



**SCOTTISHPOWER
RENEWABLES**

East Anglia TWO Offshore Windfarm

Offshore In-Principle Monitoring Plan

Applicant: East Anglia TWO Limited
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**Applicable to
East Anglia TWO**



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Glossary of Acronyms

ALARP	As Low As Reasonably Practicable
AIS	Automatic Identification System
CFWG	Commercial Fisheries Working Group
DCO	Development Consent Order
DDV	Drop Down Video
DML	Deemed Marine Licence
ES	Environmental Statement
EIA	Environmental Impact Assessment
HRA	Habitats Regulations Assessment
HVAC	High Voltage Alternating Current
IHO	International Hydrographic Organisation
IPMP	In-Principle Monitoring Plan
LAT	Lowest Astronomical Tide
MBES	Multibeam Echosounder
MCA	Maritime Coastguard Agency
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation
NGO	Non-Government Organisation
ORPAD	Offshore Renewables Protocol for Archaeological Discovery
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
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
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Body
SPR	ScottishPower Renewables
SSS	Side Scan Sonar
UXO	Unexploded Ordnance
WSI	Written Scheme of Investigation



Glossary of Terminology

Applicant	East Anglia TWO Limited
Construction operation and maintenance platform	A fixed structure required for construction, operation and maintenance personnel and activities.
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction, operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Inter-array cables	Offshore cables which link the wind turbines to each other and the offshore electrical platforms, these cables will include fibre optic cables.
Offshore cable corridor	This is the area which will contain the offshore export cable between offshore electrical platforms and landfall jointing bay.
Offshore development area	The East Anglia TWO windfarm site and offshore cable corridor (up to Mean High Water Springs).
Offshore electrical platform	A fixed structure located within the windfarm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which would bring electricity from the offshore electrical platforms to the landfall.
Offshore platform	A collective term for the offshore construction operation and maintenance platform and the offshore electrical platforms.
Platform link cable	An electrical cable which links one or more offshore platforms.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water



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1 Offshore In-Principle Monitoring Plan

1.1 Changes to Previously Submitted Document

1. This In Principle Monitoring Plan (IPMP) is an update of the previous version of the IPMP (APP-590) submitted with the Development Consent Order (DCO) application for the East Anglia TWO project (the Project) and (REP3-040) updated for Deadline 3 submission. The updates within this document take account of comments made by Natural England in REP7-074 and include the following:
 - Inclusion of reference to the Information to Support Appropriate Assessment report at paragraph 13;
 - Reference within the existing monitoring for *Sabellaria* reef (**Table 2**) to understanding reef recovery; and
 - Removal of 'statistically' from **Table 4** with regard to monitoring of underwater noise from the first four piles.

1.2 Purpose of the In-Principle Monitoring Plan

2. This 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 (DMLs).
3. The 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 the proposed East Anglia TWO project will be formally controlled and mitigated.
4. The IPMP provides a framework for further discussions post consent with the Marine Management Organisation (MMO) and the relevant Statutory Nature Conservation Bodies (SNCBs) to agree the exact detail (timings, methodologies etc.) of the monitoring that is required. Due to the long lead in time for the development of offshore windfarms it is not desirable or effective to provide final detailed method statements prior to being granted consent. However, agreeing guiding principles reinforces commitments made in the Environmental Statement (ES) and complements other requirements set out in the DMLs and will allow refinements to be made based on the best available knowledge and technology. Final detailed plans for monitoring work will be produced closer to the time that the actual work will be undertaken.



5. The relevant topics and / or receptor groups that will be 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.

1.3 Background

6. East Anglia TWO Limited (the Applicant) (a wholly owned subsidiary of ScottishPower Renewables (SPR) UK Limited) is developing the proposed East Anglia TWO project, an offshore windfarm in the southern North Sea.
7. The proposed East Anglia TWO project comprises the East Anglia TWO windfarm site, within which wind turbines, associated offshore platforms, inter-array cables and platform link cables will be located. The East Anglia TWO offshore windfarm site will be connected to the shore by offshore export cables installed within the offshore cable corridor from the East Anglia TWO windfarm site to a landfall point north of Thorpeness, Suffolk. From there, onshore cables would transport power over approximately 9km to the onshore project substation near to the village of Friston, Suffolk. A full project description is given in the ES, **Chapter 6 Project Description** (APP-054).

