

Norfolk Boreas Offshore Wind Farm

Appendix 5.1

Habitats Regulations Assessment Offshore Screening

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Photo: Ormonde Offshore Wind Farm

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Glossary of Acronyms

Cefas	Centre for Environment, Fisheries and Aquaculture Science
CIS	Celtic and Irish Sea
CV	Coefficient of Variation
cSAC	candidate Special Area of Conservation
dB	Decibel
EPP	Evidence Plan Process
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
GNS	Greater North Sea
HRA	Habitats Regulations Assessment
IAMMWG	Inter-Agency Marine Mammal Working Group
km	kilometre
JNCC	Joint Nature Conservation Committee
LSE	Likely Significant Effects
MMMP	Marine Mammal Mitigation Plan
MU	Management Units
NS	North Sea
NWT	Norfolk Wildlife Trust
O&M	Operation and Maintenance
OWF	Offshore Wind Farm
PTS	Permanent Threshold Shift
SAC	Special Area of Conservation
SEL	Sound Exposure Level
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCI	Site of Community Importance
SCOS	Special Committee on Seals
SMRU	Sea Mammal Research Unit
SNCB	Statutory Nature Conservation Body
SNS	Southern North Sea
TTS	Temporary Threshold Shift
TWT	The Wildlife Trusts
UK	United Kingdom
UXO	Unexploded Ordnance
WDC	Whale and Dolphin Conservation
WS	West Scotland

Glossary of Terminology

Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and information to support the HRA.
Interconnector cables	Buried offshore cables which link offshore electrical platforms within the Norfolk Boreas site.
Landfall	Where the offshore cables come ashore at Happisburgh South.
Offshore service platform	A platform to house workers offshore and/or provide helicopter refuelling facilities. An accommodation vessel may be used as an alternative for housing workers.
Offshore cable corridor	The area where the offshore export cables would be located.
Offshore electrical platform	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which transmit electricity from the offshore electrical platform to the landfall.
Offshore project area	The area including the Norfolk Boreas site, project interconnector search area and offshore cable corridor.
Project interconnector cable	Buried offshore cables which would link turbines or an offshore electrical platform within the Norfolk Boreas site and an offshore platform within one of the Norfolk Vanguard offshore wind farm sites
Project interconnector search area	The area within which the project interconnector cable would be buried.
Safety zone	An area around a vessel which should be avoided during offshore construction.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.
The Applicant	Norfolk Boreas Limited
The Norfolk Boreas site	The redline boundaries of Norfolk Boreas which will contain the wind turbines, offshore platforms, and inter-array cables (does not contain the export cable corridor).
The project	Norfolk Boreas Offshore Wind Farm, including the onshore and offshore infrastructure.

1 INTRODUCTION

1.1 Purpose of this document

1. This document provides the offshore screening of Natura 2000 sites for Habitats Regulations Assessment (HRA) in relation to the Norfolk Boreas offshore wind farm. This document covers designated sites for marine mammals, benthic habitats, fish and birds. The document draws on information that has been used in stakeholder consultation as part of both the Norfolk Vanguard and Norfolk Boreas Evidence Plan Process's and will be used to seek agreement on the designated sites which should be considered further. This also forms stage 1 of the HRA Process (discussed further in section 2.4). Impacts of the onshore project infrastructure on Natura 2000 sites are screened separately in a separate onshore screening document (Appendix 5.2 of this Information to support HRA).
2. This document forms part of the Norfolk Boreas Development Consent Order (DCO) Application and therefore forms part of the statutory consultation for the Norfolk Boreas project.
3. A version of this document was consulted on as part of the Norfolk Boreas Preliminary Environmental Information Report (PEIR). The consultation was undertaken between the 31st October and 11th December 2018.
4. Designated sites are proposed to be "screened out" where no Likely Significant Effect (LSE) from Norfolk Boreas is predicted. Where LSE cannot be ruled out at this stage the designated sites will be "screened in" and assessed further. Information for the Habitats Regulations Assessment Report (both offshore and onshore) will be provided with the Development Consent Order (DCO) application.
5. Note that Natura 2000 sites included in this document include sites in other EU Member States.
6. The classes of Natura 2000 designations considered within this HRA Screening are:
 - Special Protection Areas (SPAs) (some of which are also Ramsar sites)
 - Potential SPA (pSPA)
 - SPAs that are approved by the UK Government but are still in the process of being classified
 - Special Areas of Conservation (SACs)
 - Possible SACs (pSACs)
 - A site which has been identified and approved to go out to formal consultation.
 - Candidate SACs (cSACs)

- Following consultation on the pSAC, the site is submitted to the European Commission (EC) for designation and at this stage it is called a cSAC.
- Sites of Community Importance (SCI)
 - Once the EC approves the site it becomes a SCI, before the national government then designates it as a SAC.
- 7. Consideration is also given to impacts on Ramsar sites. Ramsar sites protect wetland areas and extend only to “areas of marine water the depth of which at low tide does not exceed six metres”.
- 8. Screening of SPAs and SACs affected by the onshore project elements will be provided separately.

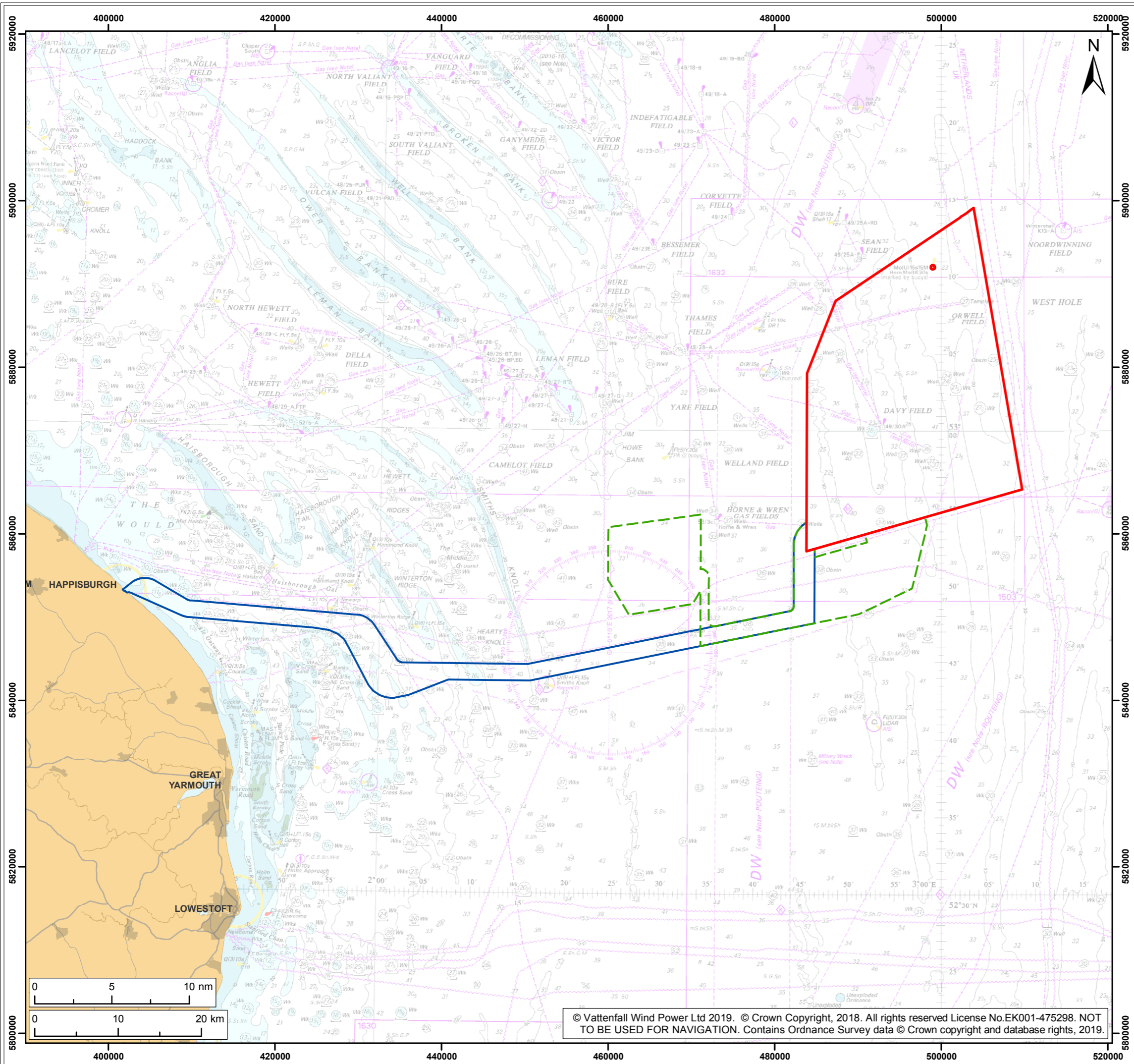
1.2 Project Background

9. In December 2009, as part of the UK Offshore Wind Round 3 tender process, The Crown Estate awarded the joint venture company, East Anglia Offshore Wind (EAOW) Ltd, the rights to develop Zone 5 (later called the ‘East Anglia zone’). These rights were granted through a Zone Development Agreement (ZDA). EAOW Ltd. was at that time a 50:50 joint venture owned by Vattenfall Wind Power Ltd (VWPL) and ScottishPower Renewables (UK) Limited (SPR).
10. Under the ZDA, the joint venture consented East Anglia ONE, and commenced the EIAs for East Anglia THREE (prior to the project being taken forward to submission by SPR) and East Anglia FOUR (up to submission of a request for a Scoping Opinion in 2012).
11. In December 2014, a decision was taken to split the zone, with VWPL having development rights within the north of the former East Anglia Zone, and SPR continuing to develop the southern part. In agreement with The Crown Estate, the ZDA was effectively dissolved in 2016. New Agreement for Lease (AfL) areas have been awarded by The Crown Estate within the former Zone, separately to VWPL and its affiliate companies, and SPR and its affiliates.
12. Norfolk Boreas Limited and Norfolk Vanguard Limited (affiliate companies of VWPL) are now seeking consent to develop the Norfolk Boreas and Norfolk Vanguard projects. Norfolk Vanguard is approximately one year ahead of Norfolk Boreas and submitted its DCO application in June 2018. Norfolk Boreas are planning to submit their DCO application in June 2019. Norfolk Boreas consists of a single wind farm site whereas Norfolk Vanguard consists of two distinct areas, Norfolk Vanguard East (NV East) and Norfolk Vanguard West (NV West) (‘the OWF sites’). All three sites share an offshore cable corridor (Figure 1).

13. As part of the EIA process Norfolk Boreas submitted a Scoping Report to the Planning Inspectorate in May 2017 (Royal HaskoningDHV, 2017) and a PEIR was published for consultation on the 31st October 2018.

14. The development of the Norfolk Boreas offshore project area has followed a careful site selection process in order to avoid designated sites where possible and if unavoidable minimise impacts to these. It has not been possible to avoid the Southern North Sea SAC which overlaps with the whole of the former East Anglia zone. Although the site selection process has enabled Norfolk Boreas to avoid the Cromer Shoal Chalk Beds MCZ it has led to a requirement to route through the Haisborough, Hammond and Winterton SAC. Further information in the Norfolk Boreas site selection process is provided in Chapter 4, Site Selection and Assessment of Alternatives.

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Legend:

- Norfolk Boreas site
- Offshore cable corridor
- Project interconnector search area

Project: Norfolk Boreas	Report: Norfolk Boreas HRA Screening: Offshore
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Title:
Offshore project areas

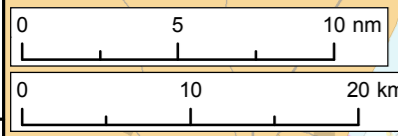
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Co-ordinate system: ETRS 1989 UTM Zone 31N EPSG: 25831

VATTENFALL

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2 HRA LEGISLATION, POLICY AND GUIDANCE

2.1.1 Legislation

15. The HRA process derives from the requirements of specific European Directives and the Regulations that implement their requirements in national law.
16. The UK has triggered article 50 of the Treaty on European Union (TEU) and is in a two year process of negotiating a withdrawal agreement for the UK to leave the EU. Following withdrawal from the EU, the UK government plans to enact the Great Repeal Bill. In its white Paper the UK Government has confirmed that it plans to transpose all current European environmental regulation into UK law after Brexit.

2.1.1.1 The Birds Directive

17. The EU Directive on the Conservation of Wild Birds (2009/147/EC) (hereafter called the Birds Directive) provides a framework for the conservation and management of wild birds in Europe. The relevant provisions of the Directive are the identification and classification of SPAs for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive.

2.1.1.2 The Habitats Directive

18. The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (hereafter called the Habitats Directive) provides a framework for the conservation and management of natural habitats, wild fauna (except birds) and flora in Europe. Its aim is to maintain or restore natural habitats and wild species at a favourable conservation status. The relevant provisions of the Directive are the identification and classification of Special Areas of Conservation (SAC) (Article 4) and procedures for the protection of SACs and SPAs (Article 6). SACs are identified based on the presence of natural habitat types listed in Annex I and populations of the species listed in Annex II. The Directive requires national Governments to establish SACs and to have in place mechanisms to protect and manage them.

2.1.1.3 The Conservation of Habitats and Species Regulations 2017

19. The Conservation of Habitats and Species Regulations 2017 (hereafter called the 'Habitats Regulations') combine the 2010 regulations with subsequent amendments. 'The Habitats Regulations' transposed the Habitats Directive and elements of EU Wild Birds Directive into UK law.

20. Under the Habitats and Species Regulations (2017) the relevant Secretary of State must consider whether a plan or project has the potential to have an adverse effect on the integrity and features of a Natura 2000 site. This process is known as Habitat Regulations Assessment (HRA). Under Regulation 61 of the Habitats and Species Regulations, appropriate assessment is required for a plan or project which, either alone or in combination with other plans or projects, is likely to have a significant effect on a Natura 2000 site and is not directly connected with or necessary for the management of the site.

2.1.1.4 The Conservation of Offshore Marine Habitats and Species Regulations 2017

21. The Conservation of Offshore Marine Habitats and Species Regulations 2017 (referred to here as the ‘Offshore Regulations’) consolidate and update the Offshore Marine Conservation Regulations 2007. These transposes the Birds Directive and the Habitats Directive into national law in the offshore environment (from territorial waters to the continental shelf). The Offshore Regulations place an obligation on ‘competent authorities’ to carry out an appropriate assessment of any proposal likely to affect a SAC or SPA, to seek advice from Natural England and / or the joint Nature Conservation Committee (JNCC) and not to approve an application that would have an adverse effect on a SAC or SPA except under very tightly constrained conditions that involve decisions by the Secretary of State. The competent authority in the case of Norfolk Boreas is the Secretary of State for Business, Energy and Industrial Strategy.

2.1.1.5 Application of the legislation to designated sites

22. As discussed in section 1.1 the HRA process also applies as a matter of law or policy to the following sites:
- SCIs: HRA process applied as a result of Article 4(5) and Article 6(2)(4) of the Habitats Directive.
 - pSPAs: HRA process applied as a result of UK Government policy - paragraph 176 of the National Planning Policy Framework (MHCLG, 2018).
 - pSACs: HRA process applied as a result of UK Government policy - paragraph 176 of the National Planning Policy Framework (MHCLG, 2018).
 - Listed and proposed Ramsar sites (internationally important wetlands designated under the Ramsar Convention 1971): HRA process applied as a result of UK Government policy (ODPM & Defra, 2005; MHCLG, 2018 (para 176)).

2.1.2 Guidance on the HRA Process

23. In preparing this report, consideration has been given to the relevant guidance issued by a number of Governmental, statutory and industry bodies.
24. In relation to guidance from Government bodies this includes:

- European Commission: Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites.
- European Commission: EU Guidance on wind energy development in accordance with EU nature directives.
- Department of Communities and Local Government: Guidance on ‘Planning for the Protection of European Sites: Appropriate Assessment’.
- The Planning Inspectorate Advice Note Nine: Rochdale Envelope.
- The Planning Inspectorate Advice Note Ten: Habitat Regulations Assessment relevant to nationally significant infrastructure projects.

25. In relation to guidance from the Statutory Nature Conservation Bodies (SNCBs) this includes:

- English Nature: Habitats Regulations Guidance Note (HRGN 1): The Appropriate Assessment (Regulation 48) The Conservation (Natural Habitats &c) Regulations, 1994.
- English Nature: Habitats Regulations Guidance Note (HRGN 3): The Determination of Likely Significant Effect under the Conservation (Natural Habitats &c) Regulations, 1994.
- English Nature: Habitats Regulations Guidance Note (HRGN 4): Alone or in combination.
- Natural England and JNCC: Interim advice on HRA screening for seabirds in the non-breeding season.
- Natural England and JNCC: Advice on HRA screening for seabirds in the breeding season.
- Natural England and JNCC: Interim Advice Note – Presenting information to inform assessment of the potential magnitude and consequences of displacement of seabirds in relation to Offshore Wind farm Developments.

2.2 The HRA Process

26. The HRA process is carried out in a sequential manner and the stages of that sequence are described as follows in Planning Inspectorate Advice Note 10 (Planning Inspectorate, 2017):

- Stage 1 –Screening (This report for HRA Screening: Offshore and Appendix 22.12 for HRA Screening: Onshore);
 - European and Ramsar sites are screened for LSE, both effects from the project alone and in combination with other projects. The Planning Inspectorate advises that for those projects where no LSE is predicted then that should be reported in the form of a No Significant Effects

Report (NSER) and the Stage 2 assessment is not carried out (the Planning Inspectorate, 2017).

