Department of Energy & Climate Change

ENVIRONMENTAL ASSESSMENT REPORT COMPRISING:

- **HABITATS REGULATIONS ASSESSMENT**
- **TRANSBOUNDARY ASSESSMENT**
- **ASSESSMENT OF IMPACTS UPON GULLS**

***Project Title*: HORNSEA**

Date: 27 November 2014

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Preamble

This Environmental Assessment Report has been produced on behalf of the Secretary of State to analyse and document the key environmental issues for the Hornsea project.

This report provides the formal record of decisions made under Regulation 61 of the Conservation of Habitats and Species Regulations and Regulation 25 of the Offshore Habitats Regulations.

The report also contains analysis and assessment of the potential impacts of the Hornsea project upon designated sites in other European Union Member States (known as transboundary sites).

Finally, the report contains the analysis and assessment of the potential impacts of the Hornsea project upon populations of gulls in the North Sea.

1. Habitats Regulations Assessment

Introduction

1.1 This is a record of the Habitats Regulation Assessment (HRA) that the Secretary of State (SoS) for Energy and Climate Change has undertaken under the Conservation of Habitats and Species Regulations 2010 (as amended) (the Habitats Regulations) and the Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended) (the Offshore Habitats Regulations) in respect of the Development Consent Order (DCO) and Deemed Marine Licence (DML) for the proposed Hornsea Offshore Wind Farm and its associated infrastructure (the Development). For the purposes of these Regulations the SoS is the competent authority.

1.2 On 30 July 2013, SMart Wind Limited (hereafter the Applicant) submitted an application to the Planning Inspectorate (PINS), for consent under Section 37 of the Planning Act 2008 (as amended) for the construction and operation of a 1.2 GW offshore wind farm, and its associated offshore and onshore infrastructure. The offshore array, offshore substations and most of the export cable are located outside of English territorial waters (beyond 12 nautical miles of the coast) and the whole project is within the UK renewable energy zone. The Development's application is described in more detail in Section 2.

1.3 The offshore cable route extends in a south westerly direction from the Development to the proposed landfall point at Horseshoe Point in Lincolnshire. The offshore cable route is approximately 150 km in length. From Horseshoe Point the proposed onshore cable extends for 40 km to the National Grid connection point at North Killingholme in North Lincolnshire.

1.4 In England and Wales, offshore energy generating stations greater than 100 MW constitute nationally significant infrastructure projects (NSIPs) and applications for consent are subject to the requirements of the Planning Act 2008 (as amended). This Development constitutes a NSIP as it has a generation capacity of 1.2 GW.

1.5 The application was accepted by the Planning Inspectorate (PINS) on 22 August 2013 and a panel of Inspectors was appointed as the Examining Authority (ExA). The examination of the application began on 10 December 2013 and was completed on 10 June 2014. The ExA submitted its report of the examination, including its recommendation (the ExA's Report), to the SoS on 10 September 2014.

1.6 The SoS conclusions on habitats and wild birds issues contained in this HRA report have been informed by the ExA's Report, and further information and analysis, including a Report on the Implications for European Sites (RIES) and written responses to it.

1.7 Natural England (NE) is the Statutory Nature Conservation Body (SNCB) for England and for English waters within the 12 nm limit. The Joint Nature Conservation Committee (JNCC) are the SCNB beyond 12 nm however this duty has been discharged to NE following the 2013 Triennial Review of both organisations.

Legislation

1.8 Council Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive) aims to ensure the long-term survival of certain species and habitats by protecting them from adverse effects of plans and projects.

1.9 The Habitats Directive provides for the designation of sites for the protection of habitats and species of European importance. These sites are called Special Areas of Conservation (SACs) once designated at a national level. Sites that have been proposed to the European Commission but are not yet formally adopted are known as Sites of Community Importance (SCI). The Birds Directive provides for the classification of sites for the protection of rare and vulnerable birds and for regularly occurring migratory species. These sites are called Special Protection Areas (SPAs). SACs and SPAs are collectively termed European sites and form part of a network of protected sites across Europe. This network is called Natura 2000.

1.10 The Convention on Wetlands of International Importance 1972 (the Ramsar Convention) provides for the listing of wetlands of international importance. These sites are called Ramsar sites. It is UK Government policy to afford Ramsar sites in the United Kingdom the same protection as European sites.

1.11 There is significant overlap between SPA and Ramsar designations, so for the purposes of this assessment; consideration of the Ramsar designations has been undertaken in parallel with the SPA designation. All relevant species are covered by both designations.

1.12 In the UK, the Habitats Regulations transpose the Habitats and Birds Directives into national law as far as the 12 nm limit of territorial waters. Beyond territorial waters, the Offshore Habitats Regulations serves the same function for the UK's offshore marine area.

1.13 Regulation 61 of the Habitats Regulations provides that:

"…..*before deciding to give consent, permission or other authorisation for, a plan or project which is likely to have a significant effect on a European site (either alone or in combination) and which is not directly connected with or necessary to the management of the site, the competent authority must make an appropriate assessment of the implications for the site in view of the site's conservation objectives.*"

1.14 Regulation 25 of the Offshore Habitats Regulations provides that:

"…..*before deciding to give consent, permission or other authorisation for, a plan or project which is to be carried out on any part of the waters or on or in any part of the seabed or subsoil comprising an offshore marine area or on or in relation to an offshore marine installation and which is likely to have a significant effect on a European marine site (either alone or in combination) and which is not directly connected with or necessary to the management of the site, the competent authority must make an appropriate assessment of the implications for the site in view of the site's conservation objectives.*"

1.15 This Development is not directly connected with, or necessary to, the management of a European site or a European marine site. The Habitats Regulations require that, where a

project is likely to have a significant effect (LSE) on any such site, an appropriate assessment (AA) is to be carried out to determine whether or not the project will adversely affect the integrity of the site in view of its Conservation Objectives. In this document, the assessments as to whether there are LSEs, and, where required, the AAs, are collectively referred to as the HRA.

1.16 The HRA takes account of mitigation measures which are secured by requirements and conditions within both the DCO and DML.

The RIES and Statutory Consultation

1.17 Under the Habitats Regulations the competent authority must, for the purposes of an AA, consult the appropriate nature conservation body and have regard to any representation made by that body within such reasonable time as the authority specify.

1.18 The ExA, with support from PINS, prepared a RIES, based on working matrices prepared by the Applicant. The RIES documented the information received during the examination and presented the ExA's understanding of the main facts regarding the HRA to be carried out by the SoS.

1.19 The RIES was published on PINS planning portal website and circulated to interested parties on 14 May 2014 for a period of 21 days for the purposes of statutory consultation. The RIES, and the written responses to it, have been taken into account in this assessment. There were three substantive responses to the RIES consultation (from the Applicant, the Royal Society for the Protection of Birds (RSPB), and NE).

1.20 The SoS is content to accept the ExA's recommendation that the RIES, and written responses to it, represents an adequate body of information to enable the SoS to fulfil his duties in respect to European sites and species.

Information Sources

1.21 This HRA report should be read in conjunction with the following documents that provide extensive background information, the full list of documents is provided in the references:

- Planning Act 2008. Hornsea Project One. Examining Authority's report of findings and conclusions and recommendation to the Secretary of State for Energy and Climate Change. 10 September 2014;
- Report on the Implications for European Sites (RIES). Proposed Hornsea Offshore Wind Farm (Zone 4) – Project One. An Examining Authority report prepared with the support of the Environmental Services Team. May 2014;
- Environmental Statement (the ES). July 2013;
- APP 171: Habitats Regulations Assessment. July 2013;

1.22 The key information in these documents, written representations and discussions at issue specific hearings (which are available as an audio recording) are summarised and referenced in this report where used.

2. Development Description

Development Components

2.1 The offshore array is proposed to cover approximately 407 km^2 and have a maximum installed capacity of 1.2 GW. The offshore components of the Development include:

- Up to 240 three-bladed, horizontal axis wind turbines. (The original application had an upper limit of 323 turbines however this number was reduced during the Examination once the Applicant ruled out the use of 3.6 MW turbines)
- Up to 5 offshore high voltage alternating current (HVAC) collector substations
- Up to 2 high voltage direct current (HVDC) converter substations
- Inter-array cables between the turbines and the substations
- Export cables linking the substations to the landfall at Horseshoe Point, ultimately connecting to the National Grid at the North Killingholme substation.

2.2 Full details of the infrastructure to be used in the Development are detailed in Schedule A, part 1 of the DCO.

Rochdale Envelope

2.3 The Rochdale Envelope is a term used in planning to reflect that often a developer will not know all of the details associated with the proposal at the time of application. The Rochdale Envelope allows a developer to set out the broad range of options under consideration and then carry out an Environmental Impact Assessment (EIA) based on the worst case scenario for each of those options.

2.4 In this case, the precise siting of turbines within the application boundary as well as the foundation type, turbine model and certain elements of the export cable route will be determined post-consent, once detailed geotechnical seabed investigations, foundation and engineering design, economic assessments and the selection and appointment of equipment and contractors have taken place. The Applicant therefore seeks to retain flexibility in the final project design and the DCO has been framed to allow for multiple design options in accordance with the Rochdale Envelope concept. The Environmental Statement (ES) sets out these multiple options for a number of project components including indicative turbine specification (ES, 3.2: table 3.3), foundation types (ES, 3.2: table 3.10), offshore substations (ES, 3.2: table 3.14), and cable types, routes and installation methods (ES, 3.2: table 3.20).

2.5 The ES is therefore based on the assessment of a maximum adverse scenario (the realistic worst case) in environmental terms. The Development is however, bound by the DCO application boundary, which sets out areas within which the infrastructure can be located, together with various technical restrictions.

Development stages

Construction

2.6 The Applicant states in the ES that the overall construction period for the Development may occur in a single, 2 or 3 phase programme. If constructed in a single phase, the works are expected to take in the region of 5 years to complete (ES: 7.1.3). The Applicant estimates that the offshore components of the Development are likely to be constructed over a 2 to 3 year period and that construction of the onshore components of the Development will take place over 3 years, followed by commissioning (ES, 7.1.3, figure 3.30). However, this is an indicative programme that could be affected by many factors such as weather windows, vessel availability, materials and equipment lead times and the choice of contractors. The DCO contains a requirement for construction to commence within 5 years of issue.

Operation and Maintenance

2.7 The chosen offshore operation and maintenance options will depend upon a number of factors including health, safety, security and environmental legislation and best practice. Scheduled maintenance will take place year round.