1.4 Description of the Proposed East Anglia TWO Project

8. The proposed East Anglia TWO project would consist of up to 75 wind turbines.

1.4.1 Key Project Characteristics

Parameter	Characteristic
Maximum number of wind turbines	Up to 75
East Anglia TWO windfarm site area	218.4km ²
East Anglia TWO windfarm site water depth range	33 - 67m (LAT)
Distance from East Anglia TWO windfarm site to shore (closest point of site to the coast at)	32.6km



Parameter	Characteristic
Maximum offshore cable corridor area – northern route option	137.6km ²
Maximum offshore cable corridor area – southern route option	98.9km ²
Maximum number of export cables (HVAC)	Two
Maximum cable lengths	<ul style="list-style-type: none"> • Inter-array – 200km • Platform link – 75km • Export – 160km
Maximum wind turbine rotor diameter	250m
Maximum wind turbine hub height (LAT)	175m
Maximum wind turbine tip height (LAT)	282m
Minimum clearance above sea level	24m (MHWS)
Minimum separation between wind turbines (although it should be noted that nominal spacing will likely far exceed this)	In-row spacing: 800m
	Inter-row spacing: 1200m
Maximum number of wind turbine models to be installed	Three
Wind turbine foundation type options	Jacket on pin piles, gravity base structure, suction caisson, jacket on suction caisson, monopile
Maximum number of met masts	One
Maximum height of met mast (LAT)	175m
Met mast foundation type options	Jacket on pin piles, gravity base structure, suction caisson, jacket on suction caisson, monopile
Maximum number of offshore electrical platforms	Up to four
Maximum number of construction, operation and maintenance platforms	Up to one

* It should be noted that this area is for both the northern and southern offshore cable corridor route options. In practice, only one of the route options would be chosen following detailed project design.

1.5 General Guiding Principles for the Proposed Monitoring

- 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 or decommissioning phases of the proposed East Anglia TWO project.

10. 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 2014).
- 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.
- Monitoring should be targeted to address significant evidence gaps or uncertainty, which are relevant to the proposed East Anglia TWO project and can be realistically filled, as well as those species or features considered to be the most sensitive to the proposed East Anglia TWO project impacts including those of conservation, ecological and/or economic importance.
- Proposals for monitoring should be based, where relevant, on the best practice and outcomes of the latest review of environmental data associated with post-consent monitoring of licence conditions of offshore windfarms (MMO 2014).
- The scope and design of all monitoring work should be finalised and agreed following review of the results of any preceding survey and / or monitoring work (i.e. an adaptive approach), including those surveys conducted in support of the Environmental Impact Assessment (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.
- 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 East Anglia TWO DML conditions.



1.6 East Anglia TWO Residual Impacts

11. 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.
12. 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 the project and can be realistically filled.
13. For each receptor the residual impacts and major areas of uncertainty as predicted within the East Anglia TWO ES and Information to Support Appropriate Assessment report 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.

1.7 In-Principle Proposals for Monitoring

14. 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.
15. 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 proposed East Anglia TWO project, 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 neighbouring projects such as East Anglia ONE and East Anglia THREE. 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 1.5**).
16. This document has been submitted with the DCO application and will be used as a basis for further discussions post consent.

1.7.1 Engineering Related Monitoring

17. In addition to the environmental survey and monitoring required as conditions of the DMLs within the DCO, additional studies will be undertaken for engineering 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.
18. Other relevant Plans required under the DML with commitments to monitoring (linked to those listed above) are:
- A scour protection management 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.

1.7.2 Marine Geology, Oceanography and Physical Processes

1.7.2.1 Conclusions of the Environmental Statement

19. 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 survey campaign (see **section 1.7.4**).

1.7.2.2 In-Principle Monitoring

20. The following table 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.



Table 1 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	<ul style="list-style-type: none"> Engineering and design purposes Input in to benthic and other related ecological surveys and monitoring requirements as agreed with the MMO. 	A single survey within the agreed East Anglia TWO windfarm 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) 543 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.)	<p>Scope of surveys and programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 6 months prior to the commencement of any survey works.</p> <p>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 statutory nature conservation bodies</p>
		Post-construction	<ul style="list-style-type: none"> Structural integrity / engineering (scour) 	Surveys within the agreed East Anglia TWO windfarm site and offshore cable corridor survey areas using full sea bed coverage swath-bathymetric surveys undertaken to meet the requirements of MGN 543 and its Annexes. For this purpose the undertaker will, prior to the first such survey, submit a desk based assessment (which takes account of all factors which influence scour) to identify the sample of adjacent wind turbines with greatest potential for scour. The survey will be used to validate the desk	



Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				based assessment: further surveys may be required if there are significant differences between the modelled scour and recorded scour. The quantity of turbines subject to monitoring will be confirmed following the completion of detailed design studies and in consultation with the MMO.	