- Stage 2 - Appropriate Assessment;
 - For those sites where LSE on a European or Ramsar site cannot be excluded in Stage 1 then further information to inform the assessment will be prepared and the test applied to determine whether the project alone or in-combination could adversely affect the integrity of the site in view of its conservation objectives. This assessment stage will be reported in the form of a HRA Report and the results of the assessment summarised in the form of a series of matrices.
27. In those cases where the conclusion of the HRA Report is that an adverse effect on the integrity of a European or Ramsar site has been identified then the assessment proceeds to two further stages:
- Stage 3 - Assessment of Alternatives; and
 - The alternatives that have been considered will be assessed. The Planning Inspectorate advises that alternative solutions can include a proposal of a different scale, a different location and an option of not having the scheme at all – the ‘do nothing’ approach.
 - Stage 4 – Assessment of Imperative Reasons of Overriding Public Interest (IROPI).
 - If it is demonstrated that there are no alternative solutions to the proposal that would have a lesser effect or avoid an adverse effect on the integrity of the site(s), then a justified case will be prepared that the scheme must be carried out for IROPI.
28. If the conclusion of Stages 3 and 4 is that there is no alternative and that the project has demonstrated IROPI then the project may proceed with a requirement that appropriate compensatory measures are delivered.

2.2.1 In-Combination Assessment

29. The Habitats Regulations and the Offshore Regulations require the consideration of the potential effects of a project on European sites and Ramsar sites both alone and in-combination with other plans or projects.
30. The identification of plans and projects to include in the in-combination assessment will be based on:
- Approved plans;
 - Constructed projects;

- Approved but as yet unconstructed projects; and
 - Projects for which an application has been made, are currently under consideration and will be consented before the Norfolk Boreas consent decision.
31. The classes of projects that could potentially be considered for the in-combination assessment include:
- Offshore wind farms;
 - Marine renewables (wave and tidal);
 - Harbour and port developments;
 - Marine aggregate extraction and dredging;
 - Licensed disposal sites;
 - Oil and gas exploration and extraction;
 - Subsea cables and pipelines;
 - Commercial marine fishing activity;
 - Recreational marine fishing activity; and
 - Onshore major residential, commercial and industrial development.
32. The assessment will present relevant in-combination impacts of projects in the following tiered approach (Table 2.1) as advised by Natural England (JNCC and Natural England, 2013a).

Table 2.1 Suggested tiers for undertaking a staged cumulative impact assessment (JNCC and Natural England, 2013a)

Tier Description	Consenting or Construction Phase	Data Availability
Tier 1	Built and operational projects should be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/or any residual impact may not have yet fed through to and been captured in estimates of “baseline” conditions e.g. “background” distribution or mortality rate for birds.	Pre-construction (and possibly post-construction) survey data from the built project(s) and environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project).
Tier 2	Tier 1 + projects under construction	As Tier 1 but not including post-construction survey data
Tier 3	Tier 2 + projects that have been consented (but construction has not yet commenced)	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project) and possibly pre-construction

Tier Description	Consenting or Construction Phase	Data Availability
Tier 4	Tier 3 + projects that have an application submitted to the appropriate regulatory body that have not yet been determined	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project)
Tier 5	Tier 4 + projects that the regulatory body are expecting an application to be submitted for determination (e.g. projects listed under the Planning Inspectorate programme of projects)	Possibly environmental characterisation survey data (but strong likelihood that this data will not be publicly available at this stage).
Tier 6	Tier 5 + projects that have been identified in relevant strategic plans or programmes (e.g. projects identified in Round 3 wind farm zone appraisal and planning (ZAP) documents)	Historic survey data collected for other purposes/by other projects or industries or at a strategic level.

33. Projects will be included in the quantitative assessment where there is sufficient certainty and data confidence that they make a meaningful contribution to the assessment process.

2.3 Process for the Identification of European and Ramsar Sites and Features Potentially Affected by the Project

34. The initial identification of European and Ramsar sites for inclusion in the Stage 1 HRA Screening is primarily based on the location of the site relative to Norfolk Boreas. The approach for each site interest feature (i.e. marine mammals, benthic habitat, fish and birds) is outlined in sections 3, 4, 5 and 6 as each receptor has a different range and therefore different potential for connectivity.

2.4 HRA Stage 1 Screening Process

35. Screening has been based on a conceptual ‘source-pathway-receptor’ approach. The approach identifies likely environmental impacts resulting from the proposed construction, operation and maintenance (O&M) and decommissioning of the wind farm and its supporting transmission infrastructure. The parameters are defined as follows:

- Source – the origin of a potential impact (noting that one source may have several pathways and receptors).
 - Example: Re-suspension of sediments due to cable laying activity.
- Pathway – the means by which the effect of the activity could impact a receptor.

- Example: Settlement of re-suspended sediments causing smothering of seabed.
 - Receptor – the element of the receiving environment that is impacted.
 - Example: Smothering has a direct effect on a seabed organism that forms an important part of the food chain for a site interest feature.
36. Where there is no pathway or the pathway is so long that the effect from the source has dissipated to a negligible level before reaching the receptor, there is justification for the screening out of that particular receptor.
37. It only requires one category of site interest feature to be identified in the process below for the European and / or Ramsar site to be screened in, along with all its associated interest features.
38. The approach to screening for each receptor is outlined in sections 3, 4, 5, 6, and 6.2 based on the known distribution, ecology and sensitivities of each receptor and therefore the potential for being affected by Norfolk Boreas.
39. Where there is insufficient information available at this stage to screen out a site, it is screened in for further consideration.

3 SCREENING MARINE MAMMAL SAC SITES AND FEATURES

3.1 Identification of Marine Mammal Sites and Features

40. Based on data collected during Norfolk Boreas site aerial surveys, and a review of existing data sources, the marine mammal Annex II species likely to occur in the Norfolk Boreas offshore project area, and therefore considered in the HRA screening are:
- Harbour porpoise *Phocoena phocoena*;
 - Grey seal *Halichoerus grypus*; and
 - Harbour seal *Phoca vitulina*.
41. The marine mammal species to be considered in the HRA were agreed during consultation with the marine mammal Expert Topic Group (ETG)¹ for both Norfolk Boreas and Norfolk Vanguard.
42. Bottlenose dolphin *Tursiops truncatus* have not been identified during Norfolk Boreas aerial surveys and no bottlenose dolphin were positively sighted during the aerial surveys of the adjacent Norfolk Vanguard site surveys (Norfolk Vanguard Limited, 2018) or the nearby East Anglia THREE site (EATL, 2015). During SCANS III surveys in summer 2016, no bottlenose dolphin were recorded in or around the area of Norfolk Boreas (Hammond et al., 2016). During the SCANS II surveys, only two bottlenose dolphin groups were sighted within the survey block which encompasses the East Anglia Zone; resulting in an estimated density of 0.0032 (CV 0.74) individuals per km² (Hammond et al., 2013). There are currently seven Management Units (MU) for bottlenose dolphin in UK waters; Norfolk Boreas is located in the Greater North Sea (GNS) MU, which has an estimated population size of zero (IAMMWG, 2015). Taking into account the very low occurrence of sightings in and around Norfolk Boreas and the assessment of the GNS MU population size by the IAMMWG, this species will not be considered further.
43. The following sections (3.1.1 to 3.1.3) describe the process used to define the list of sites for which there is theoretical connectivity and therefore potential for a source – pathway – receptor relationship for harbour porpoise, grey seal and harbour seal.

3.1.1 Harbour porpoise

44. Harbour porpoise within the eastern North Atlantic are generally considered to be part of a continuous biological population that extends from the French coastline of the Bay of Biscay to northern Norway and Iceland (Tolley and Rosel, 2006; Fontaine

¹ Natural England, Whale and Dolphin Conservation (WDC), The Wildlife Trust (TWT) and Cefas.

et al., 2007, 2014; IAMMWG, 2015). However, for conservation and management purposes, it is necessary to consider this population as smaller MUs. MUs provide an indication of the spatial scales at which effects of plans and projects alone, and in combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK (IAMMWG, 2015). The IAMMWG defined three MUs for harbour porpoise: North Sea (NS); West Scotland (WS); and the Celtic and Irish Sea (CIS). Norfolk Boreas is located within the North Sea MU (Plate 3.1; IAMMWG, 2015). Therefore, all designated sites out with the North Sea MU have been screened out from further consideration.

45. For harbour porpoise, connectivity is considered potentially possible between Norfolk Boreas and any Natura 2000 site within the North Sea MU where harbour porpoise are listed as a qualifying feature (Inter-Agency Marine Mammal Working Group (IAMMWG, 2015) (see Plate 3.1). The extent of the North Sea MU has been agreed during consultation with the Marine Mammals ETG² (February 2017), as the most appropriate population which any harbour porpoise occurring within Norfolk Boreas may be a part of.

² Natural England, Whale and Dolphin Conservation (WDC), Wildlife Trust and Cefas.

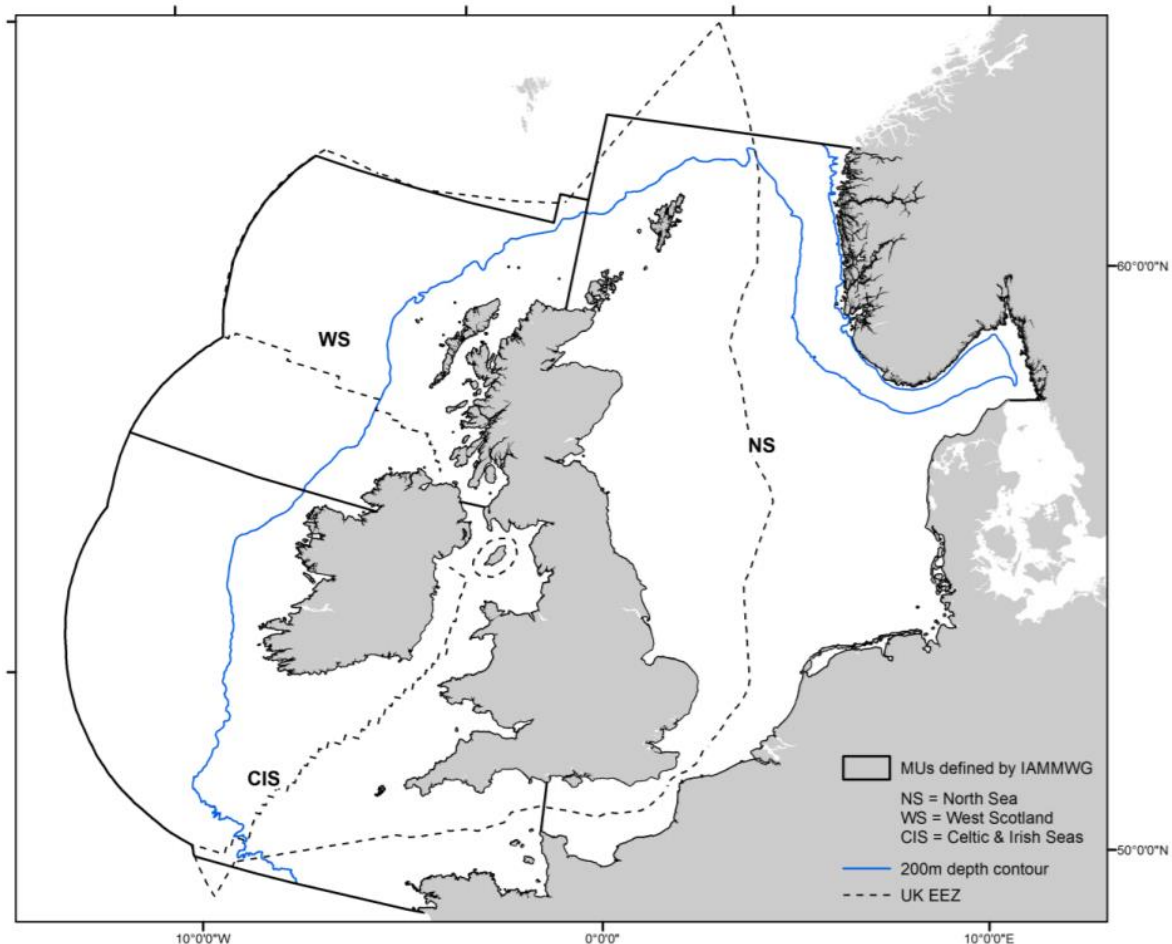


Plate 3.1 Harbour porpoise management units (IAMMWG, 2015)

46. This HRA screening considers any Natura 2000 site within the harbour porpoise North Sea MU, where the species is considered as a grade A, B or C feature. Grade D indicates a non-significant population (JNCC, 2009) and have therefore not been considered further. All Natura 2000 sites out with the harbour porpoise North Sea MU area have been screened out from further consideration.
47. Table 3.2 provides the list of sites with harbour porpoise interest features considered for screening. This list has been further refined and screened, in relation to the potential effects assessed in section 3.3.1.

3.1.2 Grey seal

48. Grey seals are wide ranging and can breed and forage in different areas (Russell et al., 2013). For example, tags deployed on grey seals at Donna Nook and Blakeney Point in May 2015, indicated that they used multiple haul-outs sites; with one hauling out in the Netherlands and one in Northern France (Russell, 2016). Plate 3.2 shows the tagged seal movements along the east coast of England and indicates that

grey seal travel between haul-out sites along the east coast of England, as well as to the north of France, Firth of Forth and Dogger Bank (Russell, 2016).

49. Grey seals will typically forage in the open sea and return regularly to land to haul-out, although they may frequently travel up to 100km between haul-out sites. Foraging trips generally occur within 100km of their haul-out sites, although grey seal can travel up to several hundred kilometres offshore to forage (SCOS, 2017). Grey seal generally travel between known foraging areas and back to the same haul-out site, but will occasionally move to a new site. For example, movements have been recorded between haul-out sites on the east coast of England and the Outer Hebrides (SCOS, 2017).

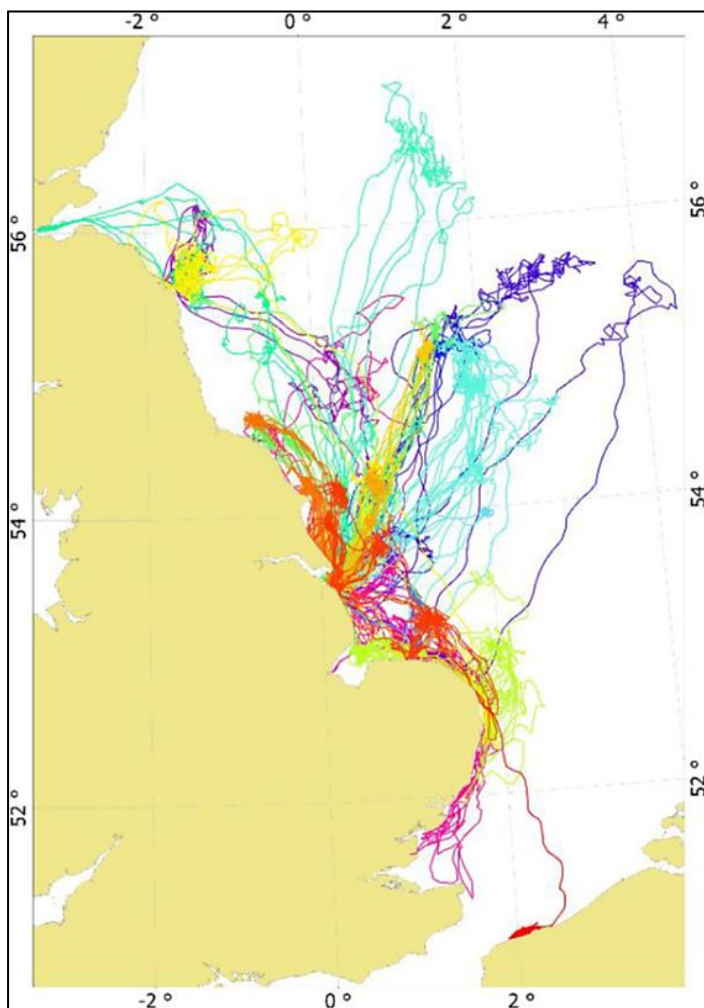


Plate 3.2 Tagged grey seal movements along the East coast of England (Russell, 2016)

50. To take the wide range and movements of grey seal into account, all designated sites where grey seal are a qualifying feature in the Greater North Sea OSPAR region II (Plate 3.3) were considered. All designated sites out with this region were screened

out from further consideration. For grey seal, the screening process includes any designated site where the species is a grade A, B or C feature.

51. Table 3.2 provides the list of sites with grey seal interest features considered for screening. This list has been further refined and screened, in relation to the potential effects assessed in section 3.3.2.