Decommissioning and Repowering

2.8 At the end of the Development's design life, a decision will be made to either refurbish the Development by allowing it to extend its life by repowering it with the latest turbine technology, or to decommission it. The decision on repowering would be taken on commercial grounds, based on the performance of the wind farm and would be subject to a future consents application and a fresh assessment under the Habitats Regulations by the relevant authorities at that time. Decommissioning will take place at the end of the Development lifetime and will involve the removal of all accessible offshore installed components. It is however anticipated that the onshore cables will be left buried *in situ*, unless lifted to be replaced by new cables to be run along the same route as part of future developments or wind farm repowering.

2.9 The Development falls within the scope of the Energy Act 2004 which includes decommissioning provisions. Broadly speaking, the SoS shall require a person who is responsible for an offshore renewable energy installation to prepare a costed decommissioning programme and ensure that it is carried out. The SoS can approve, modify or reject a decommissioning programme at any point.

2.10 Decommissioning activities will need to comply with all relevant UK legislation at the time. The person(s) responsible for the wind farm will produce and agree a decommissioning programme with the Department of Energy and Climate Change (DECC) and in consultation with the Marine Management Organisation (MMO), SNCBs or their respective successors.

3. Development location and designated sites

Location

3.1 The offshore elements of the Development are located in the North Sea, 103 km off the Yorkshire coast, the eastern boundary of the site is 43.6 km from the median line between UK and Netherlands' waters. A map showing the location of the array and the offshore and onshore export cable route is given at figure 1.

European and International Sites

3.2 The UK sites listed below were included in the RIES LSE screening matrices.

- Flamborough and Filey Coast pSPA
- Flamborough Head and Bempton Cliffs SPA
- Humber Estuary SAC
- The Humber Estuary SPA and Ramsar
- Coquet Island SPA
- Farne Islands SPA
- Forth Islands SPA
- River Derwent SAC
- Berwickshire and North Northumberland Coast SAC
- The Wash and North Norfolk Coast SAC

3.3 The RIES also identified the potential for the Hornsea project to affect a number of European sites located in other countries, known as transboundary sites. Those sites are listed below. The potential impacts upon these sites are considered in more detail within the transboundary section of the report (section 11).

- SBZ 1 / ZPS 1 (Belgium) SCI
- SBZ 2 / ZPS 2 (Belgium) SCI
- SBZ 3 / ZPS 3 (Belgium) SCI
- Vlakte van de Raan (Belgium) pSCI
- NTP S-H Wattenmeer und angrenzende Küstengebiete SCI (Germany)
- Dogger Bank SCI (Germany)
- Östliche Deutsche Bucht SCI (Germany)
- Sylter Außenriff SCI (Germany)

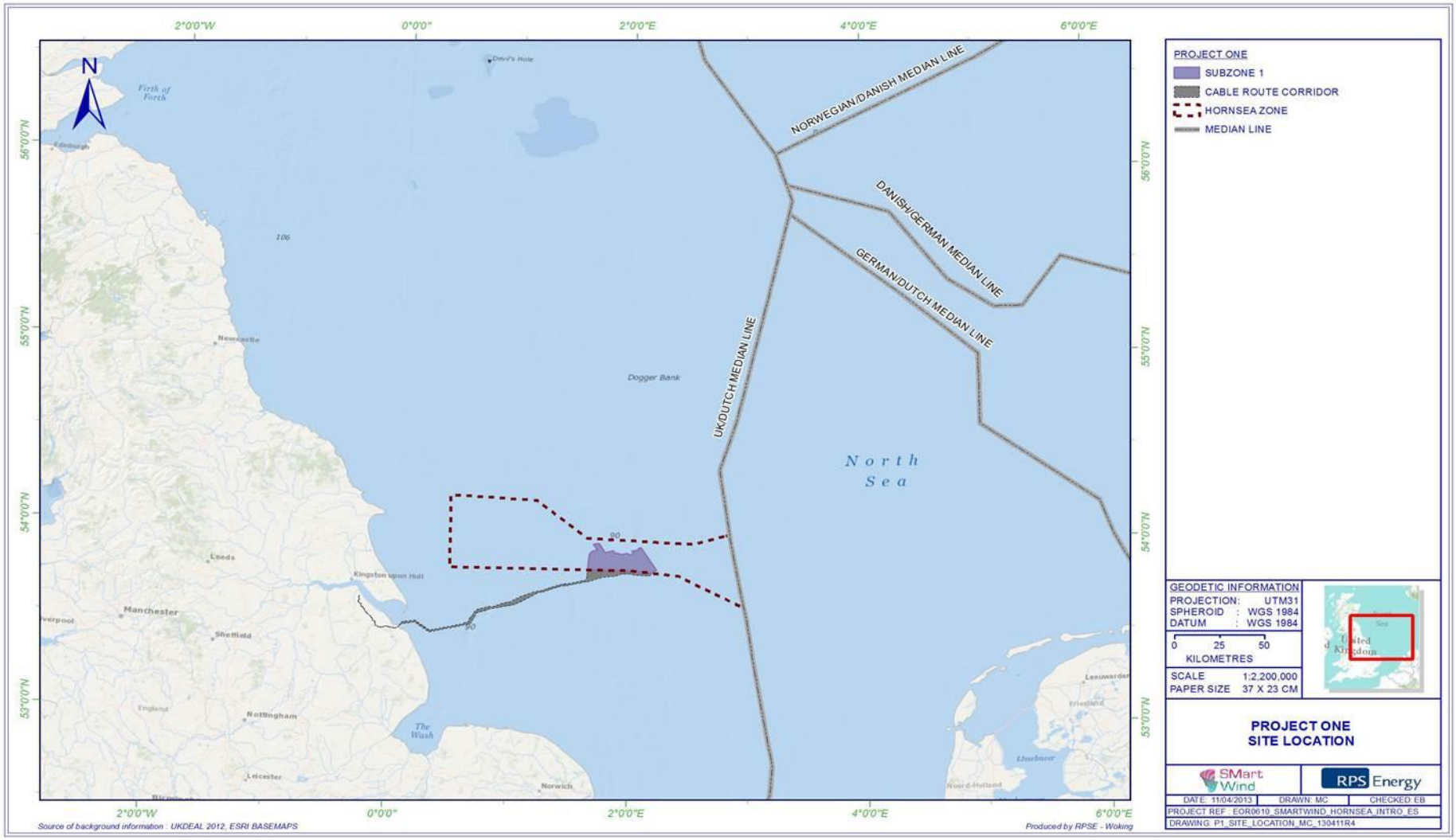
- Steingrund SCI (Germany)
- Helgoland mit Helgoländer Felssockel SCI (Germany)
- Hamburgisches Wattenmeer SCI (Germany)
- Unterelbe SCI (Germany)
- Borkum-Riffgrund SAC (Germany)
- Nationalpark Niedersächsisches Wattenmeer SCI (Germany)
- Gule Rev SAC (Denmark)
- Sydlige Nordsø SAC (Denmark)
- Falaises du Cran aux oeufs et du cap gris-nez, dunes du chatelet, marais de tardinghen et dunes de wissant pSCI (France)
- Bancs des Flandres pSCI (France)
- Recifs Gris-nez Blanc-nez pSCI (France)
- Ridens et dunes hydrauliques du detroit du pas-de-calais pSCI (France)
- Baie de canche et couloir des trois estuaries pSCI (France)
- Doggersbank pSCI (Netherlands)
- Klaverbank pSCI (Netherlands)
- Vlakte van de Raan SAC (Netherlands)
- Noordzeekustzone SAC (Netherlands)
- Noordzeekustzone II pSCI (Netherlands)

3.4 During the Examination, and following agreement between NE and the Applicant, the ExA wished to prevent duplication and focus the RIES on those sites for which a LSE cannot be excluded rather than reproducing detailed LSE matrices for all sites.

3.5 The SoS agrees that this is a sensible approach and has decided to list all of the sites for which a possible LSE was identified in Annex A. However, only the detailed analysis for those sites for which a LSE cannot be excluded is provided within the main body of this document.

3.6 For information about the reasons why a LSE was excluded from several sites, the reader is invited to refer to the published RIES for the Hornsea project. The SoS is satisfied with the decision to exclude a LSE from these sites and has adopted these conclusions for the purposes of the HRA.

Figure 1: Map of development location showing both offshore and onshore elements (taken from ES)



4 Likely Significant Effects Test

4.1 Under Regulation 61 of the Habitats Regulations (and Regulation 25 of the Offshore Habitats Regulations), the SoS must consider whether a Development is likely to have a significant effect (LSE) on a European site, either alone or in combination with other plans or projects. A LSE is, in this context, any effect that may be reasonably predicted as a consequence of a plan or project that may affect the conservation objectives of the features for which the site was designated, but excluding trivial or inconsequential effects. An AA is required if a plan or project is likely to have a significant effect on a European site, either alone or in combination with other plans or projects.

4.2 The purpose of this test is to identify LSEs on European sites that may result from the Development and to record the SoS's conclusions on the need for an AA and his reasons for screening activities, sites or plans and projects in for further consideration in the AA. For those features where a LSE is identified, these must be subject to an AA. This review of potential implications can be described as a 'two-tier process' with the LSE test as the first tier and the review of effects on integrity (AA) as the second tier.

4.3 This section addresses this first tier of the HRA, for which the SoS has considered the potential impacts of the Development both alone and in combination with other plans and projects on each of the interest features of the European sites identified in the RIES (and listed in paragraph 3.2) to determine whether or not there will be an LSE. Where there are predicted LSEs, these are described briefly in table 1. Further detail is set out in the RIES Matrices.

Treatment of decommissioning impacts

4.4 At the end of the Development's lifetime, decommissioning must take place and at that point separate authorisation will be required, as a planning matter, after the preparation of an ES and HRA (including appropriate consultation with the relevant SNCBs). It is not possible at this stage to predict with any certainty what the European and Ramsar site context of the Development will be in the future: sites may increase or decrease in importance over that time.

4.5 However, if the environmental baseline were to be similar to the current situation, then the impacts of decommissioning of the Development could be expected to be similar to the anticipated impacts of construction, without the impacts of piling. There is no reason to suppose that the impacts of decommissioning would cause an adverse effect on site integrity and on this basis, the SoS considers that it is reasonable not to include a detailed discussion on decommissioning impacts in this report. He is satisfied that decommissioning effects will be addressed fully by the relevant authorities, prior to decommissioning and in light of more detailed information on decommissioning processes and environmental conditions at that time.

Table 1. The European sites for which a LSE from the Hornsea project cannot be excluded.