1.7.3 Marine Water and Sediment Quality

1.7.3.1 Conclusions of the Environmental Statement

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

1.7.3.2 In-Principle Monitoring

22. As stated in **section 1.5**, 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 the proposed East Anglia TWO project 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.

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

1.7.4 Benthic Ecology

1.7.4.1 Conclusions of the Environmental Statement

24. No impact was greater than minor adverse for the project alone or cumulatively. The proposed East Anglia TWO project has no direct impact on any designated site and therefore no Annex 1 habitat features will be impacted.

1.7.4.2 In-Principle Monitoring

25. The following table provides information on the monitoring requirements for benthic ecology. Where it is possible, synergies with monitoring commitments made in **section 1.7.2** would be explored in interpreting geophysical data.

26. No Annex 1 surveys are proposed. Consideration has been given to habitats / species of principal importance. The specific habitats of relevance identified within the offshore development area are the focus for monitoring outlined within **Table 2** below. These shall be referred to specifically as surveys for the main feature of concern: *Sabellaria spinulosa* (*Sabellaria* reef). Initial geophysical surveys will be reviewed with drop-down video (DDV) ground-truthing surveys to confirm presence as appropriate. This shall then be used to inform detailed layout design in the design plan and this will constitute the outline mitigation scheme requirements. As secured through condition 17(1)(j) of the Generation DML and condition 13(1)(j) of the Transmission DML, the management of *Sabellaria* reef will be controlled through the *Sabellaria* reef management plan which will be in accordance with the outline *Sabellaria* reef management plan (REP1-044).

1.7.4.2.1 Deadline 5 Update

27. Following discussions with the MMO, the Applicant has agreed to undertake monitoring of benthic communities and the potential spread of marine non-native species.



28. As stated in the ES (**Chapter 9 Benthic Ecology**) (APP-057) multiple studies indicate no / negligible impact with regard to benthic ecology from operational windfarms from Round 1 and Round 2 (e.g. CMACS 2010; 2012; MMO 2014 and Marine Space 2015). Whilst it is acknowledged that the foundation designs proposed for the proposed East Anglia TWO project are larger than those monitored in the studies cited, the impact pathways would be the same. While each individual footprint area impacted would be larger, there would be fewer individual impact areas given that the proposed wind turbines will be larger but fewer in number (when compared with Round 2 projects) and therefore across the entire windfarm site, any impacts from the proposed East Anglia TWO project would be likely to be comparable to those previously monitored. As a result, it is reasonable to assume that recovery rates would be comparable to the aforementioned studies. Therefore, the Applicant concluded that there is no requirement for project-specific general benthic monitoring. This approach is in line with all recent (i.e. Round 3) offshore windfarm projects.
29. MMO's advisors, Cefas, stated that whilst they acknowledged that impacts on benthic communities within the Project would be minimal, there is a degree of uncertainty around this conclusion given the larger turbine foundations and the scale of larger windfarms in comparison to the Round 2 windfarms. Accordingly, Cefas stated that the wider industry would benefit from a monitoring programme to address this data gap. The Applicant has therefore committed to undertaking monitoring of the benthic communities around the foundations to verify the results from earlier monitoring programmes.
30. The Applicant and its contractors are committed to applying best practice techniques including appropriate vessel maintenance as outlined in MARPOL (see **Chapter 8 Marine Water and Sediment Quality section 8.33**) (APP-056). Such measures are designed to prevent the spread of non-native species. Given that the majority of other vessels operating in this region of the North Sea are also likely to be complying with MARPOL, the potential for non-native species to spread and colonise windfarm infrastructure is limited. As discussed in **section 9.6.2.7 of Chapter 9 Benthic Ecology**, the relatively large distances between individual wind turbines and potential scour infrastructure within the individual windfarms would not represent any form of linked reef-like feature. However, the MMO considers that there is sufficient uncertainty around the potential spread of non-natives, particularly considering the fact that dispersal could be affected by climate change, and therefore monitoring of foundations for the spread of non-natives is required. This is acknowledged to be an industry-wide, rather than project specific, concern. The Applicant has therefore committed to undertaking monitoring of the foundations for the presence of non-native species as part of the benthic monitoring programme.