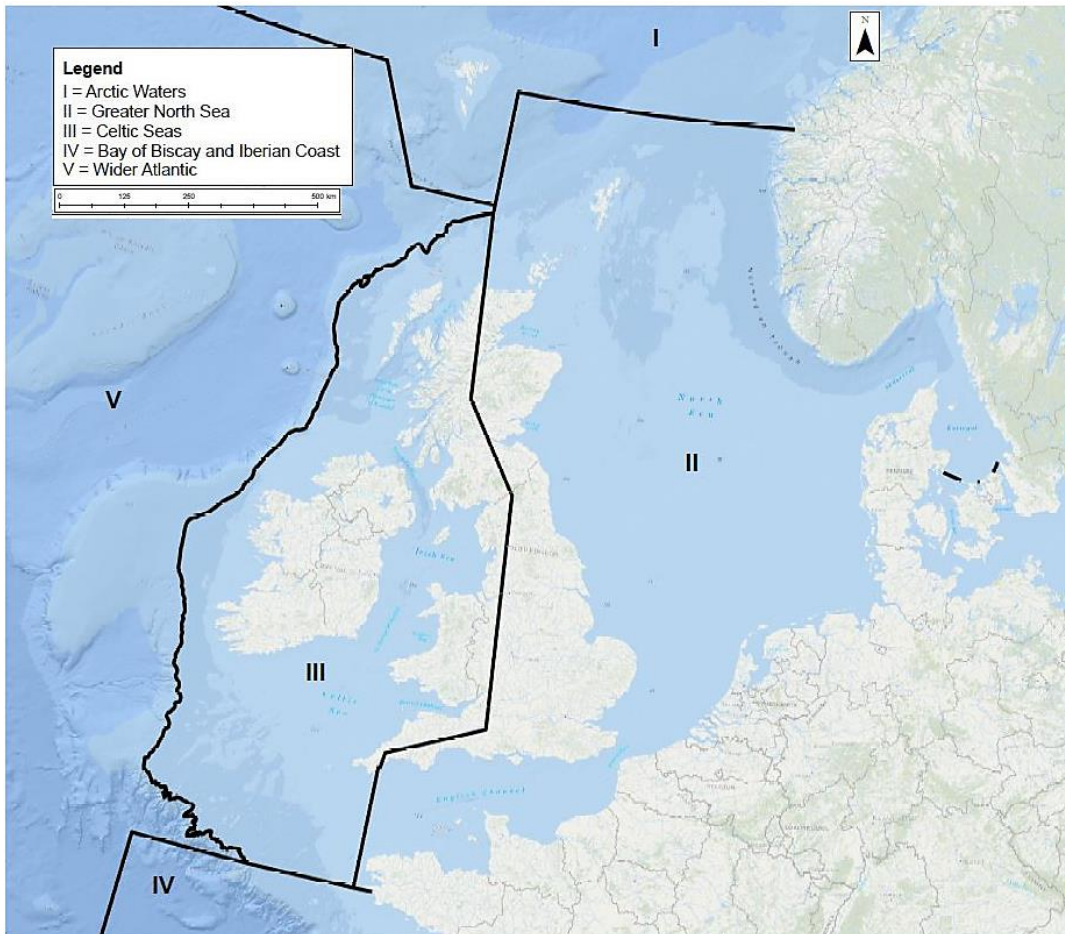


Plate 3.3 Greater North Sea OSPAR region II

3.1.3 Harbour seal

52. The Sea Mammal Research Unit (SMRU), in collaboration with others, has deployed around 344 telemetry tags on harbour seals around the UK between 2001 and 2012. The spatial distributions indicate harbour seals persist in discrete regional populations, display heterogeneous usage, and generally stay within 50km of the coast (Russell and McConnell, 2014). Tagged harbour seals were observed to have a more coastal distribution than grey seals and do not travel as far from haul-outs (Plate 3.4; Russell and McConnell, 2014).

53. Harbour seals generally make smaller foraging trips than grey seal, typically travelling 40-50km from their haul-out sites to foraging areas (SCOS, 2017). Tracking studies have shown that harbour seals travel 50-100km offshore and can travel 200km between haul-out sites (Lowry et al., 2001; Sharples et al., 2012). The range of these trips varies depending on the location and surrounding marine habitat. Tagging studies undertaken on harbour seal at The Wash (2003-2005) have shown that this population travels larger distances for their foraging trips than for other harbour seal populations and repeatedly forage between 75km and 120km offshore (average was 80km), with one seal travelling 220km (Sharples et al., 2012). The typical and average foraging range for harbour seal is 50-80km (SCOS, 2017)

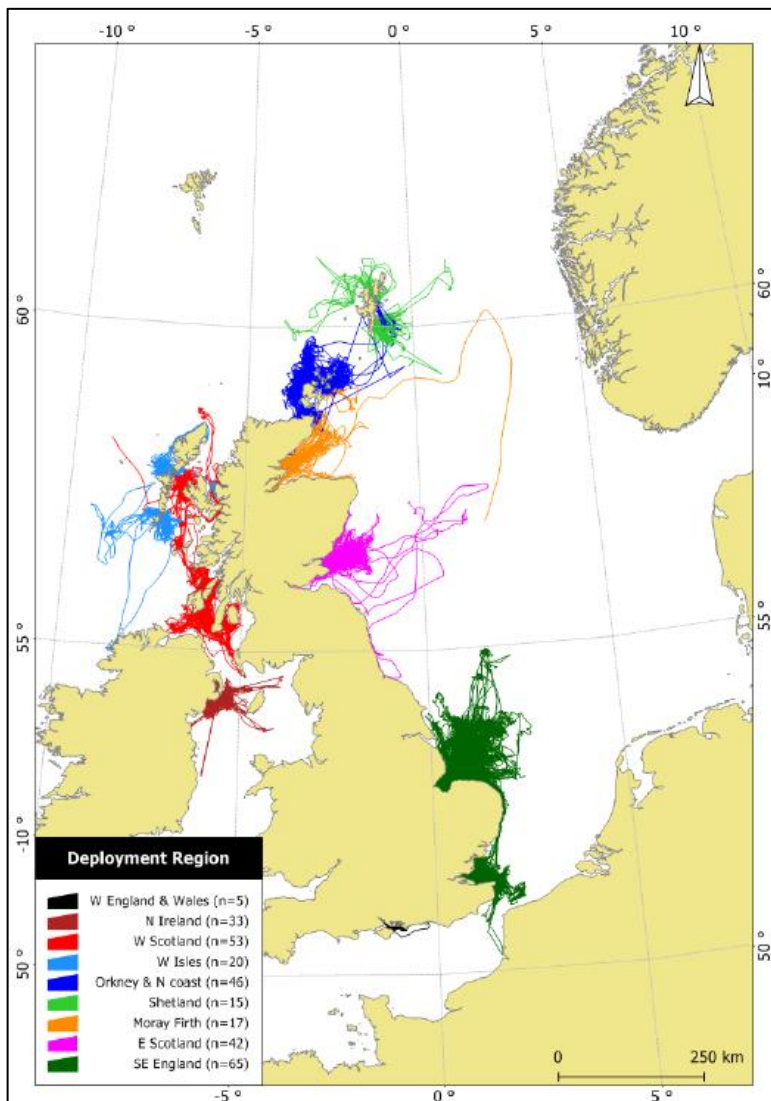


Plate 3.4 Telemetry tracks by deployment region for harbour seals aged one year or over (Russell and McConnell, 2014)

54. To take the wide range and movements of harbour seal into account, all designated sites in the Greater North Sea OSPAR region II (Plate 3.3) were considered. All designated sites out with this region were screened out from further consideration. For harbour seal, the screening process considers designated sites where the species is a grade A, B or C feature.
55. Table 3.2 provides the list of sites with harbour seal as a qualifying feature considered in the HRA screening. This list has been further refined and screened, in relation to the potential effects assessed in section 3.3.3.

3.2 Approach to screening

3.2.1 Potential Effects (Source)

56. The following potential effects during construction, Operation and Maintenance (O&M) and decommissioning are considered in the HRA process for Norfolk Boreas:
 - Underwater noise (including unexploded ordnance (UXO) clearance, piling and other construction activities, vessels, O&M activities, operational turbines and decommissioning activities);
 - Vessel interaction (increased collision risk);
 - Changes to water quality;
 - Changes to prey resource;
 - Disturbance at seal haul-out sites; and
 - Any in-combination effects.
57. The potential effects to be considered in the HRA were agreed during consultation with the marine mammal ETG for the Norfolk Vanguard and Norfolk Boreas HRA (February 2018).

3.2.2 Proximity of source to feature (i.e. SAC) (pathway and receptor)

58. For marine mammals, the approach to HRA screening primarily focuses on the potential for connectivity between individual marine mammals from designated populations and the offshore project area (i.e. demonstration of a clear source-pathway-receptor relationship). This is based on the distance of the offshore project area from the designated site, the range of each effect and the potential for animals from a site to be within range of an effect.
59. The HRA screening exercise therefore considers designated sites which meet the following criteria:
 - The distance between the potential effect of the proposed project and a designated site with harbour porpoise, grey seal or harbour seal as a qualifying

feature is within the range for which there could be an interaction (for example, the pathway is not too long for significant noise propagation).

- The distance between the proposed project and resources on which the qualifying feature (harbour porpoise, grey seal or harbour seal) depends (i.e. an indirect effect acting through prey or access to habitat) is within the range for which there could be an interaction (for example the pathway is not too long).
- The likelihood that a foraging area or a migratory route occurs within the zone of interaction of the proposed project (applies to mobile interest features when outside the designated site).

3.3 Screening of Marine Mammal Designated sites

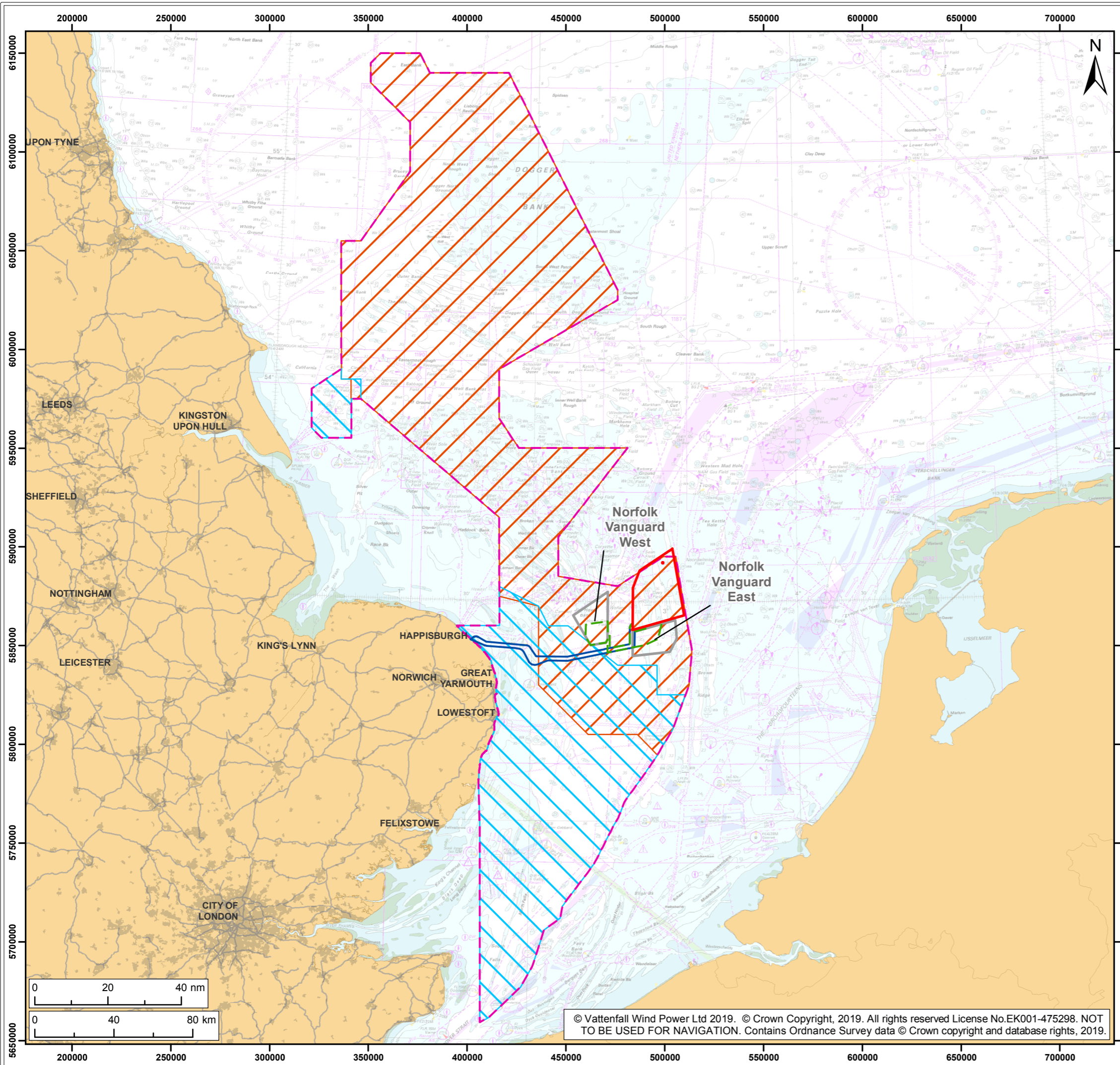
3.3.1 Harbour porpoise

3.3.1.1 Underwater noise

60. Marine Mammal Mitigation Plans (MMMPs) for UXO clearance and piling will be produced post-consent in consultation with relevant stakeholders and will be based on the latest scientific understanding, guidance, and detailed project design. A draft MMMP for piling has been included with the DCO Application (document 8.13). The MMMPs will contain adequate and effective mitigation measures that will reduce the risk of permanent auditory injury (Permanent Threshold Shift; PTS) to harbour porpoise as a result of underwater noise. The commitment to the MMMP reduces the risk of permanent auditory (PTS) injury. The HRA will assess the potential effects of any permanent auditory (PTS) injury, taking into account embedded mitigation and the MMMPs.
61. It should be noted that the UXO clearance is not part of this DCO application and Norfolk Boreas Limited are not currently applying for consent for UXO clearance, as a separate application will be submitted once there is further information on what UXO clearance could be required and the MMMP has been prepared. The UXO MMMP will be secured when removal of UXO is licensed. Information on UXO clearance has been included in the information for the HRA and in the EIA, to provide a robust assessment of all the potential impacts and effects.
62. The current Statutory Nature Conservation Bodies (SNCB) advice is that a distance of 26km from an individual percussive piling or UXO clearance location should be used to assess the area of the Southern North Sea (SNS) SAC for harbour porpoise that could be disturbed during piling and UXO clearance (JNCC, 2017a, 2017b).
63. This advice is relevant for all harbour porpoise SAC sites. Therefore, all designated sites with the exception of the Southern North Sea SAC are screened out with regard

to underwater noise impacts as all sites are greater than 26km from the Norfolk Boreas site (Table 3.2).

64. The offshore project area is located within the Southern North Sea SAC area (Figure 2.1). Therefore, any harbour porpoise affected by underwater noise from Norfolk Boreas would be within or in close proximity to the Southern North Sea SAC.



- Legend:
- Norfolk Boreas site
 - Offshore cable corridor
 - Project interconnector search area
 - Norfolk Vanguard
 - Southern North Sea Special Area of Conservation (SAC)¹
 - Summer Area¹
 - Winter Area¹

¹JNCC, 2019.

Project: Norfolk Boreas	Report: Norfolk Boreas HRA Screening: Offshore
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Title:
Southern North Sea Special Area of Conservation for harbour porpoise

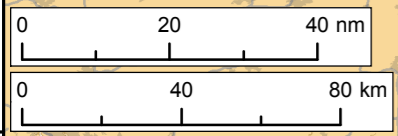
Figure: **2.1** Drawing No: **PB5640-007-002-002**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
02	20/03/2019	LB	GS	A3	1:1,900,000
01	27/02/2019	LB	GS	A3	1:1,900,000

Co-ordinate system: **ETRS 1989 UTM Zone 31N EPSG: 25831**



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65. As harbour porpoise are wide-ranging within the North Sea MU, no discrete population can be assigned to an individual designated site. It is, therefore, assumed that at any one time, harbour porpoise within or in the vicinity of the offshore project area are associated with the Southern North Sea SAC (as they cannot simultaneously be part of the population of multiple designated sites, although all are part of the larger MU population). Therefore, with regard to the potential effects of underwater noise within the offshore project area, connectivity of harbour porpoise from other designated sites, other than the Southern North Sea SAC is screened out (Table 3.2).
66. The potential effects of underwater noise during construction of the project that have the potential for LSE and therefore could have an adverse effect on the SNS SAC and will be assessed further are:
- Potential risk of any permanent auditory injury (PTS) resulting from the underwater noise associated with clearance of UXO;
 - Potential disturbance resulting from the underwater noise associated with clearance of UXO;
 - Potential risk of any permanent auditory injury (PTS) resulting from the underwater noise during piling (single and concurrent);
 - Potential disturbance resulting from underwater noise during piling (single and concurrent);
 - Potential disturbance resulting from underwater noise during other construction activities, for example, seabed preparation, rock dumping and cable installation; and
 - Potential disturbance resulting from underwater noise from vessels.
67. The potential effects of underwater noise during operation and maintenance of the project that have the potential for LSE and an adverse effect on the SNS SAC that will be assessed further are:
- Potential disturbance resulting from operational turbines;
 - Potential disturbance resulting from underwater noise during maintenance activities, (e.g. additional rock dumping and cable re-burial); and
 - Potential disturbance resulting from underwater noise from vessels.
68. The potential effects of underwater noise during decommissioning of the project that have the potential for LSE and therefore could have an adverse effect on the SNS SAC and will be assessed further are:
- Potential disturbance resulting from the noise associated with foundation removal (e.g. cutting); and

- Potential disturbance resulting from underwater noise from vessels.
69. The potential in-combination effects of disturbance from underwater noise will include:
- Offshore windfarm piling;
 - UXO clearance;
 - Seismic surveys;
 - OWF construction activities (other than piling), including vessels; and
 - Operational offshore windfarms including maintenance activities and vessels.

3.3.1.2 Vessel interactions

70. Vessel activity will be concentrated in the vicinity of the offshore project area (beyond this, vessel activity will be dispersed and becomes part of the background vessel traffic, using already established vessel routes). Therefore, all harbour porpoise that could be at increased collision risk with vessels would be within or in close proximity to the Southern North Sea SAC.
71. As outlined above, it is considered that all harbour porpoise in the offshore project area are associated with the Southern North Sea SAC and therefore all designated sites, with the exception of the Southern North Sea SAC, are screened out with regard to any potential vessel interactions (Table 3.2).

3.3.1.3 Changes to water quality

72. Disturbance of seabed sediments has the potential to release any sediment-bound contaminants, such as heavy metals and hydrocarbons that may be present within them into the water column. The accidental release of contaminants (e.g. through spillage) also has the potential to effect water quality. There is the potential for increased suspended sediments. Any potential changes to water quality in the offshore project area will be considered further in the HRA.
73. As outlined above, it is considered that all harbour porpoise in the area of the offshore project area are associated with the Southern North Sea SAC. Therefore, all other designated sites are screened out with regard to any potential changes to water quality (Table 3.2).

3.3.1.4 Changes to prey species

74. Potential effects on prey species can result from physical disturbance and loss of seabed habitat; increased suspended sediment concentrations and sediment re-deposition; and underwater noise.
75. The widest ranging potential effect on marine mammal prey species is likely to be underwater noise. The results from underwater modelling for the project indicates

that noise impacts upon fish will be limited to 18.0km, for the widest ranging behavioural effects (based on Popper et al. (2014) Temporary Threshold Shift (TTS) criteria of 186dB Sound Exposure Level (SEL) for 12 hours of continuous piling for stationary fish; see Appendix 5.4 Annex 1).