Site	Feature	Effects	LSE Alone	LSE In combination
Flamborough Head and Bempton Cliffs SPA	Kittiwake (breeding and assemblage) Seabird breeding assemblage (razorbill, guillemot, herring gull, gannet and kittiwake)	Collision, Displacement	Y	Y
Flamborough Head and Filey Coast pSPA	Kittiwake (breeding and assemblage) Gannet (breeding and assemblage) Razorbill (breeding and assemblage) Guillemot (breeding and assemblage) Puffin (assemblage) Herring gull (assemblage) Fulmar (assemblage)	Collision, Displacement	Y	Y
Humber Estuary SPA	Bar-tailed godwit (winter and assemblage) Golden plover (winter and assemblage) Dunlin (winter/passage and assemblage) Knot (winter/passage and assemblage) Redshank (winter/passage and assemblage) Dark-bellied brent goose (assemblage) Sanderling (assemblage) Ringed plover (assemblage) Oystercatcher (assemblage)	Habitat extent, Disturbance, Displacement	Y	Y
Humber Estuary Ramsar site	Bar-tailed godwit (winter and assemblage) Dunlin (winter/passage and assemblage) Knot (winter/passage and assemblage) Waterbird assemblage Dune systems and humid dune slacks Intertidal mud and sand flats Saltmarshes Sea lamprey (*Petromyzon marinus*) River lamprey (*Lampetra fluviatilis*) Grey seal (*Halichoerus grypus*)	Habitat extent, Disturbance, Displacement, Habitat loss, Water quality, Collision risk, Barrier effect, Change in prey abundance and distribution	Y	Y
Humber Estuary SAC	Estuaries Mudflats and sandflats not covered by seawater at low tide Salicornia and other annuals colonising mud and sand Atlantic salt meadows (Glauco-Puccinellietalia maritimae) Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* (‘white dunes’) Sea lamprey (*Petromyzon marinus*) River lamprey (*Lampetra fluviatilis*) Grey seal (*Halichoerus grypus*)	Habitat loss, Water quality, Collision, Changes in prey abundance and distribution	Y	Y

Likely significant effects: development alone

4.6 The information within the RIES present the potential interactions of each stage of the Development (construction, operation, decommissioning) with the qualifying features of those 10 sites listed in paragraph 3.2.

4.7 The RIES reported that a LSE could occur at 5 different sites as shown in table 1. These sites were taken forward to consider whether the Hornsea project will result in an adverse effect upon the integrity (section 5).

4.8 The SoS agrees with the ExA, he is unable to exclude a LSE from the 5 sites identified in table 1 when the impacts of the Hornsea project are considered alone.

Likely significant effects: in combination

Scope of in combination assessment

4.9 Under the Habitats Regulations, the SoS is obliged to consider whether other plans or projects in combination with the Hornsea project might affect European sites. In this case there are a number of other plans and projects which could potentially affect some of the same European sites. These include a number of planned and existing offshore wind farms within the vicinity of the Hornsea project (see table 2) and a number of projects expected to affect coastal habitats because of works to lay cables, pipelines or improve sea defences.

4.10 As different projects are at different stages of development, there are variable levels of information and certainty available on the predicted environmental impacts. For this reason the in combination plans and projects have been grouped according to their development status. This grouping was initially undertaken by the Applicant (using a 3 tier approach) however following representations from NE and JNCC at the first issue specific hearing the Applicant confirmed it would adopt the NE/JNCC approach (a 6 tier approach).

4.11 By grouping the projects, as shown in table 2, the Applicant (and therefore the ExA and the SoS) was able to place greater weight on those which were operational, under construction or consented and less weight on projects in planning for which there are variable amounts of information available.

4.12 To undertake the in combination assessment, 2 methods were used and tested during the Examination; the 'building block' approach and the 'all projects' approach. NE and the RSPB requested that the Applicant undertake the in combination assessments using both methodologies to enable the ExA and the SoS to view the full range of expected impacts.

4.13 The 'building block' approach assesses the cumulative impacts of each project up to and including the Hornsea project (projects in tiers 1, 2, 3, and 4 up to Hornsea). The 'all projects' approach considers the cumulative impacts of all of the projects in tiers 1 to 5.

4.14 Whilst the Hornsea decision has been with the SoS, the Dogger Bank Creyke Beck Offshore Wind Farm Examination has concluded. The SoS therefore considers that there is sufficient publicly available information, which has been tested during Examination, to include the Creyke

Beck project within the building block approach for the in combination assessment. For the purposes of this HRA, the building block approach will therefore be extended beyond what was included within the Examination to include all of the projects in tiers 1, 2, 3, and 4 (as shown in table 2).

Table 2: Plans and projects with the potential for in combination impacts, grouped into tiers according to methodology advocated by NE and JNCC. (Source: ExA report). Also provided are the 2 projects considers to have an in combination impact for the intertidal cabling works.

Tier	Description of tier	Agreed list of projects in tier
1	Built or operational projects, which have not been included within the environmental characterisation survey	Greater Gabbard Gunfleet Sands Lynn and Inner Dowsing Sheringham Shoal Thanet Lincs Kentish Flats Kentish Flats Extension Egmond aan Zee London Array
2	Projects under construction	Teeside Humber Gateway Westermost Rough
3	Projects that have been consented (but construction has not yet commenced)	Dudgeon Galloper[1] Race Bank Aberdeen Offshore Wind Development Centre Triton Knoll Moray Firth Beatrice
4	Projects that have an application submitted to the appropriate regulatory body that have not yet been determined	East Anglia One Hornsea Project One Dogger Bank Creyke Beck Neart na Gaoithe[2] Seagreen Alpha[2] Seagreen Bravo[2] Inch Cape[2]
5	Projects that a regulatory body is expecting that have not yet been determined	Hornsea Project Two Dogger Bank Teeside A&B
6	Projects that have been identified in relevant strategic plans	
Tetney to Saltfleet tidal flood defence scheme		
Phillips 66 Tetney Sealine replacement project		

4.15 The SoS considers that there is insufficient information available for the Dogger Bank Teeside A & B and the Hornsea project 2 developments to be included within the building block assessment. The in combination impacts of these projects will be considered using the 'all projects' approach.

[1] Since the closure of the Examination, RWE has decided to not continue with the Galloper offshore wind farm development in its current form, however as it remains a consented project it will continue to be included within the in combination assessment.
[2] These projects were consented by the Scottish Government on the 10 October 2014.

4.16 During the Examination, there was some discussion between the Applicant and NE regarding the status of 4 Scottish offshore wind projects (Neart na Gaoithe, Seagreen Alpha, Seagreen Bravo and Inch Cape), and how the environmental assessment should take into account the likely impacts of these developments. As the Scottish Government's decision on these projects was due after the Examination closed (in June or July 2014), NE advised that these projects should be considered within tier 3. As the Examination progressed, it was agreed between the Applicant and NE that the impacts of those 4 Scottish projects would be included in the 'building block' assessment in tier 4.

4.17 On the 10 October 2014 (whilst the Hornsea application has been with the SoS), the Scottish Government has granted consent for the Neart na Gaoithe, Seagreen Alpha, Seagreen Bravo and Inch Cape projects to be constructed.

Likely significant effect: In combination assessment

4.18 The matrices in the RIES consider the potential impacts of the Hornsea project in combination with other plans and projects and considers whether there is the potential for a LSE on the qualifying features of the 35 sites listed in Annex A.

4.19 The potential for a LSE was identified for a range of interest features at 5 sites (see table 1).

4.20 The SoS agrees with the ExA's conclusions, he is unable to exclude a LSE from the 5 sites identified in table 1 when the impacts of the Hornsea project are considered in combination with other plans and projects.

Conclusions on Likely Significant Effects

4.21 The SoS considers that sufficient information has been provided to inform a robust assessment in line with his requirements under the Habitats Regulations.

4.22 On the basis of the information supplied by the RIES and the responses to that document, the ExA concludes that the Hornsea project is likely to have a significant effect upon the sites (and features) listed in table 1.

4.23 The SoS is satisfied to rely on the recommendations of the ExA, the RIES, and written responses to it to inform his view. He considers that the evidence behind these judgements has been fully tested as part of the examination process. Having given due consideration to the information and analysis presented to him, the SoS is in agreement with the ExA and considers that it is these sites and features for which LSE could not be excluded that are relevant to his AA.

4.24 The SoS agrees with the ExA that there are no other LSEs on any of the other interest features of the 35 sites listed in Annex A as a result of the Development, either alone or in combination with other plans or projects.

5 Appropriate Assessment

Test for Adverse Effect on Site Integrity

5.1 The requirement to undertake an AA is triggered when a competent authority, in this case the SoS, determines that a plan or project is likely to have a significant effect on a European site either alone or in combination with other plans or projects. Guidance issued by the European Commission states that the purpose of an AA is to determine whether adverse effects on the integrity of the site can be ruled out as a result of the plan or project, either alone or in combination with other plans and projects, in view of the site's conservation objectives (European Commission, 2000).

5.2 The purpose of this AA is to determine, in view of the site's conservation objectives and using the best scientific evidence available, whether or not adverse effects on the integrity of those sites and features identified during the LSE test can be ruled out as a result of the Development alone or in combination with other plans and projects.

5.3 If the competent authority cannot ascertain the absence of an adverse effect on site integrity within reasonable scientific doubt, then under the Habitats Regulations, alternative solutions should be sought. In the absence of an acceptable alternative, the project can only proceed if there are imperative reasons of overriding public interest (IROPI) and suitable compensation measures identified. Considerations of IROPI and compensation are beyond the scope of an AA.

Conservation Objectives

5.4 Guidance from the European Commission indicates that disturbance to a species or deterioration of a European site must be considered in relation to the integrity of that site and its conservation objectives (European Commission, 2000). Section 4.6.3 of that guidance defines site integrity as:

"…the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified."

5.5 Conservation objectives outline the desired state for a European site, in terms of the interest features for which it has been designated. If these interest features are being managed in a way which maintains their nature conservation value, they are assessed as being in a 'favourable condition'. An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation (English Nature, 1997).

5.6 There are no set thresholds at which impacts on site integrity are considered to be adverse. This is a matter for interpretation on a site-by-site basis, depending on the designated feature and nature, scale and significance of the impact.

5.7 Conservation objectives have been used by the SoS to consider whether the Hornsea project has the potential to have an adverse effect on a site's integrity, either alone or in combination with other plans and projects.