Table 2 In-Principle Monitoring Proposed - Benthic Ecology

Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Effects on <i>Sabellaria</i> reef	<i>Sabellaria</i> reef	Pre-construction	Determine the location and extent of any <i>Sabellaria</i> reef within areas of the Order Limits in which it is proposed to carry out UXO clearance and construction works to inform the appropriate mitigation if found	<ul style="list-style-type: none"> Undertake geophysical survey to inform engineering design options and analyse results for potential <i>Sabellaria</i> reefs (and other potential constraints such as archaeology). Undertake ground-truthing of potential <i>Sabellaria</i> reefs through drop-down video (or grab sample where visibility prevents confirmation through video) against the methodology to be agreed with the MMO. 	<ul style="list-style-type: none"> Submit a plan showing the area in which clearance activities are proposed to take place and details of any exclusion zones / environmental micro-siting to the MMO for approval a minimum of three months prior to UXO clearance activities being undertaken. Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 6 months prior to the commencement of the geophysical survey and the drop-down video survey works. Surveys must be undertaken no longer than 12-18 months prior to UXO clearance or commencement of construction. Unless both UXO clearance and commencement of construction occurs within 18 months of the survey being undertaken, a second survey and report will be required prior to construction commencing.



Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
		Post-construction	The requirement for post-construction monitoring will be dependent on the findings of the pre-construction surveys.	<ul style="list-style-type: none"> Where no <i>Sabellaria</i> reef is identified by the pre-construction survey of the proposed works or where reef has been identified but is avoided (including associated buffers), no post-construction surveys will be undertaken; Where <i>Sabellaria</i> reef is identified during the baseline survey and has not been able to be avoided (avoidance defined as being greater than 60m from UXO clearance and 50m for all other construction activities), post-construction surveys, the number of which are to be agreed with the MMO post consent, , specifically targeting those reefs 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. 	<ul style="list-style-type: none"> If required, survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 6 months prior to completion of construction. If significant impacts are observed, the potential requirement for further surveys will be agreed with the MMO following review of the post-construction survey
Spread of non-native marine invasive species	Benthic communities	Operation	Monitor the potential spread of marine non-native species infrastructure.	<ul style="list-style-type: none"> Undertake monitoring of the benthic communities comprising grab samples and video around foundations. Analysis of sample data to determine species composition and the presence of any marine non-native species. 	<ul style="list-style-type: none"> Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 6 months prior to the commencement of any survey works.



Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
Changes to benthic community structure as a result of foundation installation	Benthic communities	Pre- and Post-Construction	The increased size of wind turbine foundations has led to uncertainty regarding this effect which has been previously monitored at Round 1 and Round 2 windfarms. The proposed monitoring seeks to fill this data gap.	<ul style="list-style-type: none"> Undertake monitoring of the benthic communities comprising grab samples in the form of a cruciform design at a select number of foundations the number and location of which are to be agreed with the MMO post-consent. Analysis of sample data to determine potential changes to the benthic community structure from before and after construction. 	<ul style="list-style-type: none"> Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 6 months prior to the commencement of any survey works.



1.7.5 Fish Ecology

1.7.5.1 Conclusions of the Environmental Statement

31. No impact was greater than minor adverse for the project alone or cumulatively for the proposed East Anglia TWO project.

1.7.5.2 In-Principle Monitoring

32. 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. Monitoring should be targeted to address significant evidence gaps or uncertainty, which are relevant to the proposed East Anglia TWO project 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.

1.7.5.2.1 Deadline 5 Update

33. Following discussions with the MMO, the Applicant has agreed to undertake PSA monitoring to determine sandeel habitat suitability.
34. MMO highlighted that the pressure on habitat availability for sandeel resulting from total habitat loss across multiple windfarm developments throughout the North Sea has not currently been accounted for or monitored. MMO therefore requested that pre- and post-construction sandeel habitat monitoring using the MarineSpace (2013) approach is necessary, in order to monitor the continued suitability of the windfarm site for sandeel habitat. This is acknowledged to be an industry-wide, rather than project specific, concern. The Applicant has therefore committed to undertaking monitoring of the sediment within the East Anglia TWO windfarm site to determine its continued suitability for sandeel habitat.