76. As outlined above, it is considered that all harbour porpoise in the offshore project area are associated with the Southern North Sea SAC. Therefore, all other designated sites are screened out with regard to any potential changes to prey resources (Table 3.2).

3.3.2 Grey seal

3.3.2.1 Underwater noise

77. Studies on the interactions between seals and offshore windfarms, have shown avoidance of pile driving activity out to ranges of 25km, but did not show avoidance of general construction activity or of operational windfarms (Russell et al., 2016; SCOS, 2016). Therefore, with regard to direct underwater noise effects on designated sites or individual grey seals within them, all designated sites for grey seal are screened out as they are all located more than 25km from the Norfolk Boreas site (Table 3.2).
78. Grey seals could come from any of the designated sites considered to have potential connectivity and as a result these may be affected within the potential disturbance range of 25km.
79. Based on tagging studies and the movements of grey seal along the east coast of England, grey seal in the area of the Norfolk Boreas site could be from the Humber Estuary SAC (Figure 5.4 of the Information to support HRA report) which is 112km at its closest point to the cable corridor route, and is therefore screened in with regard to the potential effects of underwater noise from the project (Table 3.2).
80. Applying the same approach, the in-combination assessment will also consider grey seal from the Wash and North Norfolk Coast SAC, although grey seal are not currently a qualifying feature at this site.
81. Although grey seal are also not currently a qualifying feature at the Winterton-Horsey Dunes SAC it is recognised that this site is important for the population as breeding, moulting and haul-out sites. Therefore, in the HRA consideration will also be given to grey seal as part of the Winterton-Horsey Dunes SAC to determine if there is the potential for any disturbance of seals hauled out at this site.
82. As a precautionary approach, it is also proposed the disturbance of grey seal from Winterton-Horsey Dunes SAC (Figure 5.4 of the Information to support HRA report)

as a result of activities and vessels in the cable corridor during construction, operation, maintenance and decommissioning are assessed.

83. In addition, European sites that are within the identified foraging range for grey seal (100km) have been screened in for assessment for the potential for disturbance from underwater noise. These sites are the Klaverbank SAC and Noordzeekustzone SAC, both in the Netherlands.

3.3.2.2 Vessel interactions

84. Vessel activity will be concentrated in the vicinity of the offshore project area (beyond this, vessel activity will be dispersed and becomes part of the background vessel traffic, using already established vessel routes).
85. As outlined above, to take into account the movement of grey seal along the east coast of England, the Humber Estuary SAC and the Wash and North Norfolk Coast SAC were screened in with regard to any potential vessel interactions (Table 3.2).
86. In addition, as a precautionary approach, it is proposed the increased collision risk of grey seal from Winterton-Horsey Dunes SAC as a result of vessels in the cable corridor during construction, operation, maintenance and decommissioning are also assessed.

3.3.2.3 Changes to water quality

87. Disturbance of seabed sediments has the potential to release any sediment-bound contaminants, such as heavy metals and hydrocarbons that may be present within them into the water column. The accidental release of contaminants (e.g. through spillage) also has the potential to affect water quality. There is the potential for increased suspended sediments. Any potential changes to water quality in the offshore project area will be considered further in the HRA.
88. As outlined above, to take into account the movement of grey seal along the east coast of England, the Humber Estuary SAC and the Wash and North Norfolk Coast SAC were screened in with regard to any potential changes to water quality (Table 3.2).
89. In addition, as a precautionary approach, it is proposed that any changes in water quality in the cable corridor during construction, operation, maintenance and decommissioning are also assessed for grey seal from the Winterton-Horsey Dunes SAC.

3.3.2.4 Changes to prey species

90. Potential effects on prey species can result from physical disturbance and loss of seabed habitat; increased suspended sediment concentrations and sediment re-deposition; and underwater noise.

91. The widest ranging potential effect on marine mammal prey species is likely to be underwater noise. The results from underwater modelling for the project indicates that noise impacts upon fish will be limited to 18km, for the widest ranging behavioural effects (based on Popper et al. (2014) TTS criteria of 186dB SEL for 12 hours of continuous piling for stationary fish; see Appendix 5.4 Annex 1).
92. As outlined above, to take into account the movement of grey seal along the east coast of England, the Humber Estuary SAC and the Wash and North Norfolk Coast SAC were screened in with regard to any potential changes to prey resources (Table 3.2).
93. In addition, as a precautionary approach, it is proposed that any potential changes to prey resources in the cable corridor during construction, operation, maintenance and decommissioning are also assessed for grey seal from the Winterton-Horsey Dunes SAC.
94. European sites that are within the identified foraging range for grey seal (100km) have been screened in for assessment for the potential changes to prey resources. These sites are the Klaverbank SAC and Noordzeekustzone SAC, both in the Netherlands.

3.3.2.5 Disturbance at seal haul-out sites

95. The port location is not confirmed at this stage, however if a port to the north is selected there could be the potential for disturbance of grey seal hauled out in the Humber Estuary SAC and the Wash and North Norfolk Coast SAC. If a port to the south is used there will be no impact on grey seal SACs due to the distance of the route vessels which would be required in relation to designated sites for grey seal (Figure 5.4 of the Information to support HRA report).
96. It is recognised that, while grey seal is not currently a qualifying feature of the Winterton-Horsey Dunes SAC, the site is used by the species. As part of the EPP, the ETG requested that the potential for any disturbance and / or interaction with vessels and cable installation activities for the project should be taken into account within the HRA for Norfolk Vanguard. This approach will be also be adopted for Norfolk Boreas.
97. Therefore, all other designated sites, with the exception of the Humber Estuary SAC, the Wash and North Norfolk Coast SAC and Winterton-Horsey Dunes SAC, are screened out for any potential disturbance at grey seal haul-out sites (Table 3.2).

3.3.3 Harbour seal

3.3.3.1 Underwater noise

98. As outlined above, studies on the interactions between seals and offshore windfarms have shown avoidance of pile driving activity out to ranges of 25km, but did not show avoidance of general construction activity or of operational windfarms (Russell et al., 2016; SCOS, 2016). Therefore, with regard to direct underwater noise effects on designated sites or individual harbour seals within them, all designated sites for harbour seal are screened out as they are all located more than 25km from Norfolk Boreas (Table 3.2).
99. Harbour seals could come from any of the designated sites considered to have potential connectivity and as a result these may be affected within the potential disturbance range of 25km.
100. Based on tagging studies and the movements of harbour seal along the east coast of England, harbour seal in the area of the Norfolk Boreas site could be from the Wash and North Norfolk Coast SAC (Figure 5.4 of the Information to support HRA report) which is 33km at its closest point to the cable corridor route, and therefore this site is screened in with regard to the potential effects of underwater noise at Norfolk Boreas (Table 3.2).
101. In addition, European sites that are within the identified foraging range for harbour seal (80km) have been screened in for assessment for the potential for disturbance from underwater noise. There is only one site designated for harbour seal within that range; the Klaverbank SAC in the Netherlands.

3.3.3.2 Vessel interactions

102. Vessel activity will be concentrated in the vicinity of the offshore project area (beyond this, vessel activity will be dispersed and becomes part of the background vessel traffic, using already established vessel routes).
103. As outlined above, to take into account the movement of harbour seal along the east coast of England, the Wash and North Norfolk Coast SAC was screened in for any potential vessel interactions (Table 3.2).

3.3.3.3 Changes to water quality

104. Disturbance of seabed sediments has the potential to release any sediment-bound contaminants, such as heavy metals and hydrocarbons that may be present within them into the water column. The accidental release of contaminants (e.g. through spillage) also has the potential to affect water quality. There is the potential for increased suspended sediments. Any potential changes to water quality in the Norfolk Boreas site will be considered further in the HRA.

105. As outlined above, to take into account the movement of harbour seal along the east coast of England, the Wash and North Norfolk Coast SAC was screened in for any potential changes to water quality (Table 3.2).

3.3.3.4 Changes to prey species

106. Potential effects on prey species can result from physical disturbance and loss of seabed habitat; increased suspended sediment concentrations and sediment re-deposition; and underwater noise.
107. The widest ranging potential effect on marine mammal prey species is likely to be underwater noise. The results from underwater modelling for Norfolk Boreas indicates that noise impacts upon fish will be limited to 18.0km, for the widest ranging behavioural effects (based on Popper et al. (2014) TTS criteria of 186dB SEL for 12 hours of continuous piling for stationary fish; see Appendix 5.4 Annex 1).
108. As outlined above, to take into account the movement of harbour seal along the east coast of England, the Wash and North Norfolk Coast SAC was screened in for any potential changes to prey resources (Table 3.2).
109. In addition, European sites that are within the identified foraging range for harbour seal (80km) have been screened in for assessment for the potential changes to prey resources. There is only one site designated for harbour seal within that range; the Klaverbank SAC in the Netherlands.

3.3.3.5 Disturbance at seal haul-out sites

110. The port location is not confirmed at this stage, however if a port to the north is selected there could be the potential for disturbance of harbour seal hauled out in the Wash and North Norfolk Coast SAC. If a port to the south, such as Great Yarmouth during operation and maintenance is used there will be no impact on harbour seal SACs due to the distance of the route vessels would be required to follow in relation to designated sites for harbour seal (Table 3.2).

3.3.4 Screening summary

111. To summarise, the following species are considered within the HRA screening assessment:
- Harbour porpoise;
 - Grey seal; and
 - Harbour seal.
112. The following potential effects during construction, operation, maintenance and decommissioning are considered in the HRA screening process:

- Underwater noise, including UXO clearance, piling and other construction activities, vessels, operation and maintenance activities, operational turbines and decommissioning activities;
 - Vessel interactions (increased collision risk);
 - Changes to water quality;
 - Changes to prey resources;
 - Disturbance at seal haul-out sites; and
 - Any in-combination effects.
113. Table 3.2 provides a list of all the designated sites for which there is theoretical connectivity to the potential effects of the Norfolk Boreas project for harbour porpoise, grey seal and harbour seal, as outlined in sections 3.3.1, 3.3.2 and 3.3.3, respectively.
114. In summary, a total of 33 designated sites were initially considered in the HRA screening process for harbour porpoise and these designated sites were then assessed for the potential for LSE in section 3.3.1. Designated sites in shaded rows have been screened out from further assessment in the HRA as there is no potential LSE. The Southern North Sea SAC is the only designated site for harbour porpoise that will be assessed further in the HRA for any potential adverse effects on the integrity of the site in relation to the conservation objectives for harbour porpoise (Table 3.1).
115. A total of 63 designated sites were initially considered in HRA screening for grey seal. Based on the assessment of the potential for LSE in section 3.3.2, all sites for grey seal, with the exception of the Humber Estuary SAC, have been screened out from further assessment in the HRA. The Humber Estuary SAC is the only UK designated site for grey seal that will be assessed further in the HRA for any potential adverse effects on the integrity of the site in relation to the conservation objectives for grey seal, and there are two European designated sites for grey seal that area screened in for assessment; the Klaverbank SAC and Noordzeekustzone SAC. In addition, although not currently a designated site for grey seal consideration will also be given to any potential effects on grey seal hauled out at the Winterton-Horsey Dunes SAC, and, if relevant, grey seal from the Wash and North Norfolk Coast SAC (Table 3.1).
116. A total of 73 sites were initially considered in the screening for harbour seal. Based on the potential impacts outlined in section 3.3.3, all UK sites for harbour seal, with the exception of the Wash and North Norfolk Coast SAC, have been screened out from further consideration in the HRA. In addition, one European designated site for harbour seal has been screened in for assessment; the Klaverbank SAC.

117. Table 3.1 provides a summary of the designated sites for marine mammals screened into the HRA for further assessment.

Table 3.1 Designated sites where marine mammals are a qualifying feature (or feature of interest*) screened into the HRA for further assessment

Designated site	Species	Reason for screening in
Southern North Sea SAC	Harbour porpoise	Norfolk Boreas offshore project area is within the Southern North Sea SAC. Assumed that all harbour porpoise in the Norfolk Boreas area are associated with this SAC. Potential effects from: <ul style="list-style-type: none"> ○ underwater noise; ○ vessel interactions; ○ changes to water quality; ○ changes to prey resources; and ○ any in-combination effects.
Humber Estuary SAC [UK0030170]	Grey seal	Potential effects from: <ul style="list-style-type: none"> ○ underwater noise; ○ vessel interactions; ○ changes to water quality; ○ changes to prey resources; and ○ disturbance at seal haul-out sites.
The Wash and North Norfolk Coast SAC [UK0017075]	Harbour seal (and grey seal*)	Potential effects from: <ul style="list-style-type: none"> ○ underwater noise; ○ vessel interactions; ○ changes to water quality; ○ changes to prey resources; and ○ disturbance at seal haul-out sites for grey and harbour seal.
Winterton-Horsey Dunes SAC [UK0013043]	(grey seal*)	Haul-out site less than 5km from cable landfall site. Potential effects from: <ul style="list-style-type: none"> ○ underwater noise in cable corridor; ○ vessel interactions in cable corridor; ○ changes to water quality in cable corridor; ○ changes to prey resources in cable corridor; and ○ disturbance at seal haul-out sites.
Klaverbank [NL2008002]	Grey and harbour seal	Potential disturbance effects for foraging grey and harbour seal.
Noordzeekustzone [NL9802001]	Grey seal	Potential disturbance effects for foraging grey seal.

*Grey seal are not currently a qualifying feature at the Wash and North Norfolk SAC (which includes Blakeney Point) or Winterton-Horsey Dunes SAC, however, it is recognised that these sites are important for the population, as breeding, moulting and haul-out sites.

Table 3.2 Screening list of SACs and SCIs for harbour porpoise, grey seal and harbour seal (screened out sites are shown in grey).

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
BEMNZ0001	Vlaamse Banken	Harbour porpoise	A	Y	Y	151	136	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						
BEMNZ0002	SBZ 1 / ZPS 1	Harbour seal	C	Y	Y	183	171	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
BEMNZ0005	Vlakte van de Raan	Harbour porpoise	C	Y	Y	161	153	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						
		Harbour seal	B						
DE0916391	NTP S-H Wattenmeer und angrenzende Küstengebiete	Harbour porpoise	A	Y	Y	360	386	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						
DE1003301	Doggerbank	Harbour porpoise	B	Y	Y	249	293	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
DE1011401	SPA Östliche Deutsche Bucht	Harbour porpoise	A	Y	Y	329	366	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
DE1115391	Dünenlandschaft Süd-Sylt	Grey seal	C	Y	Y	382	421	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DE1209301	Sylter Außenriff	Harbour porpoise	A	Y	Y	286	329	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						
DE1315391	Küsten- und Dünenlandschaften Amrums	Grey seal	B	Y	Y	380	416	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DE1714391	Steingrund	Harbour porpoise	C	Y	Y	345	374	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	C						
DE1813391	Helgoland mit Helgoländer Felssockel	Harbour porpoise	C	Y	Y	330	363	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	C						
DE2016301	Hamburgisches Wattenmeer	Harbour porpoise	C	Y	Y	350	382	Out	The distance between the potential impact range of the proposed project and the extent of any impact on
		Grey seal	C						

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
		Harbour seal	B						individuals from this site are negligible and would result in no potential for LSE.
DE2104301	Borkum-Riffgrund	Harbour porpoise	C	Y	Y	219	254	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						
		Harbour seal	B						
DE2306301	Nationalpark Niedersächsisches Wattenmeer	Harbour porpoise	B	Y	Y	240	267	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						
DE2507301	Hund und Paapsand	Harbour seal	C	Y	Y	255	283	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DE2507331	Unterems und Außenems	Harbour seal	C	Y	Y	259	286	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK003X202	Hesselø med omliggende stenrev	Grey seal	B	N	Y	878	923	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	B						
DK006X233	Havet og kysten mellem Præstø Fjord og Grønsund	Harbour seal	C	N	Y	1,036	1,079	Out	The distance between the potential impact range of the proposed project and the extent of any impact on

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
									individuals from this site are negligible and would result in no potential for LSE.
DK00AY176	Vadehavet med Ribe Å, Tved Å og Varde Å vest for Varde	Harbour porpoise	C	Y	Y	397	436	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						
DK00CY040	Venø, Venø Sund	Harbour seal	B	N	Y	531	577	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site would result in no potential for LSE.
DK00DX146	Anholt og havet nord for	Grey seal	A	N	Y	812	856	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	B						
DK00EX026	Dråby Vig	Harbour seal	C	N	Y	572	614	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00EY124	Løgstør Bredning, Vejlerne og Bulbjerg	Harbour seal	B	Y	Y	582	625	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00EY133	Agger Tange, Nissum Bredning, Skibsted Fjord og Agerø	Harbour seal	C	Y	Y	509	553	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
DK00EY134	Lovns Bredning, Hjarbæk Fjord og Skals, Simested og Nørre Ådal, Skravad Bæk	Harbour seal	C	N	Y	610	652	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00FX010	Strandenge på Læsø og havet syd herfor	Grey seal	C	N	Y	749	791	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	B						
DK00FX112	Skagens Gren og Skagerak	Harbour porpoise	B	Y	Y	650	694	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00FX113	Hirsholmene, havet vest herfor og Ellinge Å's udløb	Grey seal	B	N	Y	719	764	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
DK00FX122	Ålborg Bugt, Randers Fjord og Mariager Fjord	Harbour seal	C	N	Y	755	797	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00FX123	Nibe Bredning, Halkær Ådal og Sønderup Ådal	Harbour seal	C	N	Y	608	650	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
DK00FX257	Havet omkring Nordre Rønner	Grey seal	C	N	Y	739	783	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	B						
DK00VA258	Store Rev	Harbour porpoise	C	Y	Y	625	668	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00VA259	Gule Rev	Harbour porpoise	C	Y	Y	541	586	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
DK00VA347	Sydlige Nordsø	Harbour porpoise	B	Y	Y	342	384	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	B						
		Harbour seal	B						
FR2200346	Estuaires et littoral picards (baies de Somme et d'Authie)	Grey seal	B	Y	Y	293	261	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	A						
FR2300121	Estuaire de la Seine	Harbour seal	C	Y	Y	428	393	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR2500077	Baie du Mont Saint-Michel	Grey seal	B	N	Y	603	569	Out	The distance between the potential impact range of the proposed project