5.8 The potential for the Hornsea project to have an adverse effect is considered for each site in turn.

6 Flamborough and Filey Coast pSPA

6.1 The Flamborough and Filey Coast potential SPA (pSPA) is located on the Yorkshire coast between Bridlington and Scarborough. The cliffs of Flamborough Head rise to 135 metres and are composed of chalk and other sedimentary rocks. The site supports large numbers of breeding seabirds including kittiwake, *Rissa tridactyla,* and auks (guillemot, *Uria aalge*; razorbill, *Alca torda;* and puffin, *Fratercula arctica*), as well as the only mainland-breeding colony of gannet, *Morus bassanus,* in the UK. The seabirds feed and raft in the waters around the cliffs, outside the SPA, as well as feeding more widely in the North Sea. The intertidal chalk platforms are also used as roosting sites, particularly at low water and notably by juvenile kittiwakes. The pSPA covers a total area of 8039.6 ha.

6.2 Between 20 January 2014 and 14 April 2014 (during the Examination), NE held a formal public consultation on the designation of the Flamborough and Filey Coast pSPA. This pSPA, if confirmed by the Secretary of State for the Environment, Food and Rural Affairs, would represent a geographical extension to the existing Flamborough Head to Bempton Cliffs SPA (described in section 7) and add several species to the formal citation.

6.3 It is Government policy to treat pSPAs as if they were a fully designated European site under the Habitats Regulations. As such, the SoS considers it important to consider the potential impacts of the Development, both alone and in combination with other plans or projects, upon this potential site.

6.4 The pSPA consists of the following proposed changes to the existing Flamborough Head to Bempton Cliffs SPA:

- A landward extension to the north west of the existing site to incorporate important breeding colonies of seabirds.
- Marine extensions out to 2 km to protect the waters which are important to these species of breeding birds.
- Modification of the landward boundary such that the features of the pSPA are protected in the future
- Addition of the following migratory features to the pSPA citation; northern gannet (*Morus bassanus)*, common guillemot (*Uria aalge)*, razorbill (*Alca torda*) and incorporates an update to the published population figures for migratory black-legged kittiwakes (*Rissa tridactyla*).

6.5 It should be noted that there are currently no conservation objectives available for the Flamborough and Filey Coast pSPA. In order to undertake his assessment in line with the Habitats Regulations, the SoS has assumed that the new conservation objectives will be broadly similar to that at the current Flamborough Head to Bempton Cliffs SPA (as shown in table 3) but applicable to the additional species (listed in 6.4).

Table 3: Conservation objectives for the Flamborough Head and Bempton Cliffs SPA, these form the basis for assessing the impacts of the Hornsea project upon the Flamborough and Filey Coast pSPA.

Conservation Objectives	Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive. Subject to natural change, to maintain or restore: ➢ The extent and distribution of habitats of the qualifying features ➢ The structure and function of the habitats of the qualifying features ➢ The supporting processes on which the habitats of the qualifying features rely ➢ The distribution of the qualifying features within the site The qualifying features to which the conservation objectives refer are: ➢ Black-legged kittiwake (*Rissa tridactyla*) (breeding) ➢ Northern gannet (*Morus bassanus*) ➢ Seabird assemblage

6.6 A likely significant effect upon the interest features of the site was identified by the ExA because of the potential for the Hornsea project, both alone and in combination with other plans and projects, to increase collision mortality and displacement mortality rates. The potential for these impacts to constitute an adverse effect on integrity are considered for each species in turn.

Gannets: alone

6.7 The Flamborough and Filey Coast pSPA support an important breeding population of gannets. The population has grown rapidly since the 1980's when only a few hundred breeding pairs were present; estimates of numbers in 2012 were 11,061 pairs or 22,122 breeding individuals (JNCC Seabird Colony Register Counts).

6.8 It is estimated that the UK population of gannets is 440,000 individuals (Baker *et al,* 2006), with a global population of 610,000 (Tucker *et al,* 2004). In the UK, the gannet population is concentrated in northern Scotland, and whilst they are widely distributed in English seas during winter, the only breeding colony in England is at Bempton Cliffs.

6.9 A likely significant effect upon gannets was identified due to the potential for the Hornsea project to increase the risk of operational collision mortality both alone and in combination with other plans and projects.

Operational Collision Risk

6.10 There are two parts to estimating collision mortality. The first is to understand the number of birds passing through the swept area of the turbines within the Offshore Wind Farm (OWF). This is determined by calculating the number of birds which are likely to be passing through OWF and then factoring in the heights above sea level at which various species fly at to determine the numbers of birds at collision risk height. This calculation is done using a mathematical model, the Band model being the most commonly used.

6.11 There are several different versions of the Band model which use bird flight height in different ways to produce different estimates of collision risk. Band models options 1 and 2 (known as the basic Band model) assume that all individuals of a species of bird fly at the same height. For Band model option 1, that height is determined by aerial or *in situ* boat surveys. For Band model option 2, that height is based on published literature from Cook *et al* (2012). Band models options 3 and 4 (known as the extended Band model) use detailed flight height data to calculate the proportional risk to a bird according to its location within the swept rotor space. The rationale being that if a bird is closer to the nacelle then it is at greater risk of collision than if at the edge of the blade. Band model option 3 uses flight height data published in Cook *et al*, 2012. Band model option 4 builds on the assumptions of Band model option 3, but uses site specific flight information gathered during survey work to generate a flight height distribution.

6.12 The second step in estimating collision mortality is to define the percentage of birds that are likely to make a behavioural response to the presence of a wind farm (or to an individual turbine) so as to avoid flying on a path that puts them at risk of collision with the rotating turbine blades. This is known as the avoidance rate (AR). The choice of AR has a significant influence on the number of predicted collisions (see table 4 for an example of how choice of AR can make a significant difference to predicted impacts). The overall AR will be the result of a combination of factors including macro-avoidance (of the whole wind farm, by diverting over or around it) and micro-avoidance (ability to avoid collision with a turbine blade once within a wind farm). In practice, the actual AR for any given location will also be affected by site-specific and temporal variations, including the layout of turbines, weather and visibility, whether the birds are foraging or migrating and also whether they are part of a large flock.

6.13 Whilst collision AR can be generic, where essentially the same rate of turbine blade avoidance is assumed for a wide range of bird species, irrespective of any behavioural assumptions or empirical observations, it can also be tailored to a species or group of species on the basis of qualitative assessments (taking known behaviours including manoeuvrability into account) and empirical data (such as surveys of actual bird behaviours for example blade avoidance, or mortality impacts evidenced by recovered dead bird counts). Species-specific AR have been developed by Scottish Natural Heritage to take into account factors such as the behaviour patterns, reactions, size and agility of different bird species (Scottish Natural Heritage, 2010).

6.14 On the 25 November 2014, the SNCBs published their responses to the Marine Scotland Science report (Cook *et al*, 2014). The Marine Science Scotland report was commissioned to provide a review of the evidence used to determine avoidance rates for use in CRM for five priority species (kittiwakes, gannets, herring gulls, LBBG and GBBG) and make appropriate recommendations as to which AR and which version of the Band Model should be used to undertake CRM.

6.15 The SNCBs in general supported the conclusions of the report, agreeing a range of ARs for the basic Band model (options 1 and 2) and for specific species (gulls) the use of the extended

Band model (options 3 and 4) (Joint response from the SNCBs to the Marine Scotland Science avoidance rate review, 2014).

6.16 Although Cook *et al* (2014) was not published in time to be considered during the Hornsea Examination, the SoS recognises that this is an important addition to the evidence base and therefore wishes to ensure that the conclusions reached within the AA are consistent with the latest position of the SNCBs.

6.17 Once the number of birds expected to collide with the wind turbines have been calculated, the next step is to determine what impact that will have on the species population on a recurring annual basis. There are several methods of doing this; the Applicant has primarily used Potential Biological Removal (PBR) analysis to calculate this but has used Population Viability Analysis (PVA) for some European sites where sufficient data was available.

6.18 PBR analysis quantifies the potential level of additional mortality which could occur on an annual basis without resulting in a long term population decline. One of the key parts of the PBR calculation is determining what the recovery factor (f value) for a species is. This value (ranging between 0.1 and 1.0) is intended to compensate for the inherent uncertainties present when making estimates about impacts upon a population. A recovery factor of 0.1 is often used for endangered species/populations where the risks of getting a prediction wrong would have serious consequences for that species/population.

6.19 During the Examination, there was considerable discussion between the Applicant, NE and the RSPB about which version of the Band model was appropriate for use with the Hornsea project and which ARs should be used to undertake the collision risk modelling (CRM).

6.20 The Applicant wished to use 2 different Band model options for its CRM. For those species which were considered to be most at risk of collision (gannet, kittiwake, lesser black backed gull and greater black backed gull), the Applicant wished to used Band model option 4. For all other species (including razorbills, puffins and guillemots), the Applicant felt that Band model option 1 was appropriate.

6.21 NE and the RSPB did not support the use of the Extended Band model (options 3 and 4) as they felt that its use had not been validated and that there were problems with choosing appropriate ARs.

6.22 Following the representations made by NE and the RSPB, and a request from the ExA, the Applicant provided a number of clarification notes which contained estimates of collision mortality for the various species, using the various Band model options and at different ARs. The estimates produced for gannets are provided in table 4.

6.23 The Applicant's preference was to apply an AR of 98 % to Band model option 4 to generate a collision risk mortality estimate of 9 gannets. Whilst NE had some concerns about the methodology (preferring an AR of 98 % and the use of Band model option 1 resulting in a mortality estimate of 28 gannets), both parties agreed that the predicted mortality levels were well within the estimated PBR thresholds (both the Applicant's estimate of 452 (f value = 0.5)

and NE's estimate of 362 (f value = 0.4)). Therefore NE agreed that there would not be an adverse effect upon integrity upon the Flamborough and Filey Coast pSPA when the project's impacts are considered alone.

Table 4. The predicted collision mortality rates for the Hornsea project (alone) upon gannets from the Flamborough and Filey Coast pSPA.

	Band Option 1			Band Option 2			Band Option 3			Band Option 4		
Avoidance Rate	98	99	99.5	98	99	99.5	98	99	99.5	98	99	99.5
Gannet collision mortality	28	14	7	20	10	5	17	8	4	9	4	2

6.24 On this basis, the ExA was satisfied that there would not be an adverse effect upon the gannet interest feature of the Flamborough and Filey Coast pSPA when the impacts of the Hornsea project are considered alone.