Table 3 In Principle Monitoring Proposed – Fish Ecology

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Habitat loss	Sandeel	Pre- and post-construction	<ul style="list-style-type: none"> Determine the suitability of the windfarm site as sandeel habitat. 	<p>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.</p>	<ul style="list-style-type: none"> Survey programmes and methodologies for the purposes of monitoring shall be submitted to the MMO for written approval at least 6 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



1.7.6 Marine Mammals

1.7.6.1 Conclusions of the Environmental Statement

35. At a project alone level, the residual impacts from the proposed East Anglia TWO project are assessed as minor adverse at worst during construction for grey and harbour seal and harbour porpoise from the following activities:
- Piling (physical and auditory injury and disturbance impacts);
 - UXO clearance (physical and auditory injury and behavioural impacts);
 - Other construction activities (physical and auditory injury);
 - Underwater noise and disturbance from construction vessels (physical and auditory injury); and
 - Barrier effects from underwater noise.
36. In addition, negligible to minor adverse impacts are predicted for harbour porpoise displacement due to changes in prey resource, and minor adverse impacts are assessed for harbour porpoise and grey seal for vessel interaction (collision risk).
37. During operation, up to minor adverse impacts are assessed for grey and harbour seal and harbour porpoise from the following activities:
- Underwater noise from operational turbines (physical and auditory injury); and
 - Underwater noise from maintenance activities (disturbance).
 - Displacement of harbour porpoise due to changes in prey resource during operation and maintenance is also assessed to be minor adverse.
38. All the other potential impacts were determined to be negligible or no impact for construction, operation and decommissioning. No significant impacts were identified.
39. 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.
40. All potential cumulative residual impacts were determined to be minor adverse (not significant). Project-specific SIPs for the Southern North Sea SAC are proposed which will give due consideration to mitigation and monitoring, if deemed required.



41. It should also be noted that the contribution of the proposed East Anglia TWO project to the cumulative harbour porpoise assessment is very small with a worst-case of up to 0.45% of the reference population (North Sea Management Unit) assessed as being potentially disturbed during piling operations.

1.7.6.2 In-Principle Monitoring

42. It is recognised that monitoring is an important element in the management and verification of the actual proposed East Anglia TWO project impacts. The draft MMMP (document reference 8.14) and in principle Southern North Sea SAC SIP (document reference 8.17) contain key principles that provide the framework for any mitigation that could be required. 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.

1.7.6.2.1 Deadline 5 Update

43. Following a request from Natural England and the MMO, the Applicant has agreed for one of the first four piles to be within an area anticipated to generate the greatest underwater noise emissions. This is likely to be determined through detailed ground investigations, with areas of hard substrate and / or depth being correlated with higher anticipated noise emissions.
44. In addition, the Applicant has included in **Table 4** potential compliance monitoring as is secured through the MMMP and the in principle Southern North Sea SAC SIP. Details of this potential monitoring will be dependent upon the requirements of the final approved plan and protocol.
45. 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 e.g. SPR are active members in the Offshore Wind Strategic Monitoring Research Forum pilot, looking to address wider knowledge gaps and industry priorities.



Table 4 In Principle Monitoring Proposed – Marine Mammals

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Potential disturbance resulting from underwater noise	Harbour porpoise, grey seal, harbour seal	Construction	<ul style="list-style-type: none"> Determine that the maximum piling energies assessed within the ES are not being breached. 	Noise measurements taken from the first four piled foundations of each piled foundation type will be undertaken to validate the assessments within the ES and Information to Support Appropriate Assessment. One 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	Harbour porpoise	All phases	<ul style="list-style-type: none"> Determine the potential behavioural impacts of underwater noise generating activities on harbour porpoise 	Determine the potential behavioural impacts of underwater noise generating activities through monitoring of harbour porpoise 'echolocation 'clicks' using passive acoustic monitoring (PAM) devices	The Applicant's Parent Company, SPR, is in preliminary discussions about this type of monitoring for the East Anglia THREE project. Greater detail on the design of the monitoring will be discussed with SNCBs. The Applicant intends to optimise monitoring of this nature through alignment of the monitoring programmes for East Anglia TWO, East Anglia ONE North and East Anglia THREE as far as



Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
					possible with input from the relevant SNCBs (building on the PAM surveys undertaken for East Anglia ONE). The final details of the monitoring will be provided in the Monitoring Plan to be produced post-consent.
Potential disturbance resulting from underwater noise	Harbour porpoise	All phases	To ensure measures and controls managed through the SIP are monitored for effectiveness	The form of monitoring will be dependent on project design, construction method and the mitigation measures required	The final design and scope of monitoring will be agreed with the relevant stakeholders and included within the final Monitoring Plan submitted for approval.
Potential injury resulting from underwater noise	Marine mammals	Construction	Reporting of MMMP measures	The form of monitoring will be dependent on project design, construction method and the mitigation measures required	The final design and scope of any monitoring will be agreed with the relevant stakeholders and included within the final MMMP submitted for approval.