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
		Harbour seal	A						and the extent of any impact on individuals from this site result are negligible and would result in no potential for LSE.
FR2500079	Chausey	Grey seal	C	N	Y	578	544	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR2500085	Récifs et marais arrière-littoraux du Cap Lévi à la Pointe de Saire	Grey seal	C	Y	Y	458	425	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
FR2500088	Marais du Cotentin et du Bessin - Baie des Veys	Grey seal	C	Y	Y	476	442	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	A						
FR2502020	Baie de Seine occidentale	Harbour porpoise	C	Y	Y	456	422	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	A						
FR2502021	Baie de Seine orientale	Harbour porpoise	C	Y	Y	431	398	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
FR3100474	Dunes de la plaine maritime flamande	Harbour seal	C	Y	Y	195	182	Out	The distance between the potential impact range of the proposed project and the extent of any impact on

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
									individuals from this site are negligible and would result in no potential for LSE.
FR3100478	Falaises du Cran aux Oeufs et du Cap Gris-Nez, Dunes du Chatelet, Marais de Tardingen et Dunes de Wissant	Harbour porpoise	C	Y	Y	229	199	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	B						
		Harbour seal	C						
FR3100480	Estuaire de la Canche, dunes picardes plaquées sur l'ancienne falaise, forêt d'Hardelot et falaise d'Equihen	Harbour seal	C	Y	Y	215	244	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR3100482	Dunes de l'Authie et Mollières de Berck	Harbour seal	C	Y	Y	291	261	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR3102002	Bancs des Flandres	Harbour porpoise	B	Y	Y	177	152	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
		Harbour seal	C						
FR3102003	Récifs Gris-Nez Blanc-Nez	Harbour porpoise	C	Y	Y	192	220	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						
		Harbour seal	C						
FR3102004	Ridens et dunes hydrauliques du détroit du Pas-de-Calais	Harbour porpoise	C	Y	Y	234	192	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						
		Harbour seal	C						
FR3102005	Baie de Canche et couloir des trois estuaires	Harbour porpoise	C	Y	Y	240	269	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	B						
		Harbour seal	A						
FR5300009	Côte de Granit rose-Sept-Iles	Grey seal	A	N	Y	629	596	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5300010	Tregor Goëlo	Grey seal	C	N	Y	627	594	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
FR5300015	Baie de Morlaix	Grey seal	C	N	Y	668	637	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5300017	Abers - Côtes des légendes	Grey seal	C	N	Y	717	684	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5300018	Ouessant-Molène	Grey seal	A	N	Y	745	712	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5300019	Presqu'île de Crozon	Grey seal	C	N	Y	780	749	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5300020	Cap Sizun	Grey seal	C	N	Y	796	764	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5300023	Archipel des Glénan	Grey seal	C	N	Y	870	838	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5302006	Côtes de Crozon	Grey seal	C	N	Y	777	744	Out	The distance between the potential impact range of the proposed project

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
									and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5302007	Chaussée de Sein	Grey seal	C	N	Y	797	762	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
FR5302008	Roches de Penmarch	Grey seal	C	N	Y	836	805	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
NL1000001	Waddenzee	Harbour porpoise	C	Y	Y	106	132	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	A						
		Harbour seal	A						
NL2003059	Duinen Terschelling	Grey seal	C	Y	Y	144	172	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
NL2003060	Duinen en Lage Land Texel	Grey seal	C	Y	Y	102	128	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
NL2003061	Duinen Vlieland	Grey seal	C	Y	Y	125	151	Out	The distance between the potential impact range of the proposed project and the extent of any impact on

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
									individuals from this site are negligible and would result in no potential for LSE.
NL2008001	Doggersbank	Harbour porpoise	B	Y	Y	128	168	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						
		Harbour seal	C						
NL2008002	Klaverbank	Harbour porpoise	B	Y	Y	67	112	In	Screened in for grey and harbour seal as the site is within the identified foraging range for both species. The potential for disturbance to foraging seals as a result of underwater noise will be assessed.
		Grey seal	C						
		Harbour seal	C						
NL2008003	Vlakte van de Raan	Harbour porpoise	C	Y	Y	152	140	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	B						
		Harbour seal	B						
NL3009005	Duinen Ameland	Grey seal	C	Y	Y	174	201	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
NL3009016	Oosterschelde	Harbour porpoise	C	Y	Y	147	141	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	C						
		Harbour seal	C						

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
NL4000017	Voordelta	Harbour porpoise	C	Y	Y	118	122	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Grey seal	B						
		Harbour seal	B						
NL4000021	Grevelingen	Grey seal	C	Y	Y	134	132	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
NL9801079	Duinen Goeree & Kwade Hoek	Grey seal	C	Y	Y	132	136	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
NL9802001	Noordzeekustzone	Harbour porpoise	C	Y	Y	94	121	In	Screened in for grey seal as the site is within the identified foraging range of 100km. The potential for disturbance to foraging seals as a result of underwater noise will be assessed.
		Grey seal	A						
		Harbour seal	A						
SE0420002	Hallands Väderö	Harbour seal	B	N	Y	885	928	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0420360	Nordvästra Skånes havsområde	Grey seal	C	N	Y	860	904	Out	The distance between the potential impact range of the proposed project

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
		Harbour seal	C						and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0510050	Balgö	Harbour seal	C	N	Y	814	849	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0510058	Kungsbackafjorden	Harbour seal	C	N	Y	987	831	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0510084	Nidingen	Harbour seal	C	N	Y	790	833	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site result are negligible and would result in no potential for LSE.
SE0520001	Vrångöskärgården	Harbour seal	B	N	Y	768	814	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0520036	Sälöfjorden	Harbour seal	C	Y	Y	755	800	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
SE0520043	Nordre älvs estuarium	Harbour seal	C	Y	Y	761	806	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0520057	Malmöfjord	Harbour seal	C	Y	Y	764	808	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0520058	Måseskär	Harbour seal	C	Y	Y	752	797	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0520170	Kosterfjorden-Väderöfjorden	Harbour porpoise	C	Y	Y	781	816	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
		Harbour seal	C						
SE0520171	Gullmarsfjorden	Harbour seal	C	Y	Y	769	804	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0520176	Pater Noster-skärgården	Harbour seal	C	Y	Y	751	793	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
SE0520188	Soteskär	Harbour seal	C	Y	Y	768	810	Out	The distance between the potential impact range of the proposed project

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
									and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0012687	Yell Sound Coast	Harbour seal	C	Y	Y	832	867	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0012711	Mousa	Harbour seal	B	Y	Y	794	815	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0013043	Winterton – Horsey Dunes	Grey seal*	-	Y	Y	73.7	3.2	In	Haul-out site less than 5km from cable landfall site. Potential effects from underwater noise in cable corridor; vessel interactions in cable corridor; changes to water quality in cable corridor; changes to prey resources in cable corridor; and disturbance at seal haul-out sites.
UK0017072	Berwickshire and North Northumberland Coast	Grey seal	B	Y	Y	371	346	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0017075	The Wash and North Norfolk Coast	Harbour seal	B	Y	Y	110.0	32.8	In	Potential effects from underwater noise; vessel interactions; changes to water quality; changes to prey resources; and disturbance at seal haul-out sites for grey and harbour seal.
		Grey seal*	-						

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screening Decision	
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)	Screened in or out	Reason
UK0017096	Faray and Holm of Faray	Grey seal	B	Y	Y	757	759	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0019806	Dornoch Firth and Morrich More	Harbour seal	C	Y	Y	696	701	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0030069	Sanday	Harbour seal	B	Y	Y	745	752	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0030170	Humber Estuary	Grey seal	C	Y	Y	175	112	In	Potential effects from underwater noise; vessel interactions; changes to water quality; changes to prey resources; and disturbance at seal haul-out sites.
UK0030172	Isle of May	Grey seal	B	Y	Y	487	460	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0030311	Firth of Tay and Eden Estuary	Harbour seal	B	Y	Y	513	487	Out	The distance between the potential impact range of the proposed project and the extent of any impact on individuals from this site are negligible and would result in no potential for LSE.
UK0030395	Southern North Sea	Harbour porpoise	A	Y	Y	0	0	In	Norfolk Boreas offshore project area is within the Southern North Sea SAC.

Site code	Site Name	Species	Population Grade	Reason for Inclusion in Screening		Distance to the Project		Screened in or out	Screening Decision Reason
				Within NS MU	Within OSPAR region	NB site (km)	NB cable corridor (km)		
									<p>Assumed that all harbour porpoise in the Norfolk Boreas area are associated with the SNS SAC.</p> <p>Potential effects from underwater noise; vessel interactions; changes to water quality; changes to prey resources; and any in-combination effects.</p>

*Distance measured from the closest point of Norfolk Boreas (i.e. the wind turbine array) to the closest point of the SAC/SCI rounded to the nearest kilometre

4 SCREENING BENTHIC ECOLOGY SAC SITES AND FEATURES

118. The HRA screening for SACs with features of Benthic Ecology importance was provided for consultation with the Benthic and intertidal Ecology ETG in February 2018. During this consultation there was agreement from the group on the results of the Screening. The full screening report was also consulted on as part of the PEIR consultation in published 31st October 2018.

4.1 Identification of Benthic Sites and Features

119. Natura 2000 sites in the southern North Sea which have benthic habitats (Habitats Directive Annex I) as an interest feature have been considered for HRA Screening. Table 4.1 provides a list of these sites.

4.2 Approach to Screening

120. The sites which could potentially be affected by Norfolk Boreas are screened in to the HRA on the basis of the following:

- A component of the proposed project directly overlaps a site whose interest features include a habitat; and
- The distance between the proposed project and the offshore habitat interest feature is within the range for which there could be an interaction e.g. the pathway is not too long for sediment deposition.

4.2.1 Potential Effects (Source)

121. The conservation objectives for offshore Annex I habitats are to “maintain or restore the habitat in Favourable Condition”.

122. The Haisborough, Hammond and Winterton SAC is the only site designated for benthic ecology features which overlaps the offshore project area. The associated formal advice (JNCC and Natural England, 2013) identifies six pressure categories which may cause deterioration of natural habitats within SACs, either alone or in combination (and thus affect Favourable Condition). These have been identified as:

- Physical loss;
- Physical damage;
- Non-physical disturbance;
- Toxic contamination;
- Non-toxic contamination³; and

³ For some sites this includes changes in nutrient and / or organic enrichment and / or in salinity.

- Biological disturbance⁴
123. The potential effects on offshore habitats from Norfolk Boreas have been identified as follows based on the Norfolk Boreas scoping report (Royal HaskoningDHV, 2017) and scoping opinion (the Planning Inspectorate, 2017):
- Construction
 - Permanent habitat loss⁵;
 - Temporary physical disturbance;
 - Smothering due to increased suspended sediment;
 - Re-mobilisation of contaminated sediments; and
 - Underwater noise and vibration.
 - Operation
 - Permanent habitat loss;
 - Physical disturbance through maintenance activities;
 - Smothering through increased suspended sediment; and
 - Introduction of new substrate.
 - Decommissioning
 - Temporary physical disturbance;
 - Smothering due to increased suspended sediment;
 - Re-mobilisation of contaminated sediments; and
 - Underwater noise and vibration.
124. Within the Norfolk Boreas offshore project area, construction activities such as the installation of foundations, cables and ancillary structures and the placement of jack-up vessel legs, would cause direct physical disturbance and indirect disturbance through the elevation of suspended sediment.
125. Operation of Norfolk Boreas would create more long term impacts (i.e. for the 25 year predicted lifespan of the proposed project) through the loss of existing habitat and introduction of new substrate as rock or concrete mattresses used as cable and foundation scour protection as well as the foundation structures themselves. Some of these will be classed as “long term temporary” as the infrastructure would be removed during decommissioning and some would be classed as permanent if there is no certainty that particular infrastructure could be removed.

⁴ For some sites this includes the introduction of non-native species and / or the selective extraction of species.

⁵ The installation of turbine foundations will result in a permanent loss of habitat. As the loss of habitat is an on-going impact this is considered under operation rather than construction to avoid double counting.

126. Other temporary impacts identified during operation will be caused by maintenance activities such as the use of jack up vessels and the replacement and repair of any cables.
127. Decommissioning impacts will be primarily caused by the removal of structures from the seabed. Decommissioning would be expected to cause similar impacts to that identified during construction.
128. The significance of such impacts would be dependent on the characteristics of the habitats and communities (receptors) present within the footprint of the impact and, in particular, the capacity of the affected communities to recover from those impacts identified.
129. Impacts to offshore habitats will be small scale when put in the context of the wider Southern North Sea Basin environment, being localised to Norfolk Boreas and in many cases to individual elements of the proposed project.
130. Some benthic species may react to episodic noise such as that from pile driving (Lovell et al, 2005, Heinisch and Weise, 1987) however any impact is likely to be localised and temporary (i.e. occurring only during piling). Annex 1 habitats, for which Natura 2000 sites are designated, are not known to have any noise sensitivity. These include:
 - Sandbanks which are slightly covered by sea water all the time;
 - Estuaries;
 - Mudflats and sandflats not covered by seawater at low tide;
 - Coastal lagoons;
 - Reefs;
 - Large shallow inlets and bays;
 - Submarine structures made by leaking gases; and
 - Submerged or partially submerged sea caves.

4.3 Screening (Stage 1 of HRA) (receptor)

131. Table 4.1 provides the list of 30 sites within the southern North Sea which have benthic features as a primary or secondary reason for designation. In summary, it is proposed that all sites are screened out with the exception of the Haisborough, Hammond and Winterton SAC.
132. In response to comments made by Natural England on the Norfolk Vanguard PEIR, the potential pathway of effects on benthic ecology to impact upon food source for Red-throated divers, which are proposed as a designated feature for the Greater Wash SPA will be considered within the ornithology HRA (section 6).

133. Based on Chapter 8 Marine Geology, Oceanography and Physical Process impact assessment the majority of suspended sediments are predicted to be deposited locally to the area of disturbance, with only a very small proportion of mud becoming more widely dispersed before settling on the seabed.
134. Based on comparable plume modelling studies for East Anglia ONE (ABPmer, 2012), the range of indirect effects associated with the deposition of suspended sediments is predicted to extend to approximately 50km within a band of a few hundred metres in the direction of the tidal flow (north to south). This deposited sediment is likely to become rapidly incorporated into the existing mobile seabed sediment layer.
135. The North Norfolk Sandbanks and Saturn Reef SAC and Inner Dowsing, Race Bank and North Ridge SAC lie outside the area of direct impact but within the area of suspended sediment deposition. Within the predicted deposition area, the deposited sediment layer is predicted to be generally less than 0.2mm with a maximum of 2mm in some locations. No LSE on the sandbank or *S.spinulosa* reef features of the North Norfolk Sandbanks and Saturn Reef SAC is predicted in relation to a potential for up to 2mm of deposited sediment.

Table 4.1: List of SACs in the southern North Sea with their respective categories of Annex 1 habitat interest feature and screening decisions (screened out sites are shown in grey).