6.25 The SoS has considered the representations made by both the Applicant, NE and the RSPB and the recommendation as made by the ExA. The SoS recognises that an AR of 99 % has been adopted for gannets in the considerations for the Triton Knoll AA, the EA One AA and the Rampion AA. Given the available evidence (Krijgsveld *et al* 2011) which documents greater avoidance of OWFs by gannets than for many other species and estimates an overall avoidance rate of 99.1 % for this species, the SoS is of the opinion that the use of an avoidance rate of 99 % for gannets is appropriate for this species.

6.26 This AA has used a 99 % AR for gannets; however following the publication of the Cook *et al* (2014) report, the SNCBs have formally endorsed the use of a 98.9 %. The SoS accepts that the use of a 99 % AR in this AA is less precautionary than has been endorsed by the SNCBs. However given that this equates to the mortality of an additional 1 gannet for every 1000 birds at risk, the SoS is satisfied that this additional mortality (from using a 99% AR rather that a 98.9 % AR) will not result in an adverse effect on the integrity on any of the European sites potentially affected by the Hornsea project either alone or in combination with other plans and projects.

6.27 On this basis, the SoS considers that the predicted collision mortality (14 gannets, based on a 99 % AR using Band model option 1) from the Hornsea project alone to be below the level (estimated at being between 362 and 452 birds) at which the gannet population would suffer a long term decline. The SoS is therefore satisfied that the potential increased collision impacts upon gannets as a result of the Hornsea project alone would not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

Gannets: in combination

6.28 Undertaking the in combination assessment is made more complicated because different plans and projects have estimated gannet mortality using different approaches. In order to be able to

compare the impacts between the various different projects (which may have individually estimated gannet mortality in different ways), NE requested that the Applicant provided the in combination assessment in a 'common currency'.

6.29 NE had a number of concerns about the Applicant's methodology including the ordering of projects and the use of a 98 % AR. To that end, NE provided their own in combination assessment which they submitted during the East Anglia One Examination. The results of both the Applicant's and NE's assessments of the in combination impacts are provided in table 5.

Table 5. The estimated gannet collision mortality[3] from the Flamborough and Filey Coast pSPA as a result of the Hornsea project in combination with other plans and projects[4]. Figures are produced using the Band model option 1 at a range of ARs.

Avoidance Rate	98 %	99 %	99.5 %
Applicant building block (up to Hornsea)		115 - 127	57 – 64
Applicant all projects		157 - 169	78 – 85
NE building block (up to Hornsea)	281 - 565		
NE all projects	400 - 800		

6.30 The PBR thresholds for gannets from the Flamborough and Filey Coast pSPA are estimated at being 452 birds per year (the Applicant's view; f value = 0.5) and 362 (NE's view; f value = 0.4).

6.31 NE advised that an adverse effect upon integrity upon the Flamborough and Filey Coast pSPA could not be excluded when a 98 % AR is used either with the building block or the all projects approach are included within the assessment as this would breach the PBR threshold of 362 birds. However, NE recognised that if the collision risk mortality estimates were based upon a 99 % AR and the building block approach (115-127 birds), then an adverse effect upon site integrity could be excluded as it would not exceed the PBR threshold (362 birds).

6.32 The ExA agreed that there was not likely to be an adverse effect upon integrity upon the Flamborough and Filey Coast pSPA. It rejected the use of a 98 % AR as being too precautionary, instead advocating the use of a 99 % AR when using the Band model option 1 approach. The ExA also expressed concerns about including the impacts of projects in subsequent tiers (the 'all projects' approach) which are potentially subject to high variability. The ExA noted that these subsequent projects will also require their own HRA and could not be lawfully consented if an adverse effect on integrity could not be excluded.

6.33 On the basis that the predicted mortality of gannets (115-127 birds based on Band model option 1 at a 99 % AR) is below the PBR threshold (between 362 and 452 gannets), the SoS concludes that the in combination impacts of the Hornsea project (using the building block

[3] The range of estimated mortality rates is a reflection of the uncertainty associated with the potential impacts of other projects.
[4] Using the building block approach and considering all projects up to and including Hornsea.

approach for projects up to Hornsea) will not have an adverse effect upon the integrity upon the Flamborough and Filey Coast pSPA.

6.34 As discussed in paragraph 4.14, the SoS considers it important to include the impacts of the Creyke Beck project within in combination (building block) assessment for Hornsea. The RIES produced for the Creyke Beck project referenced NE's updated Supplementary Ornithological Expert Report (SOER, 07 July 2014). This report summarised NE's final position on the project's impacts upon the interest features of the Flamborough and Filey Coast pSPA. In their SOER, NE's view was that the potential gannet mortality rate of 171 birds (basic Band model, 99 % AR) as a result of the potential impacts from the Creyke Beck development in combination with other plans and projects would not constitute an adverse effect on integrity on the Flamborough and Filey pSPA as the mortality rate is below the level (PBR f value of 0.4) at which gannets would suffer a long term decline.

6.35 The SoS is therefore satisfied that the impacts of the Hornsea project in combination with other plans and projects (using the building block approach and including all projects in tiers 1-4) will not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.36 The SoS considers that it is not appropriate to consider future projects in the 'all projects' approach because of the significant levels of uncertainty associated with both the scale of future projects and their associated impacts.

6.37 The SoS notes that future projects could not be lawfully consented should they be unable to demonstrate that they will not result in an adverse effect upon the integrity of a European site. The SoS is therefore satisfied that the in combination impacts of future projects will be fully assessed at a later stage when they are being considered for consent.

Kittiwakes: alone

6.38 As with the gannets, a likely significant effect upon the kittiwake interest feature was identified because of the potential for the Hornsea project, both alone and in combination with other plans and projects, to increase the risk of collision mortality.

6.39 There was considerable discussion during the Examination about the potential impacts upon kittiwakes from the Flamborough and Filey Coast pSPA and the various parameters available to estimate CRM.

6.40 The first area of disagreement centred on the size of the kittiwake population at the Flamborough and Filey Coast pSPA. This is an important aspect as it is used to determine the baseline population and the overall kittiwake population trend. The disagreement focussed on the counts of the kittiwake population at the Flamborough cliffs in 1979 (which recorded 83,000 pairs of birds) and 1986 (83,700 pairs). The mean count (2008-2011) used to classify the SPA/pSPA was 44,502 pairs. If the 1986 count is valid, then it shows that the kittiwake population has substantially decreased in size over the last 30 years.

6.41 The Applicant disputed the 1979 and 1986 counts; they used expert testimony from Dr John Coulson to claim that this count significantly overestimated the numbers of kittiwakes by incorrectly reporting the numbers of individuals as the number of pairs. The Applicant stated that in fact the kittiwake population in the late 1970's and 1980's was more likely to be in the region of 41,500 pairs.

6.42 During the Examination, NE and JNCC produced the original count methodology and site description which they believed demonstrated sufficient evidence to justify the counts as being accurate and robust.

6.43 The ExA, having heard both sides of the argument, decided to support the Applicant's position, finding Dr Coulson's testimony to be particularly persuasive. This left the ExA with considerable doubt as to the accuracy of the counts and as such the ExA did not attach significant weight to the reported population fluctuations.

6.44 The kittiwake population trend is important as it helps to determine the f value when undertaking PBR analysis. NE's view was that as the population has experienced a significant decline in recent decades the f value should be 0.1. The Applicant, who doubted the significance of the population declines (for the reasons outlined in paragraph 6.40), advocated a less precautionary f value of 0.2. The differences in opinion resulted in 2 different estimates of the PBR, the Applicant estimated this figure to be 1023 birds, and NE estimated the PBR figure as being 512 birds.

6.45 As with the gannets, there was also a disagreement over how to model the collision mortality rates. The Applicant's view was that the use of the Extended Band model and a 98 % AR was their preferred option but if the Basic Band model was going to be used instead, then it should be used with a 99.5 % AR. NE disagreed, stating that in their view only a 98 % AR should be used with the Basic Band model. NE did note that a higher AR might be appropriate for kittiwakes but that further evidence was required to support and justify this.

6.46 The Applicant produced kittiwake mortality estimates based on all of the different Band model options and ARs, the outputs of that modelling are shown in table 6 below.

Table 6. The predicted collision mortality estimates from the Hornsea project (alone) upon kittiwakes from the Flamborough and Filey Coast pSPA.

	Band Option 1			Band Option 2			Band Option 3			Band Option 4		
Avoidance Rate	98	99	99.5	98	99	99.5	98	99	99.5	98	99	99.5
Kittiwake collision mortality	110	55	28	231	116	58	48	24	12	10	5	3

6.47 It is clear from table 6 that regardless of which AR and Band model option is chosen, the estimated kittiwake collision mortality will not be higher than either the Applicant's estimated PBR threshold (1023) or NE's estimate (512). On this basis, NE was sufficiently satisfied with

the outcome to advise that the Hornsea project alone would not have an adverse effect upon the integrity of the Flamborough Head and Filey Coast pSPA.

6.48 On this basis, the ExA was satisfied that there would not be an adverse effect upon the kittiwake interest feature of the Flamborough and Filey Coast pSPA when the impacts of the Hornsea project are considered alone.

6.49 The SoS has considered the representations made by the Applicant, NE and the RSPB and the recommendation as made by the ExA. The SoS is of the view that the use of an avoidance rate of 98 % for kittiwake is appropriate for this species.

6.50 On this basis, the SoS considers that the predicted collision mortality (110, based on a 98 % AR using Band model Option 1) from the Hornsea project alone to be below the level (estimated at being between 512 and 1023 birds) at which the kittiwake population would suffer a long term decline. The SoS is therefore satisfied that the potential increased kittiwake collision mortality as a result of the Hornsea project alone would not represent an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.51 The recent SNCB response to Cook *et al* (2014) has since advocated the use of a higher avoidance rate (98.9 %) for kittiwakes than has been used by the SoS within this AA (98 %). The SoS therefore remains satisfied that the conclusions reached within the AA in respect to this species are still appropriate.

Kittiwake: In combination

6.52 As with the gannets, in order to assess the in combination impacts of the project the Applicant produced a 'common-currency' approach. The results of the Applicant's work are shown in table 7. As with the gannets, estimates were produced for ARs of both 99 % and 99.5 % and for the 'building block' and 'all projects' approaches. NE raised several concerns with the approach used by the Applicant, not least that they did not estimate mortality using a 98 % AR, and as such NE produced their own estimates (also provided in table 7).

Table 7. The estimated kittiwake collision mortality (using Band model option 1) from the Flamborough and Filey Coast pSPA as a result of the Hornsea project in combination with other plans and projects[5].