1.7.7 Offshore Ornithology

1.7.7.1 Conclusions of the Environmental Statement

46. The impacts that could potentially arise during the construction, operation and decommissioning of the proposed East Anglia TWO project have been discussed with Natural England and RSPB as part of the Evidence Plan process (see **Chapter 12 Offshore Ornithology** of the ES) (APP-060).
47. During the construction phase, no impacts have been assessed to be greater than of minor adverse significance for any bird species. Similarly, no species is subject to an impact of greater than minor adverse significance from the potential effects of the proposed East Anglia TWO project during its operation.
48. Displacement effects on red-throated divers, gannets, razorbills and guillemots would not create impacts of more than minor adverse significance during any biological season during construction and operation phases.
49. The risk to birds from collisions with wind turbines from the proposed East Anglia TWO project alone is assessed as no greater than minor adverse significance for gannet, kittiwake, lesser black-backed gull, great black-backed gull and herring gull when considered for all biological seasons against the most appropriate population scale.
50. Potential plans and projects have been considered for how they might act cumulatively with the proposed project 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 windfarms and aggregate extraction) and the highly localised nature of the impacts the assessment concluded that there is no pathway for interaction between most impacts cumulatively.
51. The risk to birds from cumulative collisions with wind turbines across all windfarms considered is assessed as no greater than minor adverse significance for all species. Therefore, monitoring on the basis of the EIA is not required however, if, for any reason, monitoring was to be undertaken it should focus on the operational period when there is a pathway to the risk (collision with turbines).

1.7.7.2 In-Principle Monitoring

52. 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 the proposed East Anglia TWO project and the specific species.
53. Therefore, the Applicant considers that offshore ornithology monitoring for the East Anglia TWO project should focus on the potential displacement of red-throated divers.



54. Notwithstanding this, monitoring/survey work already proposed to be undertaken at the East Anglia THREE project to monitor potential collision risk impacts on seabird species will be widened to incorporate the East Anglia TWO project. The final details of this are still to be agreed with Natural England and will be included in the final Monitoring Plan post consent.
55. The Applicant also notes that if there is a requirement to implement compensatory measures as a result of an HRA Derogation, then monitoring will be a necessary part of those proposals.
56. 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 e.g. SPR are active members in the Offshore Wind Strategic Monitoring Research Forum pilot, looking to address wider knowledge gaps and industry priorities.



Table 5 In Principle Monitoring Proposed – Offshore Ornithology

Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
Displacement from operational windfarm site	Red-throated diver	Pre-and Post Construction	<ul style="list-style-type: none"> To determine the level of displacement from the EA2 (and EA1N) windfarm site, and specifically to determine the area of the Outer Thames Estuary SPA affected by EA2 (and EA1N) displacement. Potential for change in distribution of the species within the Outer Thames Estuary Special Protection Area (SPA). 	Determine whether there is a change in abundance and distribution within the windfarm site and appropriate buffer zones following construction of the windfarm.	<p>Analysis of pre- and post-construction aerial digital survey data of the windfarm site and buffer zones will be undertaken. The detailed requirements for this will be submitted to the MMO for approval six months before commencement of the first pre-construction survey for pre-construction monitoring. It is likely that the number of surveys required will be based on a power analysis.</p> <p>For post-construction monitoring, the detailed requirements will be submitted to the MMO for approval six months prior to completion of construction.</p>
Collision risk	Offshore ornithology	Post-construction	<ul style="list-style-type: none"> Increase certainty of collision risk modelling (CRM) parameters Record potential collisions with wind turbine blades 	Install collision risk monitoring system as agreed through consultation with the relevant SNCBs.	Monitoring similar to that already proposed for the East Anglia THREE through the installation of a collision risk monitoring system.