Site Code	Country	SAC name	Category of interest feature	Distance (km)	Screened in/out	Rationale
BEMNZ0001	Belgium	Vlaamse Banken SAC	H1170 Reefs; H1110 Sandbanks which are slightly covered by sea water all the time	151	Out	Beyond the range of potential impact
BEMNZ0005	Belgium	Vlakte Van de Raan SAC	H1110 Sandbanks which are slightly covered by sea water all the time	150	Out	Beyond the range of potential impact
FR3102002	France	Bancs Des Flandres SAC	H1110 Sandbanks which are slightly covered by sea water all the time	176	Out	Beyond the range of potential impact
FR3100474	France	Dunes De La Plaine Maritime Flamande SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1140 Mudflats and sandflats not covered by seawater at low tide	199	Out	Beyond the range of potential impact
FR3100478	France	Falaises Du Cran Aux Oeufs et du Cap Gris-Nez, Dunes du Chatelet, Marais de Tardinghen et Dunes de Wissant SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1140 Mudflats and sandflats not covered by seawater at low tide; H1170 Reefs	230.90 km	Out	Beyond the range of potential impact
FR3100479	France	Falaises et Dunes de Wimereux, Estuaire de la Slack, Garennes et Communaux d'Ambleteuse-Audresselles SAC	H1130 Estuaries; H1140 Mudflats and sandflats not covered by seawater at low tide; H1170 Reefs	242	Out	Beyond the range of potential impact
FR3100477	France	Falaises et Pelouses du Cap Blanc Nez, du Mont d'Hubert, des Noires Mottes, du Fond de	H1140 Mudflats and sandflats not covered by seawater at low tide; H1170 Reefs	224.89 km	Out	Beyond the range of potential impact

Site Code	Country	SAC name	Category of interest feature	Distance (km)	Screened in/out	Rationale
		la Forge et du Mont de couple SAC				
FR3102003	France	Récifs Gris-Nez Blanc-Nez SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1170 Reefs	222.68 km	Out	Beyond the range of potential impact
FR3102004	France	Ridens Et Dunes Hydrauliques Du Detroit Du Pas-De-Calais SAC	H1110 Sandbanks which are slightly covered by sea water all the time	233.13 km	Out	Beyond the range of potential impact
NL1000001	Netherlands	Waddensee SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1130 Estuaries; 1140 Mudflats and sandflats not covered by seawater at low tide	105.83 km	Out	Beyond the range of potential impact
NL9802001	Netherlands	Noordzeekustzone SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1140 Mudflats and sandflats not covered by seawater at low tide	96.41 km	Out	Beyond the range of potential impact
NL2008001	Netherlands	Doggersbank SAC	H1110 Sandbanks which are slightly covered by sea water all the time	128.14 km	Out	Beyond the range of potential impact
NL4000017	Netherlands	Voordelta SAC	H1110 Sandbanks which are slightly covered by sea water all the time; 1140 Mudflats and sandflats not covered by seawater at low tide	118.44 km	Out	Beyond the range of potential impact
UK0030076	UK	Alde, Ore and Butley Estuaries SAC	H1130 Estuaries; H1140 Mudflats and sandflats not covered by seawater at low tide	112.86 km	Out	Beyond the range of potential impact

Site Code	Country	SAC name	Category of interest feature	Distance (km)	Screened in/out	Rationale
UK0030368	UK	Bassurelle Sandbank SAC	H1110 Sandbanks which are slightly covered by sea water all the time	269.47 km	Out	Beyond the range of potential impact
UK0017072	UK	Berwickshire and North Northumberland Coast SAC	H1150 Coastal lagoons; H8330 Submerged or partially submerged sea caves	374.44 km	Out	Beyond the range of potential impact
UK0030357	UK	Braemar Pockmarks SAC	H1180 Submarine structures made by leaking gases	645.16 km	Out	Beyond the range of potential impact
UK0013690	UK	Essex Estuaries SAC	H1130 Estuaries; H1140 Mudflats and sandflats not covered by seawater at low tide	163.61 km	Out	Beyond the range of potential impact
UK0013036	UK	Flamborough Head SAC	H8330 Submerged or partially submerged sea caves	213.04	Out	Beyond the range of potential impact
UK0013107	UK	Thanet Coast SAC	H1110 Sandbanks which are slightly covered by sea water all the time; 1140 Mudflats and sandflats not covered by seawater at low tide; H1170 Reefs	185.65 km	Out	Beyond the range of potential impact
UK0030369	UK	Haisborough, Hammond and Winterton SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1170 Reefs	36.67 km	In	Overlap with the offshore cable corridor
UK0030170	UK	Humber Estuary SAC	H1130 Estuaries; H1140 Mudflats and sandflats not covered by seawater at low tide; H1110 Sandbanks which are slightly covered by sea water all the time; H1150 Coastal lagoons	170	Out	Beyond the range of potential impact

Site Code	Country	SAC name	Category of interest feature	Distance (km)	Screened in/out	Rationale
UK0030370	UK	Inner Dowsing, Race Bank and North Ridge SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1170 Reefs	118.80 km	Out	Beyond the range of potential impact
UK0030371	UK	Margate and Long Sands SAC	H1110 Sandbanks which are slightly covered by sea water all the time	136.24 km	Out	Beyond the range of potential impact
UK0030358	UK	North Norfolk Sandbanks and Saturn Reef SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1170 Reefs	23.32 km	Out	The magnitude of any impact on the features of this site is negligible and would result in no LSE
UK0014780	UK	Orfordness - Shingle Street SAC	H1150 Coastal lagoons	113.69 km	Out	Beyond the range of potential impact
UK0030354	UK	Scanner Pockmark SAC	H1180 Submarine structures made by leaking gases	576.45 km	Out	Beyond the range of potential impact
UK0017075	UK	The Wash and North Norfolk Coast SAC	H1110 Sandbanks which are slightly covered by sea water all the time; H1140 Mudflats and sandflats not covered by seawater at low tide; H1160 Large shallow inlets and bays	109.77 km	Out	Beyond the range of potential impact

* Distance measured from the closest point of Norfolk Boreas offshore project area to the closest point of the SAC site rounded to the nearest kilometre

5 SCREENING FISH SAC SITES AND FEATURES

5.1 Identification of Fish Sites and Features

136. Natura 2000 sites in the southern North Sea, which have migratory fish species as an interest feature, are considered for HRA Screening. Table 5.1 provides the list of sites considered for screening. The full screening report was consulted on as part of the PEIR consultation in November and December 2018.

5.2 Approach to Screening

137. The sites which could potentially be affected by the proposed project will be screened in to the HRA on the basis of the following:

- A component of the proposed project directly overlaps a site whose interest features includes a species of fish.
- The distance between the proposed project and a site with a fish interest feature is within the range for which there could be an interaction e.g. the pathway is not too long for sediment deposition.
- The distance between the proposed project and resources on which the interest feature depends (i.e. an indirect effect acting through prey or access to habitat) is within the range for which there could be an interaction i.e. the pathway is not too long.
- The likelihood that a foraging area or a migratory route occurs within the zone of interaction of the proposed project.

138. The key factors that will be applied during the HRA screening process are:

- Potential effects (source); and
- Proximity of source to feature (distance between the proposed development and SACs, migration routes) (pathway and receptor).

5.2.1 Potential effects (source)

139. Example conservation objectives for sites with migratory fish are listed below based on the Humber Estuary SAC (Natural England undated):

- Avoid the deterioration of the qualifying natural habitats and the habitats of qualifying species, and the significant disturbance of those qualifying species, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving Favourable Conservation Status of each of the qualifying features.
- Subject to natural change, to maintain or restore:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats and habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

140. The key effects of development on migratory fish comprise the following:

- Construction
 - Temporary physical disturbance;
 - Smothering due to increased suspended sediment;
 - Re-mobilisation of contaminated sediments; and
 - Underwater noise and vibration.
- Operation
 - Permanent habitat loss;
 - Physical disturbance through maintenance activities;
 - Smothering through increased suspended sediment;
 - Introduction of new substrate/ fish aggregation;
 - Underwater noise and vibration; and
 - Electromagnetic fields (EMF).
- Decommissioning
 - Temporary physical disturbance;
 - Smothering due to increased suspended sediment; and
 - Underwater noise and vibration.

5.2.2 Proximity of source to feature (pathway)

141. Direct impacts associated with Norfolk Boreas (e.g. from loss of habitat, physical disturbance and potential smothering) will be localised to Norfolk Boreas. As discussed in section 128, based on the draft Marine Physical Process impact assessment, there is a potential for 0.2 to 2mm of deposited sediment to a distance of approximately 50km within a band of a few hundred metres in the direction of the tidal flow (north to south).
142. Based on underwater noise modelling of potential fish disturbance impact ranges associated with pile driving, all sites greater than 50km from Norfolk Boreas are proposed to be screened out of the HRA.

143. Consideration is also given to the potential for migratory fish associated with SACs and Ramsar sites to be present in the waters in and around Norfolk Boreas.

5.2.3 Annex 2 fish species (receptor)

144. Atlantic salmon (*Salmo salar*), allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*), and sea lamprey (*Petromyzon marinus*) migrate through or spend time in the North Sea at particular stages through their lifecycle. Subject to the location and distance from Norfolk Boreas, these species could potentially be indirectly affected by the effects identified above, during the construction, operation, or decommissioning of the proposed project. Brook lamprey are fully estuarine or freshwater species and do not undertake migration through marine waters and therefore no pathway exists for impact upon designated populations of this species.
145. The nearest SAC/SCI designated for Annex II fish features (Noordzeekustzone SAC in The Netherlands) is located 94km from Norfolk Boreas. Given the distance of the sites listed in Table 5.1, from Norfolk Boreas and the potential impact ranges discussed in section 5.2.2, it is considered that there will be no pathway for impacts upon the supporting habitats and processes of any sites designated for migratory fish.
146. There is potential for migratory fish to be present in the waters in and around the proposed project to be affected by the effects listed above. However, given the distances to designated sites and to the coast from Norfolk Boreas, it is considered that there would be no significant barrier effects to migratory fish reaching the designated sites and therefore no potential LSE.

5.3 Screening

147. Table 5.1 provides a list of 13 sites for which there is theoretical connectivity to Norfolk Boreas for fish receptors, as outlined in section 2.3. Based on the approach outlined in section 5.2, it was concluded that there is no potential for LSE from Norfolk Boreas for any of the sites considered and therefore it is proposed that these will not be considered further in the HRA.

Table 5.1 List of SACs in the southern North Sea with their respective Annex 2 migratory fish species interest feature and screening decisions (screened out sites are shown in grey).

Site Code	Country	SAC name	Category of interest feature	Distance* (km)	Screening decision	Reason for screening decision
BEMNZ0001	Belgium	Vlaamse Benken SAC	1095 Sea Lamprey 1103 Twaite Shad*	151	Out	The distance between the proposed project and the site is beyond that of potential impacts on the fish features or the supporting habitat and processes and no barrier impacts are predicted.
BEMNZ0005	Belgium	Vlakte Van der Raan SAC	1095 Sea Lamprey 1099 River lamprey* 1103 Twaite Shad*	159	Out	
FR3102005	France	Baie De Canche et Couloir Des Trois Estuaires SAC	1106 Salmon 1095 Sea Lamprey 1099 River lamprey 1102 Allis Shads	240	Out	
FR2200346	France	Estuaires et littoral Picards SAC	1099 River lamprey	261	Out	
FR3100479	France	Falaises et Dunes de Wimereux, Estuaire de la Slack, Garennes et Communaux d'Ambleteuse-Audresselles SAC	1099 River lamprey	242	Out	
DE2104301	Germany	Borkum-Riffgrund (Borkum Reef Ground) SCI	1103 Twaite Shad	224	Out	
DE1209301	Germany	Sylter Außenriff (Sylt Outer Reef) SAC	1099 River lamprey* 1103 Twaite Shad	386	Out	
NL9802001	Netherlands	Noordzeekustzone SAC	1095 Sea Lamprey 1102 Allis Shad 1103 Twaite Shad	94	Out	
NL2008003	Netherlands	Vlakte Van der Raan SAC	1103 Twaite Shad*	148	Out	
NL4000017	Netherlands	Voordelta SAC	1095 Sea Lamprey 1099 River lamprey 1102 Allis Shad 1103 Twaite Shad	118	Out	
NL9803061	Netherlands	Westerschelde SAC	1099 River lamprey* 1103 Twaite Shad*	156	Out	

Site Code	Country	SAC name	Category of interest feature	Distance* (km)	Screening decision	Reason for screening decision
UK0030170	UK	Humber Estuary SAC	1095 Sea Lamprey** 1099 River lamprey**	170	Out	
UK0030253	UK	River Derwent SAC	1099 River lamprey*	257	Out	

* Distance measured from the closest point of Norfolk Boreas sites to the closest point of the SAC site rounded to the nearest kilometre

6 SCREENING SPA SITES AND FEATURES

6.1 Identification of Ornithology Sites and Features

148. SPA and Ramsar sites around the North Sea basin, in the northern North Sea and around the coast of the British Isles for which there is the potential for connectivity are considered for HRA Screening (see Table 6.1). The full screening report was consulted on as part of the PEIR consultation in November and December 2018.

6.2 Approach to Screening

149. Following the same principles as used in assessments for previous developments such as East Anglia ONE, East Anglia THREE and Norfolk Vanguard (APEM 2012, EAOL 2013, Planning Inspectorate 2013, DECC 2014, Norfolk Vanguard Limited, 2018), SPAs and Ramsar sites will be screened related to birds potentially affected by the offshore components of the proposed project as follows:

- A component of the proposed project directly overlaps a site whose interest features includes a species of bird (applies to SPAs and Ramsar sites).
- The distance between the proposed project and a site with a bird interest feature is within the range for which there could be an interaction. For seabirds in the breeding season this element of the screening process will be informed by published information on maximum foraging range (especially the data presented in Thaxter et al., 2012a).
- Assessment of species-specific risk which informs the extent to which populations of particular species may be vulnerable to collision mortality, displacement or barrier effects (Garthe & Hüppop 2004, Cook et al. 2012, Furness et al. 2013, Bradbury et al. 2014).
- The distance between the proposed project and resources on which the interest feature depends (i.e. an indirect effect acting through prey or access to habitat) is within the range for which there could be an interaction i.e. the pathway is not too long (applies to SPAs and Ramsar sites).
- Evidence that a migratory route passes through the proposed project wind turbine array for bird species migrating to and / or from protected sites (applies to SPAs and Ramsar sites). This will be informed by published information on migration routes, principally Wright et al. (2012), but also Wernham et al. (2002), Brown and Grice (2005) and Furness (2015).

6.2.1 Potential effects (source)

150. The following potential effects, related to specific stages of the offshore components of the Project, will be considered in the HRA process.
- Construction

- Disturbance / displacement; and
- Indirect impacts through effects on habitats and prey species.
- Operation
 - Disturbance / displacement (e.g. see Schwemmer et al. 2011, Dierschke et al. 2016);
 - Indirect impacts through effects on habitats and prey species (e.g. see Carter et al. 2017);
 - Collision risk (e.g. Band 2000, 2012); and
 - Barrier effect (e.g. see Carter et al. 2017).
- Decommissioning
 - Disturbance / displacement; and
 - Indirect impacts through effects on habitats and prey species.

6.2.2 Proximity of source to receptors/ pathway for effect

6.2.2.1 Migratory birds and transboundary considerations

151. Many SPA sites within the UK and in neighbouring Member States can be screened out of HRA because there is no connectivity between the SPA site and the proposed project area in terms of populations of birds that are features of the SPAs. Therefore, LSE can be ruled out. This applies to most SPAs that are distant from the proposed project. However, some bird species are highly mobile and may interact with projects because they range over considerable distances. This applies especially to seabirds.
152. Migratory birds may move into areas where there are projects and so may interact during their migration. From an initial consideration of all SPAs in the UK and in neighbouring Member States that were listed in APEM and Royal HaskoningDHV (2014), those for which connectivity with the Norfolk Boreas project can be ruled out or assessed as negligible have been scoped out. This applies to most of the SPAs in those territories, including all SPAs in Member States on the European mainland designated for coastal birds / waterbirds / seabirds (Table 6.1).
153. Birds of some species that are SPA features, such as shorebirds, may migrate from the mainland of Europe to eastern England (for example from SPAs in Netherlands to the Wash or Thames estuaries) so these birds need to be considered. Migrating shorebirds and other coastal birds tend to fly high when weather conditions are favourable for migration, and normally set off on a migratory flight under such weather conditions, and so are rarely recorded to be collision victims at offshore wind farms, where passerines are the group most at risk of collision (Hüppop et al. 2006). Indeed, Hüppop et al. (2006) reported that only six out of 442 collision carcasses in their study were non-passerine birds. Assessments of collision risk of

migrating coastal birds at offshore wind farms in UK waters also indicate that risk is low and for most species does not represent a hazard that would require HRA assessment (Wright et al. 2012; WWT 2013).

154. The Netherlands Ministry of Infrastructure and the Environment stated in a letter of 7 July 2014 that they had a concern that the proposed projects in the East Anglia zone could have an effect on the seabirds of Bruine Bank pSPA. The non-breeding seabirds that are the interest feature of the Bruine Bank (Brown Ridge) pSPA are primarily auks. An assessment of potential impacts on auks was conducted as part of the East Anglia THREE EIA (MacArthur Green 2015, sections 13.7.1.1 and 13.7.2.1) in relation to construction and operational disturbance and displacement. In all cases impacts were found to be minor or negligible (based on BDMPS populations in UK North Sea waters, Furness 2015). Assessment of impacts over the whole North Sea (i.e. including non UK waters) would greatly increase the estimated seabird population sizes and only slightly increase cumulative impacts (because most offshore wind farms are in UK waters). Accordingly a likely significant effect on the Bruine Bank (Brown Ridge) pSPA can be screened out.
155. The Netherlands Ministry of Infrastructure and the Environment also stated in their letter of 7 July 2014 'on-shore bird colonies in the Netherlands are all situated more than 100km from the Dutch-UK border, so no effects are to be expected there'. We agree with that interpretation (with one exception discussed below), particularly since the seabirds that breed in the Netherlands are predominantly species with coastal and relatively short foraging ranges, such as terns, cormorants and gulls, and there is no evidence that breeding birds from those populations cross into the UK while they are breeding. However, lesser black-backed gulls breed in large numbers in The Netherlands. Between 32,000 and 57,000 pairs were estimated to breed in The Netherlands in 1992-97 (Mitchell et al. 2004) and the numbers subsequently increased to a peak of over 90,000 pairs in 2005 (Camphuysen 2013). With a maximum foraging range of 181km from breeding colonies (Thaxter et al. 2012a), there is theoretical potential for connectivity between some colonies in The Netherlands and Norfolk Boreas. However, extensive colour ringing and tracking of breeding lesser black-backed gulls from multiple colonies in The Netherlands has found no evidence for connectivity during the breeding season between birds breeding in those colonies and the UK, and also that there is remarkably little migration of birds from the colonies in The Netherlands through UK waters outside the breeding season (Camphuysen 2013). Not only do breeding adult lesser black-backed gulls from colonies in The Netherlands normally remain on the continental side of the North Sea while breeding, but 95% of their foraging trips are less than 135km from those colonies (Camphuysen 1995, 2013), so would be very unlikely to

reach Norfolk Boreas. These studies therefore rule out any transboundary impacts of Norfolk Boreas on any of these breeding lesser black-backed gull populations.

156. Similarly, impacts on seabird breeding populations in Germany, Belgium and France can be screened out due to the distance of colonies in those countries from the proposed project (Table 6.1), which, with two exceptions discussed in the next paragraph, exceeds maximum foraging ranges of breeding seabirds (Thaxter et al. 2012a).
157. There are breeding gannets at colonies where Norfolk Boreas lies within the species' reported maximum foraging range (590km, Thaxter et al. 2012a). These colonies are at Seevogelschutzgebiet Helgoland SPA (Germany) and Littoral Seine-Marin SPA (France). However, tracking studies of breeding adults at each of these colonies show that birds from those colonies do not travel into Norfolk Boreas but forage relatively close to their breeding colonies (Stefan Garthe, pers. comm., Wakefield et al. 2013).
158. Therefore, no trans-boundary issues are screened in to this assessment.

6.2.3 Receptors

159. Based on the data collected from site specific surveys for Norfolk Boreas and a review of existing data sources, the bird species likely to occur in Norfolk Boreas can be grouped into a series of categories for this high level screening process. This categorisation is based on biological relationships related to breeding biology, feeding, habitat use and migratory pathways. The categories are:

- Breeding seabirds;
- Breeding waterbirds;
- Non-breeding seabirds
- Passage waterbirds; and
- Wintering waterbirds.

