confirm project specific micrositing requirements (for A2 receptors).	Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO, in consultation with the MCA, for written approval at least 4 months prior to the commencement of any survey works.	DML 1&2 condition 21(2)(b)
		Pre-construction	<ul style="list-style-type: none"> <li>Validate the predictions made in the Environmental Statement with respect to potential effects on the archaeological resource and to inform selection of appropriate mitigation (English Heritage requirement)</li> </ul>	Appropriate high resolution bathymetry surveys undertaken to IHO Order 1A standard and side-scan surveys of the area(s) within Work Nos 2A/2B within the Order limits in which it is proposed to carry out construction works This should include the identification of sites of historic or archaeological interest (A1 and A3 receptors) and any unidentified anomalies larger than 5m in diameter (A2 receptors), which may require the refinement, removal or introduction of archaeological exclusion zones and to confirm project specific micrositing requirements (for A2 receptors).	Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO, in consultation with the MCA, for written approval at least 4 months prior to the commencement of any survey works.	DML 3&4 condition 17(2)(b)
		Construction	<ul style="list-style-type: none"> <li>As above</li> </ul>	Specific requirements relating to	WSI to be	DML1&2

Potential effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring proposed	Details	DML reference
		and post-construction		monitoring during post-construction (including a conservation programme for finds) as detailed in the written scheme of archaeological investigation (WSI).	submitted to the MMO for approval at least four months prior to the intended start of construction.	condition 16(1)(g)  DML 3&4 condition 12(1)(g)

## 5. References

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## 6. Appendix 1

Table 6.1 Relevant DCO and DML conditions

DML and Relevant Condition	Commitments Secured
DMLs 1&2 condition 16	<p>Captures a number of pre-construction plans and documentation including the following of relevance for offshore monitoring:</p> <ul style="list-style-type: none"> <li>- Construction and monitoring programme to include proposed pre-construction, during and post construction monitoring, format for baseline reports and format for final reports from surveys</li> <li>- Construction method statement including methods for drilling and drill arisings and other infrastructure installation including piling procedures (including soft start)</li> <li>- Environmental management and monitoring plan (EMMP)</li> <li>- Fisheries liaison officer and plan</li> <li>- Marine mammal mitigation protocol and outline for surveys in line with this document</li> <li>- Cable specification and installation plan</li> <li>- Written scheme of archaeological investigation (WSI)</li> </ul>
DMLs 1&2 condition 21	<p>Pre-construction surveys in line with this document including (specifically mentioned in the DML):</p> <ul style="list-style-type: none"> <li>- Benthic survey</li> <li>- Bathymetric survey</li> <li>- Ornithology surveys</li> </ul>
DMLs 1&2 condition 22	<p>Construction monitoring in line with this document including (specifically mentioned in the DML):</p> <ul style="list-style-type: none"> <li>- Noise monitoring in the event that piled foundations are used</li> </ul>
DMLs 1&2 condition 23	<p>Post construction monitoring in line with this document including (specifically mentioned in the DML):</p> <ul style="list-style-type: none"> <li>- Ornithology surveys</li> <li>- Bathymetric surveys</li> <li>- Benthic surveys with methods to be dependent on pre-construction surveys</li> <li>- Vessel traffic monitoring</li> <li>- Monitoring of the disposal mounds</li> </ul>
DMLs 3&4 condition 12	<p>Captures a number of pre-construction plans and documentation including the following of relevance for offshore monitoring:</p> <ul style="list-style-type: none"> <li>- Construction and monitoring programme to include proposed pre-construction, during and post construction monitoring, format for baseline reports and format for final reports from surveys</li> <li>- Construction method statement including methods for drilling and drill arisings and other infrastructure installation including piling procedures (including soft start)</li> <li>- Environmental management and monitoring plan (EMMP)</li> <li>- Fisheries liaison officer and plan</li> </ul>

	<ul style="list-style-type: none"> <li>- Marine mammal mitigation protocol and outline for surveys in line with this document</li> <li>- Cable specification and installation plan</li> <li>- Written scheme of archaeological investigation (WSI)</li> </ul>
DMLs 3&4 condition 17	<p>Pre-construction surveys in line with this document including (specifically mentioned in the DML):</p> <ul style="list-style-type: none"> <li>- Benthic survey</li> <li>- Bathymetric survey</li> </ul>
DMLs 3&4 condition 18	<p>Construction monitoring in line with this document including (specifically mentioned in the DML):</p> <ul style="list-style-type: none"> <li>- Noise monitoring in the event that piled foundations are used</li> </ul>
DMLs 3&4 condition 19	<p>Post construction monitoring in line with this document including (specifically mentioned in the DML):</p> <ul style="list-style-type: none"> <li>- Bathymetric surveys</li> <li>- Benthic surveys with methods to be dependent on pre-construction surveys</li> </ul>