Potential Effect	Receptors	Phase	Headline reasons for monitoring	Monitoring Proposal	Details
					The Applicant intends to optimise monitoring of this nature through alignment of the monitoring programmes for East Anglia TWO, East Anglia ONE North and East Anglia THREE as far as possible with input from the relevant SNCBs. The final details of the monitoring will be provided in the Monitoring Plan to be produced post-consent.



1.7.8 Commercial Fisheries

1.7.8.1 Conclusions of the Environmental Statement

57. The impacts on commercial fisheries during the construction, operation and decommissioning phases of the proposed East Anglia TWO project found that following the mitigation proposed, no receptors are predicted to experience significant impacts as a result of the individual project. This is with the exception of potential impacts on unidentified individual local inshore vessels for which impacts may be of moderate adverse significance noting that due to data limitations, it is not possible to assess the impacts on individual vessels. Cumulatively, the only receptors which have the potential to experience moderate adverse impacts are Anglo-Dutch beam trawlers and Dutch seine netters during the operation phase due to the loss of ground on these fleets.

1.7.8.2 In-Principle Monitoring

58. For the proposed East Anglia TWO project it is proposed that no further monitoring or independent surveys are required.

59. The DML includes the requirement for a Fisheries Liaison and co-existence Plan which requires to be in accordance with the Outline Fisheries Liaison and Co-existence Plan.

60. In order to aid and maintain regular communication between the Applicant and local fishermen potentially affected by the projects in the former East Anglia Zone, a Commercial Fisheries Working Group (CFWG) has been established with a representative from each local port which could potentially be impacted by the proposed East Anglia TWO project (Orford, Aldeburgh, Harwich, Felixstowe, Lowestoft and Southwold). The CFWG aims to identify and develop co-existence strategies during a project's lifecycle.

1.7.9 Shipping and Navigation

1.7.9.1 Conclusions of the Environmental Statement

61. The effects of the proposed East Anglia TWO project have been assessed in **Chapter 14 Shipping and Navigation** of the ES (APP-062) with impacts ranging from broadly tolerable to tolerable / as low as reasonably possible (ALARP).

1.7.9.2 In-Principle Monitoring

62. **Table 6** provides information on the vessel traffic monitoring requirements for shipping and navigation.



Table 6 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 in line with the Navigation Monitoring Strategy (APP-595) 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.	Post-construction vessel traffic monitoring would be in line with the Navigation Monitoring Strategy (APP-595) 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.



1.7.10 Marine Archaeology and Cultural Heritage

1.7.10.1 Conclusions of the Environmental Statement

63. The construction, operation and decommissioning phases of the proposed East Anglia TWO project will result in a range of effects upon the marine archaeological and cultural heritage environment. For the project alone, the effects that have been assessed are anticipated to be reduced to a minor residual significance or are considered to be negligible on the basis of embedded mitigation and best practice, including further 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 (embedded and project-specific).

1.7.10.2 In-Principle Monitoring

64. **Table 7** provides information on the monitoring requirements for marine archaeological and cultural heritage. The principle mechanism for delivery of monitoring for marine archaeological and cultural heritage is through agreement on the Written Scheme of Investigation and / or further activity specific method statements to be agreed with MMO in consultation with Historic England.



Table 7 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.	<ul style="list-style-type: none"> An outline project specific Written Scheme of Investigation (WSI) (offshore) (APP-583) has been compiled which makes provision for all archaeological mitigation that might be required in the light of preconstruction 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 6 months in advance of the licensed activities. Full sea floor coverage swath-bathymetric surveys undertaken to 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 	The Applicant has submitted an outline WSI (offshore) with the DCO application. A WSI will be in place prior to pre-construction archaeological investigations, UXO clearance and pre-commencement material operations which involve intrusive sea bed works. A WSI will be submitted at least six months prior to the intended start of construction.
All direct and indirect effects on the archaeological resource					



Potential Effect	Receptor/s	Phase	Headline reason/s for monitoring	Monitoring Proposal	Details
				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).	
All direct and indirect effects on the archaeological resource	All Archaeology receptors	Construction	Validate the predictions made in the Environmental Statement, where reasonable, with respect to potential effects on the archaeological resource and to inform selection of appropriate mitigation (Historic England requirement)	<ul style="list-style-type: none"> Specific requirements relating to monitoring during post-construction (including a conservation programme for finds) as detailed in the WSI. Notably the 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



1.8 References

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