6.3 Screening

160. Table 6.1 provides a list of SPAs and Ramsar sites in the North Sea and around the British Isles, along with whether they are proposed to be screened in or out based on whether LSE is deemed to be possible (summarised in Table 6.1 and discussed where relevant in greater detail in paragraphs 161 to 164).

Table 6.1 List of SPA and Ramsar sites with their respective categories of bird interest feature and screening decisions (screened out sites are shown in grey)

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
N/A	Netherlands	Bruine Bank (Brown Ridge) pSPA	Non-breeding seabirds	c. 20 (estimate as no detailed maps available)	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.
UK9020309	UK	Outer Thames Estuary SPA and pSPA extension	Wintering marine birds and breeding terns	40	In	SPA is beyond maximum foraging range of designated breeding seabird species (terns) and tern foraging tends to be coastal so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are likely to be small as these species are thought to remain close to shore during much of their migration through UK waters. Migrations of non-breeding seabirds from this SPA are likely to result in only very small numbers passing through the site during migration, as the migration of divers and sea ducks from SE England tends to be to German Bight and northeastwards to breeding areas, and not therefore in the direction of Norfolk Boreas. However there is potential for disturbance to wintering red-throated diver from operation and maintenance vessels so further consideration has been undertaken.
UK9014041	UK	Greater Wash SPA	Non-breeding seabirds and breeding terns	c. 59 (estimate as no detailed maps available)	IN	SPA is beyond maximum foraging range of designated seabird species (terns) and tern foraging tends to be coastal so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are likely to be small as these species are thought to remain close to shore during much of their migration through UK waters. Migrations of non-breeding seabirds from this SPA are likely to result in small numbers passing through the site during migration, but given the proximity of the site to this SPA further more detailed assessment of that is appropriate.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9009271	UK	Great Yarmouth and North Denes SPA	Breeding seabirds	73	Out	SPA is beyond maximum foraging range of designated seabird species (little tern) and little tern foraging tends to be coastal so has no breeding season connectivity. Proportions of this populations migrating through Norfolk Boreas are likely to be small as the species is thought to remain close to shore during much of its migration through UK waters.
UK9009181	UK	Breydon Water SPA and Ramsar	Wintering and passage waterbirds	76	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009253	UK	Broadland SPA and Ramsar	Wintering and passage waterbirds	76	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009101	UK	Minsmere - Walberswick SPA and Ramsar	Breeding, wintering and passage waterbirds	96	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
#N/A	Netherlands	Frisian Front pSPA	Non-breeding seabirds	c. 100	Out	Migrations of birds from this pSPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.
NL9801001	NL	Waddenzee (Wadden Sea) SPA	Wintering and passage waterbirds	105	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009112	UK	Alde-Ore Estuary SPA and Ramsar	Breeding seabirds and breeding, wintering and passage waterbirds	117	IN	Lesser black-backed gull and herring gull populations may have connectivity with Norfolk Boreas. This SPA holds the closest large colony of these species to Norfolk Boreas, and some birds from that SPA may pass through Norfolk Boreas during migration.
NL4000017	NL	Voordelta SPA	Wintering and passage waterbirds	118	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009261	UK	Deben Estuary SPA and Ramsar	Wintering and passage waterbirds	128	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9009031	UK	North Norfolk Coast SPA and Ramsar	Wintering and passage waterbirds	142	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009121	UK	Stour & Orwell Estuaries SPA and Ramsar	Wintering and passage waterbirds	140	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009131	UK	Hamford Water SPA and Ramsar	Wintering and passage waterbirds	146	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9008021	UK	The Wash SPA and Ramsar	Wintering and passage waterbirds	150	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9008022	UK	Gibraltar Point SPA and Ramsar	Wintering and passage waterbirds	161	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009243	UK	Colne Estuary SPA and Ramsar	Wintering and passage waterbirds	164	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
BEMNZ0004	Belgium	SBZ 3 / ZPS 3[GK9] (off Molenhoek)	Non-breeding seabirds	166	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.
BEMNZ0003	Belgium	SBZ 2 / ZPS 2 (off Ostend)	Non-breeding seabirds	168	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.
UK9009141	UK	Abberton Reservoir SPA and Ramsar	Wintering and passage waterbirds	171	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009242	UK	Dengie SPA and Ramsar	Wintering and passage waterbirds	175	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
BEMNZ0002	Belgium	SBZ 1 / ZPS 1 (off Nieuwpoort)	Non-breeding seabirds	183	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9009245	UK	Blackwater Estuary SPA and Ramsar	Wintering and passage waterbirds	185	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009246	UK	Foulness SPA and Ramsar	Wintering and passage waterbirds	186	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009244	UK	Crouch & Roach Estuaries SPA and Ramsar	Wintering and passage waterbirds	187	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9012071	UK	Thanet Coast and Sandwich Bay SPA and Ramsar	Wintering and passage waterbirds	187	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK0030170	UK	Humber Estuary SPA and Ramsar	Wintering and passage waterbirds	190	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9009171	UK	Benfleet & Southend Marshes SPA and Ramsar	Wintering and passage waterbirds	202	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9012011	UK	The Swale SPA	Wintering and passage waterbirds	205	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9012021	UK	Thames Estuary and Marshes SPA and Ramsar	Wintering and passage waterbirds	210	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9012031	UK	Medway Estuary & Marshes SPA and Ramsar	Wintering and passage waterbirds	210	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9006171	UK	Hornsea Mere SPA	Wintering and passage waterbirds	215	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
Not available	UK	Flamborough and Filey Coast SPA	Breeding seabirds	216	IN	Uncertain proportions of the kittiwake, gannet, common guillemot, razorbill and puffin populations most likely migrate through Norfolk Boreas. Only gannet has potential for connectivity during the breeding season based on maximum foraging range but tracking data indicate no connectivity of breeding gannets.
DE2104301	Germany	Borkum-Riffgrund SPA	Non-breeding seabirds	218	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of Biologically Defined Minimum Population Scale (BDMPS) regional populations.
DE1209301	Germany	Sylter Außenriff SPA	Non-breeding seabirds	286	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.
UK9006061	UK	Teesmouth and Cleveland Coast SPA and Ramsar	Wintering and passage waterbirds	301	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9006131	UK	Northumbria Coast SPA and Ramsar	Wintering and passage waterbirds	319	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
FR2310045	France	Littoral Seino-Marin SPA	Breeding seabirds	329	Out	Norfolk Boreas is within the theoretical maximum foraging range of breeding gannets from this SPA, but tracking data show that breeding gannets from the SPA do not reach Norfolk Boreas. The SPA is far beyond maximum foraging range of other designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are likely to be extremely small relative to BDMPS.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
DE1813491	Germany	Seevogelschutzgebiet Helgoland SPA	Breeding seabirds	329	Out	Tracking data from gannets breeding on Helgoland show these birds do not travel in the direction of or as far as Norfolk Boreas despite this site being within theoretical maximum foraging range of gannet. The site is beyond the maximum foraging range of other seabird species at Helgoland. Proportions of these populations migrating through Norfolk Boreas are likely to be very small relative to BDMPS regional populations.
DE1011401	Germany	Östliche Deutsche Bucht SPA	Non-breeding seabirds	329	Out	Migrations of birds from this SPA are likely to result in negligible numbers passing through Norfolk Boreas during migration relative to the size of BDMPS regional populations.
UK9011011	UK	Chichester & Langstone Harbours SPA	Migratory waterbirds	340	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9011051	UK	Portsmouth Harbour SPA	Migratory waterbirds	347	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9011061	UK	Solent & Southampton Water SPA	Migratory waterbirds	351	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
DE0916491	Germany	Ramsar-Gebiet S-H Wattenmeer und angrenzende Küstengebiet e SPA	Breeding, wintering and passage waterbirds	355	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9006031	UK	Coquet Island SPA	Breeding seabirds	373	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9006021	UK	Farne Islands SPA	Breeding seabirds	397	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9006011	UK	Lindisfarne SPA and Ramsar	Wintering and passage waterbirds	403	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9010091	UK	Chesil Beach & The Fleet SPA	Migratory waterbirds	441	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK0030281	UK	St Abbs Head to Fast Castle SPA	Breeding seabirds	441	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
FR2502020	France	Baie de Seine Occidentale SPA	Breeding, wintering and passage waterbirds	447	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
FR2510099	France	Falaise du Bessin Occidental SPA	Breeding seabirds	463	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9004411	UK	Firth of Forth SPA	Wintering and passage waterbirds	468	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9004171	UK	Forth Islands SPA	Breeding seabirds	476	Out	Tracking data show breeding gannets from Bass Rock do not commute to Norfolk Boreas although the site is just within maximum foraging range. Except for gannet, SPA is far beyond maximum foraging range of other designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9010081	UK	Exe Estuary SPA	Migratory waterbirds	491	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9004451	UK	Imperial Dock Lock, Leith SPA	Breeding seabirds	498	Out	SPA is far beyond maximum foraging range of designated seabird species (common tern) so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9004121	UK	Firth of Tay & Eden Estuary SPA	Wintering and passage waterbirds	506	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9004031	UK	Montrose Basin SPA	Wintering and passage waterbirds	520	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9002271	UK	Fowlsheugh SPA	Breeding seabirds	524	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002491	UK	Buchan Ness to Collieston Coast SPA	Breeding seabirds	553	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002221	UK	Ythan Estuary, Sands of Forvie and Meikle Loch SPA	Wintering and passage waterbirds	553	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9002211	UK	Loch of Strathbeg SPA	Wintering and passage waterbirds	576	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9002471	UK	Troup, Pennan and Lion`s Heads SPA	Breeding seabirds	593	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9001625	UK	Moray and Nairn Coast SPA	Wintering and passage waterbirds	622	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9001624	UK	Inner Moray Firth SPA	Wintering and passage waterbirds	652	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9001623	UK	Cromarty Firth SPA	Wintering and passage waterbirds	664	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9001622	UK	Dornoch Firth and Loch Fleet SPA	Wintering and passage waterbirds	668	Out	Survey data show little or no evidence of SPA features occurring in Norfolk Boreas and migrations of birds from this SPA are likely to result in negligible numbers passing through the site during migration.
UK9001182	UK	East Caithness Cliffs SPA	Breeding seabirds	682	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9001181	UK	North Caithness Cliffs SPA	Breeding seabirds	703	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9001131	UK	Pentland Firth Islands SPA	Breeding seabirds	710	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002151	UK	Copinsay SPA	Breeding seabirds	718	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002141	UK	Hoy SPA	Breeding seabirds	728	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002091	UK	Fair Isle SPA	Breeding seabirds	750	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002431	UK	Calf of Eday SPA	Breeding seabirds	753	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9002371	UK	Rousay SPA	Breeding seabirds	756	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002121	UK	Marwick Head SPA	Breeding seabirds	761	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002101	UK	West Westray SPA	Breeding seabirds	766	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002111	UK	Papa Westray (North Hill and Holm) SPA	Breeding seabirds	770	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002511	UK	Sumburgh Head SPA	Breeding seabirds	778	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002361	UK	Mousa SPA	Breeding seabirds	793	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002081	UK	Noss SPA	Breeding seabirds	802	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002061	UK	Foula SPA	Breeding seabirds	822	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.

Site code	Country	SPA/ Ramsar site name	Category of interest feature	Distance (km)*	Screening decision	Reason for screening decision
UK9002051	UK	Papa Stour SPA	Breeding seabirds	839	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002031	UK	Fetlar SPA	Breeding seabirds	844	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002041	UK	Ronas Hill - North Roe and Tingon SPA	Breeding seabirds	852	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.
UK9002011	UK	Hermaness, Saxa Vord and Valla Field SPA	Breeding seabirds	866	Out	SPA is far beyond maximum foraging range of designated seabird species so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are small relative to BDMPS.

*Distance measured from the closest point of Norfolk Boreas site (i.e. the wind turbine array) to the closest point of the SPA site rounded to the nearest kilometre

161. Many protected sites can be scoped out as having negligible connectivity with Norfolk Boreas. Three sites were scoped in for further detailed assessment: Alde-Ore Estuary SPA, Flamborough & Filey SPA, Outer Thames Estuary SPA and Greater Wash SPA.
162. Thaxter et al. (2012a) report a maximum foraging range of 181km for lesser black-backed gull, a mean maximum across studies of 141km and a mean foraging range of 71.9km. The Alde-Ore Estuary SPA is a minimum of 117km from Norfolk Boreas, so is beyond the mean foraging range but within the maximum foraging range of this species, so some breeding birds from the Alde-Ore Estuary SPA may forage within Norfolk Boreas. Further consideration therefore needs to focus on evidence regarding the foraging of lesser black-backed gulls from the Alde-Ore Estuary SPA, especially in relation to tracking work (Thaxter et al. 2012b, 2015), and the extent to which connectivity with Norfolk Boreas may occur.
163. The Flamborough and Filey Coast SPA is a minimum of 216km from Norfolk Boreas. Thaxter et al. (2012a) report a maximum foraging range of breeding gannets as 590km, puffins as 200km, common guillemots as 135km, kittiwakes as 120km, and razorbills as 95km. RSPB tracking data from gannets breeding at Flamborough and Filey Coast SPA suggest low connectivity with Norfolk Boreas (RSPB 2012). However, Carroll et al. (2017) present tracking data from breeding kittiwakes at Flamborough and Filey Coast SPA showing that these birds may travel particularly far out into the Dogger Bank area to forage while breeding. Therefore, Flamborough and Filey Coast SPA is potentially within the maximum foraging range of both kittiwake and gannet from that SPA. Some of the birds from that colony are also likely to pass through Norfolk Boreas during migrations. Assessed impacts on these populations need also to consider the conservation status of the designated populations (e.g. increases in gannet numbers (Trinder 2012, WWT 2012, Murray et al. 2015) but declines in kittiwake and many other seabird breeding numbers, and other factors driving population change, such as breeding success (Coulson 2017), and the influences on this of changes in fish stocks and fisheries (ICES 2013, Carroll et al. 2017), and winter distributions of birds (Frederiksen et al. 2012).
164. The Greater Wash SPA is approximately 59km from Norfolk Boreas. This is beyond the maximum foraging range of Sandwich tern (54km; Thaxter et al. 2012), and the breeding colonies themselves (already designated as North Norfolk Coast SPA) are even further from Norfolk Boreas. This means there is very little likelihood of breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are likely to be small as these species are thought to remain close to shore during much of their migration through UK waters. Migrations of non-breeding seabirds (red-throated divers, little gulls and common scoters; Lawson et al. 2016)

from this SPA are likely to result in small numbers passing through the site during migration, but given the proximity of the site to this SPA further more detailed assessment of that is appropriate.

165. Outer Thames Estuary SPA is approximately 40km from Norfolk Boreas. The SPA is designated for its wintering population of red-throated diver, and while the Norfolk Boreas site is beyond the range at which turbines could cause displacement of this population, operations and maintenance vessels may cross the SPA to and from the wind farm (the final decision on the O&M port has not been taken). Therefore consideration of this potential effect has been provided.

7 OVERALL SUMMARY

166. Following the screening process, seven sites will be considered further within the HRA to determine any LSE. The assessment of impacts to four sites will be provided within the Information to support HRA report which will be provided as part of the DCO application. A draft of this report will be consulted upon with the relevant ETGs through the Evidence Plan process (for further information see chapter 7 technical consultation of this PEIR).
167. Four sites will be considered for marine mammals:
- Southern North Sea SAC will be further assessed for harbour porpoise, as Norfolk Boreas lies within the SAC;
 - Humber Estuary SAC will be further assessed for grey seal as there is potential for underwater noise, vessel interactions, changes to water quality, changes to prey resources and disturbance at seal haul-out sites vessel interactions if a port to the north of Norfolk Boreas is selected;
 - Winterton – Horsey Dunes SAC will be further assessed for grey seal as there is potential for underwater noise in cable corridor, vessel interactions in cable corridor, changes to water quality in cable corridor, changes to prey resources in cable corridor and disturbance at seal haul-out sites from the construction work in the cable corridor; and
 - Wash and North Norfolk Coast SAC will be further assessed for harbour seal (and grey seal), as there is potential for underwater noise, vessel interactions, changes to water quality, changes to prey resources and disturbance at seal haul-out sites vessel interactions if a port to the north of Norfolk Boreas is selected.
 - Klaverbank SAC will be further assessed for potential disturbance effects for foraging grey and harbour seal.

- Noordzeekustzone SAC will be assessed further for potential disturbance effects for foraging grey seal.
168. One site will be considered for benthic:
- Haisborough, Hammond and Winterton SCI will be further assessed for Sandbanks which are slightly covered by sea water all the time and Reefs, as it overlaps with the cable corridor.
169. Four sites will be considered further for birds:
- Greater Wash SPA will be further assessed for non breeding seabirds. The SPA is beyond maximum foraging range of designated seabird species (terns) and tern foraging tends to be coastal so has no breeding season connectivity. Proportions of these populations migrating through Norfolk Boreas are likely to be small as these species are thought to remain close to shore during much of their migration through UK waters. Migrations of non-breeding seabirds from this SPA are likely to result in small numbers passing through the site during migration, but given the proximity of the site to this SPA further more detailed assessment of that is appropriate;
 - Outer Thames Estuary SPA will be further assessed for potential vessel disturbance to non breeding seabirds.
 - Alde-Ore Estuary SPA and Ramsar will be further assessed for Breeding seabirds and breeding, wintering and passage waterbirds. Lesser black-backed gull populations may have connectivity with Norfolk Boreas. This SPA holds the closest large colony of this species to Norfolk Boreas, and some birds from that SPA may pass through Norfolk Boreas during migration; and
 - Flamborough and Filey Coast SPA will be further assessed for breeding seabirds. Uncertain proportions of the kittiwake, gannet, common guillemot, razorbill and puffin populations most likely migrate through Norfolk Boreas. Gannet and kittiwake have potential connectivity during the breeding season based on maximum foraging ranges although tracking data indicates connectivity for both species is likely to be very low.
170. No sites will be considered further for impacts to designated fish features as there will be no connectivity.