Avoidance Rate	98 %	99 %	99.5 %
Applicant building block (up to Hornsea)		143.5 – 159.5	71.5 - 79
Applicant all projects		682 - 698	341 - 349
NE building block (up to Hornsea)	357 – 472		
NE all projects	759 - 874		

[5] Using the building block approach and considering all projects up to and including Hornsea

6.53 Following their calculations, NE was satisfied that the predicted kittiwake mortality level using the building block approach (357-472 birds based on Band model option 1 and a 98 % AR) would be below the PBR threshold of 512 birds (f value = 0.1). On this basis, NE advised that there would not be an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.54 However, NE could not provide the same advice when considering the in combination impacts using the 'all projects' approach, as the predicted level of mortality (759-874 kittiwakes based on Band model option 1 and a 98 % AR) would be significantly higher than their predicted PBR threshold (512 birds). NE therefore advised that in this scenario an adverse effect upon integrity upon the Flamborough and Filey Coast pSPA could not be excluded.

6.55 The ExA considered a 98 % AR for Band model option 1 to be over-precautionary, rejecting the advice from NE. The ExA also considered there to be too much uncertainty associated with the status (and impacts) of future projects and as such rejected the 'all projects' approach in favour of the 'building block' approach.

6.56 The ExA concluded that there would not be an adverse effect upon the integrity upon the Flamborough Head and Filey Coast pSPA from the Hornsea project, either alone or in combination with other plans and projects (using the building block approach).

6.57 The SoS has carefully considered all of the representations and the recommendations made by the ExA. The SoS considers that the Hornsea project, in combination with other plans and projects (using the building block approach and including projects up to Hornsea), will not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA as the estimated cumulative kittiwake mortality level (between 357-472 birds based on Band model option 1 and a 98 % AR) is lower than can be sustainable removed (512 birds; f value = 0.1)) without affecting the population in the long term.

6.58 The SoS notes the disagreement between the SNCBs and the Applicant regarding the size and trend of the kittiwake population at the Flamborough and Filey Coast pSPA. Given the disagreement between expert witnesses on this matter, the SoS considers it appropriate to take a precautionary approach. The SoS has therefore based his decision on the original count records of the kittiwake population (i.e. that the site was used by approximately 80,000 pairs of birds) at the Flamborough Cliffs site. On this basis, the SoS is satisfied that the potential kittiwake collision mortality rates are below the estimated PBR threshold produced using the most precautionary estimate of population trend (512 birds; f value = 0.1).

6.59 As discussed in paragraph 4.14, the SoS considers it important to include the impacts of the Creyke Beck project within in combination (building block) assessment for Hornsea. The RIES produced for the Creyke Beck project referenced NE's updated Supplementary Ornithological Expert Report (SOER, 07 July 2014). This report summarised NE's final position on the project's impacts upon the interest features of the Flamborough and Filey Coast pSPA. In their SOER, NE's view was that the potential kittiwake mortality rate of 392 birds (basic Band model,

98 % AR) as a result of the potential impacts from the Creyke Beck development in combination with other plans and projects would not constitute an adverse effect on integrity on the Flamborough and Filey pSPA as the mortality rate is below the level (PBR f value of 0.1) at which gannets would suffer a long term decline.

6.60 The SoS is therefore satisfied that the impacts of the Hornsea project in combination with other plans and projects (using the building block approach and including all projects in tiers 1-4) will not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.61 The SoS considers that it is not appropriate to consider future projects in the 'all projects' approach because of the significant levels of uncertainty associated with both the scale of future projects and their associated impacts.

6.62 The SoS notes that future projects could not be lawfully consented should they be unable to demonstrate that they will not result in an adverse effect upon the integrity of a European site. The SoS is therefore fully satisfied that the in combination impacts of future projects will be fully assessed at a later stage when they are being considered for consent.

Auks (guillemot, razorbill and puffin): alone

6.63 The latest (2013) counts of auks at the Flamborough and Filey Coast pSPA were recorded as being 41,607 guillemots, 10,570 razorbills and 490 puffins.

6.64 The Hornsea project poses a risk to the auks from the Flamborough and Filey Coast pSPA due to the effects of displacement rather than collision. Furness *et al* (2013) reported that guillemots, razorbills and puffins are relatively prone to disturbance/displacement effects in comparison with other seabirds (listed 11, 12 and 17, out of the 38 species assessed, respectively).

6.65 The magnitude of this impact was sufficient enough for it to constitute a likely significant effect upon the pSPA. Those auks that are displaced from the wind farm site and the surrounding area are likely to suffer from increased mortality as they will need to compete with other birds for scarcer resources. It is the magnitude of that mortality which will determine whether the project will result in an adverse effect upon the species.

6.57 There is a two-stage process to evaluating the magnitude of the displacement effects. First, it must be determined what proportion of the site's population which will be displaced. Then secondly; the proportion of those individuals that will suffer mortality as a result of density-dependent effects needs to be modelled.

6.58 To estimate the abundances of birds using the project site, the Applicant surveyed the proposed project site plus a 1 km buffer zone. They then applied a range of displacement and mortality scenarios to those abundances to generate estimates of displacement impacts.

6.59 NE and the RSPB raised a number of concerns with this approach, arguing that a 2 km buffer zone was appropriate, that displacement scenarios up to 70 % and mortality rates up to 10 % should be modelled and that there were problems associated with apportioning those impacts

to the Flamborough and Filey Coast pSPA. The RSPB also raised issues relating to the treatment of breeding birds, foraging ranges, and the merits of PBR and PVA analysis.

6.60 To address the issues raised by NE and the RSPB, the Applicant provided further analysis which itself was subject to disagreement. Eventually the Applicant, NE and the RSPB reached a point in the Examination where their respective positions were maintained and no further common ground was possible.

6.61 The range of displacement scenarios, mortality rates, estimated mortality levels and PBR thresholds, as estimated by both the Applicant and NE, are shown for comparison in table 8. Table 8 demonstrates the differences in opinion between the Applicant and NE regarding which displacement scenario and mortality rate was appropriate for use when producing mortality estimates.

Table 8. A comparison of the various assumptions used to estimate auk mortality and the predicted PBR thresholds (and f values) by both the Applicant and NE. Estimated mortality is based on the impacts of the Hornsea project alone.

	Guillemot		Razorbill		Puffin	
	Applicant	NE	Applicant	NE	Applicant	NE
Displacement scenario (%)	30	30-70	40	70	30	70
Mortality rate (%)	2	1-10	2	10	2	10
Mortality estimate	29	333[6]	25	219	0	0
PBR threshold	1293	970	607	364	8	4
F value	0.4	0.3	0.5	0.3	0.2	0.1

6.62 For guillemots, the Applicant proposed that a displacement scenario of 30 % and a 2 % mortality rate was sufficient to estimate the number of birds likely to suffer mortality. These assumptions resulted in an estimated annual mortality of 29 birds. NE advocated displacement scenarios ranging from 30-70 % with associated mortality rates of between 1-10 %. This resulted in an estimated worst case annual mortality rate of 333 birds.

6.63 For razorbills, the Applicant proposed that a displacement scenario of 40 % and a 2 % mortality rate was sufficient to estimate the number of birds likely to suffer mortality. These assumptions resulted in an estimated annual mortality of 25 birds. NE proposed a worst case displacement scenario of 70 % and a mortality rate of 10 %. This resulted in an estimated worst case annual mortality rate of 219 birds.

6.64 For puffins, the Applicant proposed that a displacement scenario of 30 % and a 2 % mortality rate was sufficient to estimate the number of birds likely to suffer mortality. These assumptions resulted in an estimated annual mortality of less than 1 bird. NE proposed a worst case

[6] This figure is the estimate based on the worst case displacement scenario and mortality rate

displacement scenario of 70 % and a mortality rate of 10 %. This resulted in an estimated worst case annual mortality rate of less than 1 bird.

6.65 The range of assessments provided by the Applicant was sufficient to demonstrate that even the predicted worst case scenarios were below NE's and the Applicant's estimated PBR values. NE estimated the PBR threshold as being 970 guillemots, 364 razorbills and 4 puffins (f values of 0.3, 0.3 and 0.1 respectively), whilst the Applicant estimated the PBR thresholds as being 1293 guillemots, 607 razorbill and 8 puffins (f values of 0.4, 0.5 and 0.2 respectively).

6.66 On this basis, NE was satisfied that the displacement mortality impacts upon Auks (guillemots, razorbills and puffins) from the Hornsea project alone would not have an adverse effect upon the integrity of the Flamborough Head and Filey Coast pSPA. This conclusion was supported by the ExA.

6.67 The SoS has considered all of the representations made regarding the potential impacts resulting from the Hornsea project alone on guillemots, razorbills and puffins from the Flamborough and Filey Coast pSPA. He is satisfied with the range of displacement scenarios and mortality rates produced by the Applicant, even though he notes that many assumptions about auk behaviour were not agreed with NE and the RSPB.

6.68 Given the lack of agreement about which of the modelling assumptions is most appropriate to use to predict auk displacement mortality, the SoS is satisfied that the use of a range of estimates is an appropriate method to characterise the predicted mortality rates.

6.69 As all of the predicted mortality rates are below the level which can be sustainably removed without affecting the population in the long term (as shown in table 8), the SoS concludes that the Hornsea project alone will not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

Auks (guillemot, razorbill and puffin): In combination

6.70 During the Examination, there was a disagreement about which projects should be considered alongside the Hornsea project when estimating the potential impacts upon species of auks. This was largely due to the Applicant's difficulties in obtaining relevant and comparable data to undertake the assessment. Initially only data for 8 projects was provided, but following representations from NE and the RSPB and a request from the ExA, the Applicant sourced additional information. The full list of plans and projects included in the auk in combination assessment is listed in table 9.

6.71 The estimated puffin displacement mortality was very low across the range of displacement and mortality scenarios modelled. On the basis of those predicted puffin impacts, NE was satisfied that the Hornsea project, in combination with other plans and projects (both the building block and the all projects approaches), would not have an adverse effect upon the Flamborough and Filey Coast pSPA.

Table 9. The list of projects used by the Applicant to undertake the in combination assessment for auks.