8 REFERENCES

- ABPmer. (2012). East Anglia Offshore Wind Project ONE Windfarm: Marine geology, oceanography and physical processes environmental baseline. Report R3945. May 2012.
- APEM (2012) *East Anglia Offshore Wind: EA ONE Environmental Statement – Chapter 12: Ornithology: Coastal*. Stockport: APEM.
- APEM and Royal HaskoningDHV (2014) *East Anglia THREE HRA Screening: Report on High Level Screening, May 2014*. Stockport: APEM.
- Band, W. (2000) *Wind farms and birds: Calculating a theoretical collision risk assuming no avoidance action*. Guidance note series. Scottish Natural Heritage.
- Band, W. (2012) *Using a Collision Risk Model to Assess Bird Collision Risks for Offshore Wind farms*. Final Report to SOSS, March 2012. Available at: http://www.bto.org/sites/default/files/u28/downloads/Projects/Final_Report_SOSS02_Band1ModelGuidance.pdf
- Bradbury G., Trinder, M., Furness, R.W., Banks, A.N., Caldow, R.W.G. and Hume, D. (2014) 'Mapping seabird sensitivity to offshore wind farms', *PLoS ONE*, 9(9): e106366.
- Brown, A. and Grice, P. (2005) *Birds in England*, London: T & AD Poyser.
- Camphuysen, C.J. (1995) 'Herring gulls and lesser black-backed gulls feeding at fishing vessels in the breeding season: competitive scavenging versus efficient flying', *Ardea*, 83, 365-380.
- Camphuysen, C.J. (2013) *A historical ecology of two closely related gull species (Laridae): multiple adaptations to a man-made environment*. PhD thesis, University of Groningen.
- Carroll, M.J., Bolton, M., Owen, E., Anderson, G.Q.A., Mackley, E.K., Dunn, E.K. & Furness, R.W. (2017). Kittiwake breeding success in the southern North Sea correlates with prior sandeel fishing mortality. *Aquatic Conservation* doi: 10.1002/aqc.2780
- Carter, F., Daunt, F., Dierschke, V., Furness, R.W., Gray, C.E., Larsen, J.K., O'Brien, S., Petersen, I.K., Schmutz, J. & Zydalis, R. (2017). Possible behavioural, energetic and demographic effects of displacement of red-throated divers. JNCC Report No 605. JNCC, Peterborough.
- Cook A., Johnston A., Wright L., and Burton N. (2012) Strategic Ornithological Support Services Project SOSS-02. *A review of flight heights and avoidance rates of birds in relation to offshore wind farms*. Report of work carried out by the British Trust for Ornithology on behalf of The Crown Estate. May 2012.
- Coulson, J.C. (2017). Productivity of the black-legged kittiwake *Rissa tridactyla* required to maintain numbers. *Bird Study* 64, 84-89.
- Cunningham, L., Baxter, J. M., Boyd, I. L., Duck, C. D., Lonergan, M., Moss, S. E. & McConnell, B. (2009). Harbour seal movements and haul-out patterns; implications for monitoring and management. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 19: 398 – 407.

DECC (2014) *Record of the Habitats Regulations Appraisal undertaken under Regulation 25 of the Offshore Marine Conservation regulations 2007 (as amended) for an application under the Planning Act 2008 (as amended). East Anglia ONE offshore wind farm.*

Department for Communities and Local Government (2012). Guidance on 'Planning for the Protection of European Sites: Appropriate Assessment'. DCLG, London.

Dierschke, V., Furness, R.W. & Garthe, S. (2016). Seabirds and offshore wind farms in European waters: Avoidance and attraction. *Biological Conservation* 202, 59-68.

EAOL (2013) *Statement of common ground with JNCC and Natural England (offshore), July 2013.* (Doc Ref: REP-184).

East Anglia THREE Ltd (EATL) (2014). HRA Screening, Report on High Level Screening

East Anglia THREE Ltd (EATL) (2015). East Anglia THREE Environmental Statement.

Fontaine, M.C., Baird, S.J.E., Piry, S., Ray, N. et al. (2007). Rise of oceanographic barriers in continuous populations of a cetacean: the genetic structure of harbour porpoises in Old World waters. *BMC Biology* 5: 30.

Fontaine, M.C., Roland, K., Calves, I., Austerlitz, F., Palstra, F.P., Tolley, K.A., Ryan, S., Ferreira, M., Jauniaux, T., Llavona, A. and Öztürk, B. (2014). Postglacial climate changes and rise of three ecotypes of harbour porpoises, *Phocoena phocoena*, in western Palearctic waters. *Molecular ecology*, 23(13), pp.3306-3321.

Frederiksen, M., Moe, B., Daunt, F., Phillips, R.A., Barrett, R.T., Bogdanova, M.I., Boulinier, T., Chardine, J.W., Chastel, O., Chivers, L.S., Christensen-Dalsgaard, S., Clement-Chastel, C., Colhoun, K., Freeman, R., Gaston, A.J., Gonzalez-Solis, J., Goutte, A., Gremillet, D., Guilford, T., Jensen, G.H., Krasnov, Y., Lorentsen, S.-H., Mallory, M.L., Newell, M., Olsen, B., Shaw, D., Steen, H., Strøm, H., Systad, G.H., Thorarinsson, T.L. & Anker-Nilssen, T. (2012) 'Multi-colony tracking reveals the winter distribution of a pelagic seabird on an ocean basin scale', *Diversity & Distribution*, 18, 530-542.

Furness, R.W. (2015) *Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS).* Natural England Commissioned Reports, Number 164.

Furness, R.W., Wade, H. and Masden, E.A. (2013) 'Assessing vulnerability of seabird populations to offshore wind farms', *Journal of Environmental Management*, 119, 56-66.

Garthe, S and Hüppop, O. (2004) 'Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index', *Journal of Applied Ecology*, 41, 724-734.

Hammond P.S., Macleod K., Berggren P., Borchers D.L., Burt L., Cañadas A., Desportes G., Donovan G.P., Gilles A., Gillespie D., Gordon J., Hiby L., Kuklik I., Leaper R., Lehnert K, Leopold M., Lovell P., Øien N., Paxton C.G.M., Ridoux V., Rogano E., Samarraa F., Scheidatg M., Sequeira M., Siebertg U., Skovq H., Swifta R., Tasker M.L., Teilmann J., Canneyt O.V. and Vázquez J.A. (2013). Cetacean abundance and distribution in European Atlantic shelf waters to inform conservation and management. *Biological Conservation* 164, 107-122.

Hammond PS, Lacey C, Gilles A, Viquerat S, Börjesson P, Herr H, Macleod K, Ridoux V, Santos MB, Scheidat M, Teilmann J, Vingada J and Øien (2016) N Estimates of cetacean

abundance in European Atlantic waters in summer 2016 from the SCANS III aerial and shipboard surveys

Hüppop, O., Dierschke, J., Exo, K-M., Fredrich, E. and Hill, R. (2006) 'Bird migration studies and potential collision risk with offshore wind turbines', *Ibis*, 148, 90-109.

IAMMWG (2015). Management Units for cetaceans in UK waters (January 2015). JNCC Report No. 547, JNCC Peterborough.

ICES (2013) *Report of the Benchmark Workshop on Sandeel, 6-10 September 2010, Copenhagen, Denmark*. ICES CM2010/ACOM:57, 185pp.

Joint Nature Conservation Committee (2009). Selection Criteria And Guiding Principles For Selection Of Special Areas Of Conservation (SACs) For Marine Annex I Habitats And Annex II Species In The UK. JNCC, Peterborough.

JNCC (2017a). A potential approach to assessing the significance of disturbance against conservation objectives of the harbour porpoise cSACs. Discussion document version 3.0.

JNCC (2017b). Harbour porpoise SACs noise management stakeholder workshop. Report.

Joint Nature Conservation Committee and Natural England (2013). *Haisborough, Hammond and Winterton candidate Special Area of Conservation: Formal advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010 (as amended), and Regulation 18 of The Offshore Marine Conservation Regulations (Natural Habitats, &c.) Regulations 2007 (as amended)*. [Version 6.0 March 2013]. JNCC, Peterborough.

Joint Nature Conservation Committee and Natural England (2013a). *Suggested Tiers for Cumulative Impact Assessment, 12 September 2013*. JNCC, Peterborough.

Jones, E., McConnell, B., Sparling, C and Matthiopolous, J. (2013). Grey and harbour seal density maps. Marine Mammal Scientific Support Research Programme MMSS/001/11. Available at: <http://www.scotland.gov.uk/Resource/0041/00416981.pdf>

Lawson, J., Kober, K., Win, I., Allcock, Z., Black, J., Reid, J.B., Way, L. & O'Brien, S.H. (2016). An assessment of the numbers and distributions of wintering red-throated diver, little gull and common scoter in the Greater Wash. JNCC Report No. 574. JNCC, Peterborough.

Lowry, L.F., Frost, K.J., Hoep, J.M. and Delong, R.A. (2001). Movements of satellite-tagged subadult and adult harbor seals in Prince William Sound, Alaska. *Marine Mammal Science* 17(4): 835–861.

MacArthur Green (2015) *East Anglia THREE Chapter 13 Offshore Ornithology*.

McConnell, B.J., Chambers, C., Nicholas, K.S. & Fedak, M.A. (1992). Satellite tracking of grey seals (*Halichoerus grypus*). *Journal of the Zoological Society of London*, 226: 271–282.

Mitchell, P I, Newton, S, Ratcliffe, N. and Dunn, T E. (2004) *Seabird populations of Britain and Ireland*. London: T & AD Poyser.

Murray, S., Harris, M.P. and Wanless, S. (2015) 'The status of the gannet in Scotland in 2013-14', *Scottish Birds*, 35, 3-18.

Natural England (undated). European Site Conservation Objectives for Humber Estuary Special Area of Conservation. Natural England, Sheffield.

Norfolk Vanguard Limited (2018) Norfolk Vanguard Offshore Windfarm Environmental Statement. Available at:

<https://infrastructure.planninginspectorate.gov.uk/projects/eastern/norfolk-vanguard/?ipcsection=docs&stage=app&filter1=Environmental+Statement>

O'Brien, S.H., Webb, A., Brewer, M.J. and Reid, J.B. (2012) 'Use of kernel density estimation and maximum curvature to set Marine Protected Area boundaries: Identifying a Special Protection Area for wintering red-throated divers in the UK', *Biological Conservation*, 156 (Supplement 1), 15-21.

ODPM & DEFRA. (2005). Government Circular: Biodiversity and Geological Conservation - Statutory Obligations and their Impact within the Planning System. (ODPM Circular 06/2005 & Defra Circular 01/2005). ODPM, London.

The Planning Inspectorate (2017). Advice Note Ten: Habitat Regulations Assessment relevant to nationally significant infrastructure projects (Version 8, November 2017). Planning Inspectorate, Bristol.

The Planning Inspectorate (2016b). Norfolk Vanguard Scoping Opinion

Planning Inspectorate (2013) *Report on the implications for European Sites. Proposed East Anglia ONE offshore wind farm.*

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D., Bartol, S., Carlson, T., Coombs, S., Ellison, W. T., Gentry, R., Halvorsen, M. B., Løkkeborg, S., Rogers, P., Southall, B. L., Zeddies, D., and Tavalga, W. N. (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report

Royal HaskoningDHV (2017). Norfolk Boreas Offshore Wind Farm Environmental Impact Assessment Scoping Report

Royal Society for the Protection of Birds (2012) *Early post-breeding dispersal by adult gannets from Bempton Cliffs in September/October 2011.*

http://www.rspb.org.uk/Images/Figure%20%20postbreeding%202011_tcm9-311301.pdf

Russell, D.J.F (2016). Movements of Grey Seal That Haul Out on the UK Coast of the Southern North Sea. Report for The Department of Energy and Climate Change (OESEA-14-47).

Russell, D.J.F., Hastie, G.D., Thompson, D., Janik, V.M., Hammond, P.S., Scott-Hayward, L.A.S., Matthiopoulos, J., Jones, E.L. And Mcconnell, B.J. (2016). Avoidance of Wind Farms by Harbour Seals is Limited to Pile Driving Activities. *Journal of Applied Ecology*: DOI: 10.1111/1365-2664.12678.

Russell, D.J.F. And Mcconnell, B.J. (2014). Seal At-Sea Distribution, Movements and Behaviour. Report to DECC. Urn: 14d/085. March 2014 (Final Revision).

Russell, D.J.F., Mcconnell, B.J., Thompson, D., Duck, C.D., Morris, C., Harwood, J. And Matthiopoulos, J. (2013). Uncovering the Links Between Foraging and Breeding Regions in a Highly Mobile Mammal. *Journal of Applied Ecology*, Vol 50, No. 2, Pp. 499-509.

Schwemmer, P. Mendal, B., Sonntag, N., Dierschke, V. & Garthe, S. 2011. 'Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning', *Ecological Applications*, 21, 1851-1860.

SCOS (2016). Scientific Advice on Matters Related to the Management of Seal Populations: 2016. Available at: <http://www.smru.st-andrews.ac.uk/files/2017/04/SCOS-2016.pdf>

SCOS (2017). Scientific Advice on Matters Related to the Management of Seal Populations: 2017. Available at: <http://www.smru.st-andrews.ac.uk>

Sharples R. J., J. Matthiopoulos and P. S. Hammond (2008). *Distribution and movements of harbour seals around the coast of Britain: Outer Hebrides, Shetland, Orkney, the Moray Firth, St Andrews Bay, The Wash and the Thames*. Report to DTI July 2008.

Sharples, R.J., Moss, S.E., Patterson, T.A. and Hammond, P.S. (2012). Spatial Variation in Foraging Behaviour of a Marine Top Predator (*Phoca vitulina*) Determined by a Large-Scale Satellite Tagging Program. PLoS ONE 7(5): e37216

Thaxter, C. B., Lascelles, B., Sugar, K., Cook A., Roos, S., Bolton, M., Langston, R. and Burton, N. (2012a) 'Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas', *Biological Conservation*, 156, 53-61.

Thaxter, C. B., Ross-Smith, V. H., Clark, N. A., Conway, G.J. Wade, H., Masden E.A., Rehfisch, M.M., Bouten W. and Burton, N. H. K. (2012b) *Measuring the interaction between marine features of Special Protection Areas with offshore wind farm development zones through telemetry: second year report*. BTO Research Report No. 610.

Thaxter, C.B., Ross-Smith, V., Bouten, W., Clark, N.A., Conway, G.J., Rehfisch, M.M. and Burton, N.H.K. (2015) 'Seabird-wind farm interactions during the breeding season vary within and between years: A case study of lesser black-backed gulls *Larus fuscus* in the UK', *Biological Conservation*, 186, 347-358.

Thompson, P. M. and Miller, D. (1990). Summer foraging activity and movements of radio tagged common seals (*Phoca vitulina*) in the Moray Firth, Scotland. *Journal of Applied Ecology*, 63: 24-30.

Tolley, K.A. and Rosel, P.E. (2006). Population structure and historical demography of eastern North Atlantic harbour porpoises inferred through mtDNA sequences. *Marine Ecology Progress Series*, 327, pp.297-308.

Tollit, D. J., Black, A. D., Thompson, P. M., Mackay, A., Corpe, H. M., Wilson, B., Van Parjis, S. M., Grellier, K. & Parlane, S. (1998). Variations in harbour seal *Phoca vitulina* diet and dive-depths in relation to foraging habitat. *Journal of Zoology*, 244: 209 -222.

Tougaard, J., Buckland, S., Robinson, S. and Southall, B. (2013). An analysis of potential broad-scale impacts on harbour porpoise from proposed pile driving activities in the North Sea. Report of an expert group convened under the Habitats and Wild Birds Directive – Marine Evidence Group MB0138. 38pp.

Tougaard, J., Teilmann J., Tougaard, S. (2008). Harbour seal spatial distribution estimated from Argos satellite telemetry: overcoming positioning errors. *Endangered Species Research*, 4: 113-122.

Trinder, M. (2012) *East Anglia ONE Offshore Wind Farm Lesser black-backed gull. PVA Report*. Glasgow: MacArthur Green.

Vincent, C., Ridoux, V., Fedak, M and Hassani, S. (2002). Mark-recapture and satellite tracking of rehabilitated juvenile grey seals (*Halichoerus grypus*): dispersal and potential effects on wild populations. *Aquatic mammals* 28: 121-130

Wakefield, E.D., Bodey, T.W., Bearhop, S., Blackburn, J., Colhoun, K., Davies, R., Dwyer, R.F., Green, J.A. Gremillet, D., Jackson, A.L., Jessopp, M.J., Kane, A., Langston, R.H.W., Lescroel, A., Murray, S., Le Nuz, M., Patrick, S.C., Peron, C., Soanes, L.M., Wanless, S., Votier, S.C. and Hamer, K.C. (2013) 'Space partitioning without territoriality in gannets', *Science*, 341, 68-70.

Webb, A., Dean, B.J., O'Brien, S.H., Sohle, I., McSorley, C., Reid, J.B Cranswick, P.A, Smith L.E and Hall, C. (2009) *The numbers of inshore waterbirds using the Greater Thames during the non-breeding season: an assessment of the area's potential for qualification as a marine SPA*. JNCC Report No. 374.

Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (2002). *The Migration Atlas: Movements of the Birds of Britain and Ireland*. T & AD Poyser, London.

Wright, L.J., Ross-Smith, V.H., Massimino, D., Dadam, D., Cook, A.S.C.P., and Burton, N.J.K. (2012) *Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species)*. The Crown Estate Strategic Ornithological Support Services (SOSS) report SOSS-05.

WWT. (2012) *SOSS-04 Gannet PVA Report*. Slimbridge: Wildfowl and Wetlands Trust.

WWT. (2013) *Migratory species collision risk modelling assessments*. Slimbridge: Wildfowl and Wetlands Trust.