Project	Tier
Beatrice Demonstrator	1
Blyth Demonstration Site	1
Greater Gabbard	1
Gunfleet Sands I, II and III	1
Humber Gateway	1
Kentish Flats	1
Kentish Flats Extension	1
Lincs	1
London Array Phase I	1
Lynn and Inner Dowsing	1
Sheringham Shoal	1
Thanet	1
Teesside	1
Westermost Rough	2
Aberdeen offshore wind farm development	3
Beatrice Offshore Wind Farm (BOWL)	3
Galloper	3
Moray Firth Project One (MORL)	3
Race Bank	3
Triton Knoll	3
East Anglia One	4
Hornsea Project One	4
Inch Cape	4
Neart na Gaoithe	4
Seagreen Alpha	4
Seagreen Bravo	4
Dogger Bank Creyke Beck	4
Dogger Bank Teesside A & B	5[7]
Hornsea Project two	5

6.72 As with the gannets and kittiwakes, the significance of the in combination impacts upon guillemots and razorbills is largely dependent on the scope of the assessment. The Applicant took the view that the in combination assessment should exclude the projects proposed for the Firth of Forth (Inch Cape, Neart na Gaoithe, Seagreen Alpha, Seagreen Bravo) from the building block approach as there was no date for determination but include the proposals for Dogger Bank (Creyke Beck and Teeside A & B) as there was data in the public domain. NE took the counter view, advising that the Scottish projects should be included (due to their likely decision date of June/July 2014) and the Dogger Bank projects should be excluded as the auk data had not been tested in Examination yet and was subject to on-going discussions and analysis regarding the assessment of their displacement impacts.

6.73 As with the impacts of the project alone, a wide range of displacement and mortality scenarios was produced by the Applicant to estimate the in combination impacts on guillemots and razorbills. As an example, the Applicant estimated that approximately 947 guillemots (using a displacement scenario of 40% and a mortality rate of 10%) would suffer potential mortality effects as a result of displacement from the Hornsea project in combination with other plans

[7] When calculating auk displacement the Applicant initially considered Dogger Bank Teeside A & B in tier 4. However given Teeside's status in the planning system, and that its data has not been tested during examination, it has been considered within tier 5 in this assessment.

and projects. The Applicant also calculated the PBR threshold for guillemots (1293 birds, f value = 0.4) and was of the view that there would not be an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.74 For razorbills, the Applicant estimated that approximately 359 birds (using a displacement scenario of 45% and a mortality rate of 10%) would suffer potential mortality effects as a result of displacement from the Hornsea project in combination with other plans and projects. The Applicant also calculated the PBR threshold for razorbills (607 birds, f value = 0.5) and was of the view that there would not be an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.75 NE produced their own range of mortality estimates, based on a number of displacement scenarios and mortality rates, for guillemots and razorbills. As an example, NE estimated that approximately 1048 guillemots (using a displacement scenario of 40% and a mortality rate of 10%) would suffer potential mortality effects as a result of displacement from the Hornsea project in combination with other plans and projects. NE estimated the PBR threshold for guillemots to be 970 birds (f value = 0.3). For razorbills, NE estimated that approximately 346 razorbills (using a displacement scenario of 40% and a mortality rate of 10%) would suffer potential mortality effects as a result of displacement from the Hornsea project in combination with other plans and projects. NE estimated the PBR threshold for razorbills to be 364 birds (f value = 0.3).

6.76 NE advised that "it is only when the displacement and mortality are at high levels that the PBR threshold is breached, therefore on balance we consider…" that an adverse effect upon integrity could be excluded for both guillemots and razorbills when the impacts of Hornsea are considered in combination with other plans and projects using the building block approach (and including the Firth of Forth projects).

6.77 However, NE could not exclude an adverse effect on integrity using the all projects approach although they recognised the significant amount of unavoidable uncertainty associated with future projects.

6.78 The ExA's view is that the predicted additional mortality of guillemots and razorbills does not constitute an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA when considered in combination with other plans and projects using the building block approach. The ExA rejected NE's advice regarding the potential for an adverse effect when using the all projects approach for the in combination assessment due to the significant levels of uncertainty associated with future projects as described within paragraphs 6.36 and 6.37.

6.79 Given the lack of agreement between NE and the Applicant about which of the modelling scenarios is most appropriate to use to predict auk displacement mortality, the SoS is satisfied that the use of a range of estimates is an appropriate method to characterise the predicted mortality rates.

6.80 The predicted displacement mortality rates are below the level which can be sustainably removed without affecting the population in the long term. On this basis, the SoS concludes that the Hornsea project, in combination with other plans and projects (using the building block approach up to and including Hornsea), will not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.81 As discussed in section 4.14, the SoS considers it important to include the impacts of the Creyke Beck project within in combination assessment for Hornsea.

6.82 As detailed within the RIES produced for the Creyke Beck project, NE submitted its updated SOER summarising its final position on the project's impacts upon the interest features of the Flamborough and Filey Coast pSPA. Whilst using a slightly different approach to that used for Hornsea, Forewind (the Applicant for Creyke Beck) estimated that the Creyke Beck project impacts, in combination with other plans and projects, would result in a worst case potential mortality rate of 875 guillemots (displacement scenario of 70 %, mortality rate of 10 %). Natural England, in their SOER, advised that this potential worst case mortality rate would not constitute an adverse effect on integrity as it is below the level (PBR estimate of 970 birds, f = 0.3) (Dogger Bank Creyke Beck: information to inform appropriate assessment, 2013)) at which guillemots would suffer a long term decline.

6.83 For razorbills, Forewind estimated that the Creyke Beck project impacts, in combination with other plans and projects, would result in a worst case potential mortality rate of 364 birds (displacement scenario of 70 %, mortality rate of 10 %). Natural England, in their updated SOER, advised that this potential worst case mortality rate would not constitute an adverse effect on integrity as it is below the level (PBR estimate of 486 birds, f = 0.3) (Dogger Bank Creyke Beck: information to inform appropriate assessment, 2013)) at which razorbills would suffer a long term decline.

6.84 The SoS is therefore satisfied that the impacts of the Hornsea project in combination with other plans and projects (using the building block approach and including all projects in tiers 1-4) will not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.85 The SoS is of the view that the significant uncertainty associated with future developments means he is unable to consider these projects within the in combination assessment. The SoS is satisfied that the impacts of the projects will be fully considered at a later stage, recognising that it would be unlawful to consent these future projects should it not be possible to rule out an adverse effect upon integrity.

Assemblage species: fulmar and herring gull

6.86 The fulmar (*Fulmarus glacialis*) population of Flamborough and Filey Coast pSPA is estimated as being 1447 pairs (2008-2011 count). The fulmar population is designated as part of the breeding bird assemblage of the pSPA and is potentially at increased risk of collision from the Hornsea project.

6.87 Analysis undertaken by the Applicant estimated that the Hornsea project alone could lead to the mortality of approximately 4 adult fulmars on an annual basis, equivalent to 0.1 % of the breeding population.

6.88 When the impacts of the Hornsea project are considered in combination with other plans and projects, the estimated fulmar mortality was 7 adult birds during the breeding season. This is equivalent to 0.2 % of the Flamborough and Filey Coast pSPA.

6.89 The predicted fulmar mortality rates, both alone and in combination, were low enough for NE and the Applicant to reach an agreement that there would not be adverse effect upon the integrity of the Flamborough and Filey Coast pSPA. The ExA supported this position.

6.90 The herring gull (*Larus argentatus*) population of Flamborough and Filey Coast pSPA is estimated as being 711 pairs (2008-2011 count). Herring gulls are designated as part of the breeding bird assemblage and are also at increased risk of collision from the Hornsea project.

6.91 The Applicant calculated that the Hornsea project lies beyond the published maximum foraging range of herring gulls (92 km, Thaxter *et al,* 2012) and therefore it is unlikely that any of the predicted collision mortality will be herring gulls from the Flamborough and Filey Coast pSPA.

6.92 The lack of interaction between herring gulls and the Hornsea project was agreed between NE and the Applicant. Therefore all parties (including the ExA) were satisfied that the impacts of the Hornsea project, when considered both alone and in combination with other plans and projects, would not have an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

6.93 In summary, given the consensus reached between all the parties (including the ExA) about the predicted impacts upon the herring gull and fulmar populations, the SoS is satisfied that the Hornsea project, when considered alone and in combination with other plans and projects, will not result in an adverse effect upon the integrity of the Flamborough and Filey Coast pSPA.

7 Flamborough Head and Bempton Cliffs Special Protection Area

7.1 As discussed in paragraphs 6.1 to 6.5, a decision is currently pending by the Department for Environment, Food and Rural Affairs (DEFRA) SoS as to whether the original Flamborough Head and Bempton Cliffs SPA should subsumed into a new designation (the Flamborough and Filey Coast pSPA) which covers a wider area and adds more species onto the SPA citation.

7.2 The assessment for the Flamborough and Filey Coast pSPA (in section 6) has considered in detail all of the impacts expected to affect the interest features for the original Flamborough Head and Bempton Cliffs SPA. The designated interest features of the SPA are:

- Kittiwakes
- Breeding assemblage (gannet, guillemot, razorbill, puffin, herring gull)

7.3 Given the overlap of interest features between the 2 sites, there is no requirement to repeat the assessment of the impacts of the Hornsea project for the features of the Flamborough Head and Bempton Cliffs SPA. For a detailed assessment of the impacts, please refer to section 6.

7.4 On the basis of the analysis and conclusions reached in section 6, the SoS is satisfied that the Hornsea project, when considered both alone and in combination with other plans and projects, will not have an adverse effect upon the integrity of the Flamborough Head and Bempton Cliffs SPA.

8 Humber Estuary Special Area of Conservation

8.1 The Humber Estuary SAC covers approximately 36,657 ha and is designated to protect the second largest coastal plain estuary in the UK. A number of important habitats and species are protected by the designation. The conservation objectives for the Humber Estuary SAC are shown in table 10.

Table 10. The qualifying features and conservation objectives for the Humber Estuary SAC.

Conservation Objectives	Avoid the deterioration of the qualifying natural habitats and the habitats of qualifying species, and the significant disturbance of those qualifying features, 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 features; ➢ The structure and function (including typical species) of the habitats of qualifying natural habitats and habitats of qualifying features; ➢ The supporting processes on which the qualifying natural habitats and habitats of the qualifying features rely; ➢ The populations of qualifying species; and ➢ The distribution of the qualifying species within the site. The qualifying features to which the conservation objectives refer are: ➢ Estuary; ➢ Atlantic salt meadows; ➢ Coastal lagoons; ➢ Fixed and shifting dunes; ➢ Mudflats; ➢ *Salicornia* and other annuals colonising mud and sand; ➢ Sea lamprey (*Petromyzon marinus*); ➢ River lamprey (*Lampetra fluviatilis*); ➢ Grey seal (*Halichoerus grypus*).

8.2 A likely significant effect was predicted due to the potential for the Hornsea project to have a negative impact upon a range of SAC habitats where the export cable comes onshore. The potential to affect SAC species was also considered to represent a likely significant effect.

Impacts alone

8.3 The proposed cable route as it comes onshore is shown in figure 2. The section of export cable within the Humber Estuary SAC is approximately 3.2 km in length and passes through various habitats as it comes onshore. The predicted extent of SAC habitats likely to be affected by the works is shown in table 11.

8.4 Although the exact method of installation is yet to be decided, it is likely to involve either (or a combination of) ploughing, jetting or trenching. Depending on the chosen methodology, vehicle access for a range of plant and machinery will be needed within intertidal areas. A full installation plan will be submitted to the Marine Management Organisation for approval before works commence.

Table 11. The approximate extent of Humber Estuary SAC habitats likely to be affected by the Hornsea project alone.

Qualifying feature	Approximate area (ha)	Relative proportion of SAC habitat (%)
Estuaries	174.8 (sub-tidal = 12.8) (intertidal = 162)	<0.47
Mudflats	157.2	<1.68
Salicornia and other annuals colonising mud and sand	4.8	7.8
Atlantic salt meadows	0	0
Embryonic shifting dunes	0.012	0.03

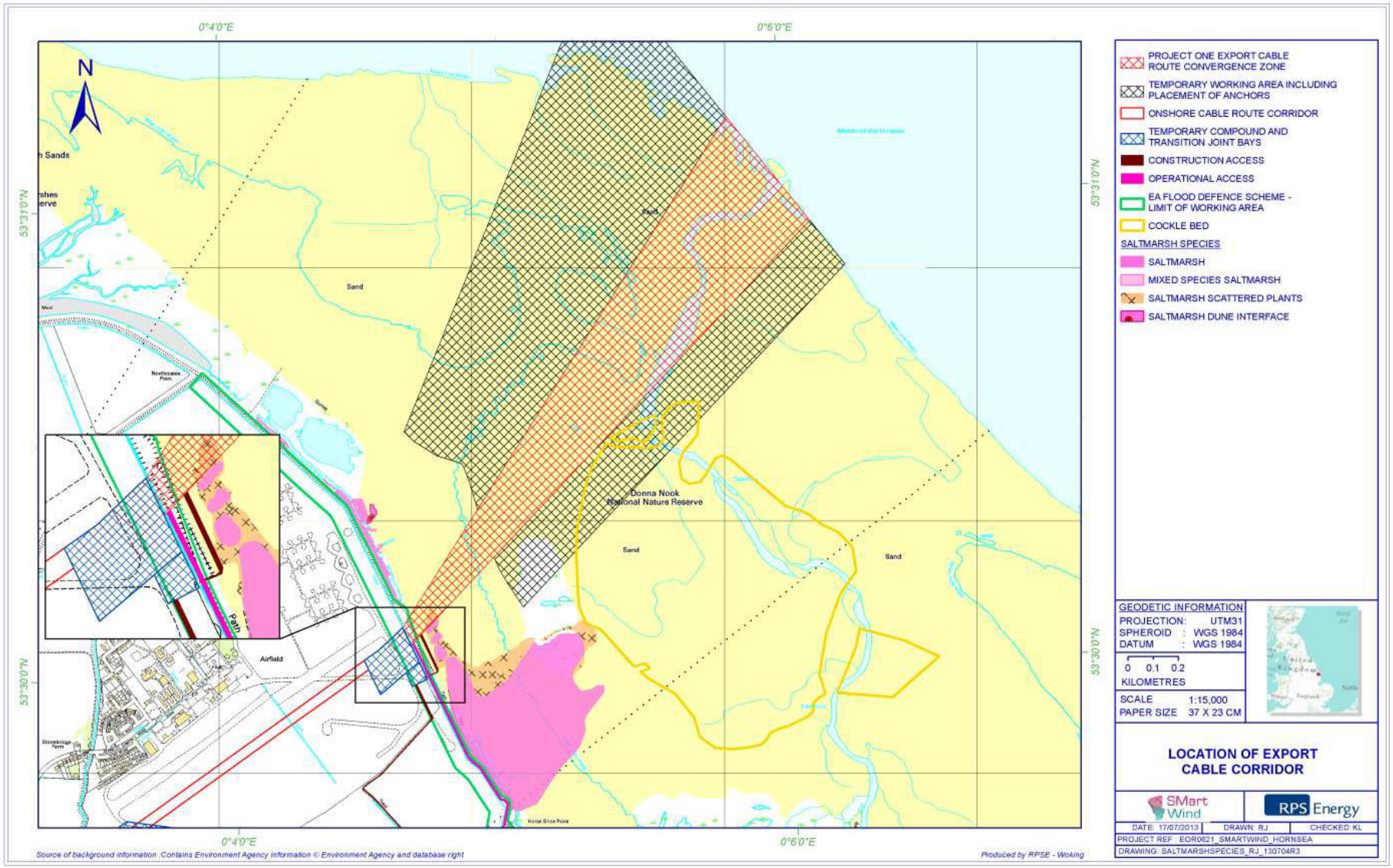
8.5 Although table 11 shows that large areas of SAC habitats are likely to be affected by the cabling works, particularly the '*Salicornia* and other annuals colonising mud and sand' feature, the impacts are only temporary in nature. The Applicant has proposed a number of mitigation measures and monitoring within the DML to minimise the impacts upon intertidal habitats. Those measures include restricting all intertidal works to the convergence zone and temporary working corridor (as shown in figure 2), undertaking pre and post construction monitoring surveys and establishing a '*Salicornia'* reinstatement plan.

8.6 The use of these mitigation measures should ensure a relatively rapid recovery of the affected habitats. Evidence of recovery is expected to be visible within a few months, with full recovery due within one year, and result in no long term reduction in habitat extent. A clarification note provided by the Applicant confirmed that the predicted rates are consistent with the demonstrated recovery rates of the same habitats affected by similar cabling works elsewhere in the UK and in Europe.

8.7 A likely significant effect upon sea lamprey and river lamprey were considered to arise because of the potential for electro-magnetic fields (EMF), as a result of the installation of the export cables, to act as a barrier and prevent migration. As the export cables would be buried at all times to protect them from damage, this will reduce the potential for lamprey to detect the cables. Studies in other migratory species have shown that EMF effects are highly localised and do not act as a barrier to the overall direction of migration (Ohman *et al* 2007, Westerberg and Langenfelt, 2008). In any event, as the Hornsea export cables do not extend across the whole mouth of the Humber they should not act as a barrier to preventing migration, should the EMF even be detectable to the 2 SAC species of lamprey.

8.8 A likely significant effect upon grey seals were considered to arise because of the potential for the Hornsea project to increase disturbance given the increase in vessel movements and restrict access to breeding sites. Although cable laying vessels have the potential to increase disturbance, the effects are likely to be both temporary and highly localised. The Humber is a busy shipping area with many vessels transiting in and out of the harbour. In the context of those movements, it is unlikely that the additional shipping movements as a result of the Hornsea project will adversely affect the grey seal SAC population. Grey seals are potentially

Figure 2. The export cable route and work area as it comes onshore. (Source: ES)



vulnerable to collision with cable-laying vessels. Blunt traumas from collision with vessel' hulls and/or lacerations caused by propeller strikes can be fatal to seals. According to JNCC guidance, cable-laying vessels in the Humber Estuary SAC pose a medium risk to grey seals. The JNCC recommend avoiding the breeding season and consider using alternatives to vessels with ducted propellers. The Applicant proposes to follow the published best practice guidelines (JNCC, 2012) to minimise the potential for injuries.

8.9 NE's initial position was that an adverse effect upon the integrity of the SAC could not be excluded however as the Examination progressed, and the Applicant provided further clarification notes, their position evolved. NE was satisfied that it would be unlikely that there would be any impacts upon the 'fixed and shifting dune' interest features of the Humber Estuary SAC. NE also advised that there would not be an adverse effect upon the 'mudflat', '*Salicornia* and other annuals colonising mud and sand', and the 'Atlantic salt meadows' interest features of the SAC. NE was also satisfied that there would not be an adverse effect on the Humber Estuary SAC species (grey seal, sea lamprey and river lamprey).

8.10 On that basis, NE subsequently agreed with the Applicant that the Hornsea project alone would not have an adverse effect upon the integrity of the Humber Estuary SAC.

8.11 The ExA's view was that the impacts from the Hornsea project alone would not have an adverse effect upon the integrity of the Humber Estuary SAC.

8.12 The SoS has considered all of the representations and is satisfied that the Hornsea project, alone, will not have an adverse effect upon the integrity of the Humber Estuary SAC.

Impacts in combination

8.13 The plans and projects thought likely to have a significant effect upon the Humber Estuary SAC when considered in combination with the Hornsea project are; the Tetney to Saltfleet Tidal Flood Defence Scheme (proposed by the Environment Agency), the Phillips 66 Tetney sealine replacement project, and Hornsea project 2. The predicted in combination impacts upon SAC habitats are shown in table 12.

Table 12. The approximate extent of Humber Estuary SAC habitats likely to be affected by the Hornsea project in combination with other plans and projects.

Qualifying feature	Approximate area (ha)	Relative proportion of SAC habitat (%)
Estuaries	275.6 (sub-tidal = 55.1) (intertidal = 220.5)	0.75
Mudflats	210.7	2.24
Salicornia and other annuals colonising mud and sand	9.6	16
Atlantic salt meadows	0.0125	<0.001
Embryonic shifting dunes	0.22	0.2

8.14 When the impacts of the Hornsea project were considered in combination with other plans and projects the amount of habitat expected to be affected significantly increased. The '*Salicornia*

and other annuals colonising mud and sand' interest feature is particularly affected with up to 16 % of the total extent likely to be affected by the various projects.

8.15 Despite the potential increase in affected habitat extent, as with impacts of the project alone (paragraph 8.6), the in combination impacts upon these interest features are expected to be only temporary in nature. The mitigation measures (described in paragraph 8.5) proposed by the Applicant are expected to ensure recovery of the habitats within 1 year and result in no long term reduction in habitat extent. This prediction is in line with the observed recovery rates of habitats affected by similar works in the UK and around Europe.

8.16 As the Examination progressed, the concerns about the in combination impacts of the Tetney to Saltfleet and the Phillips 66 projects were resolved. Representations were submitted which indicated that there would be no temporal overlap between the Hornsea works and the Phillips 66 project, or with the Tetney to Saltfleet tidal flood defence scheme.

8.17 During the Examination, the Applicant provided further information about the potential in combination effects of the Hornsea project 1 and the Hornsea project 2. The clarification note explained that there was currently no publicly available information for project 2 however various assumptions were made so that an assessment could be carried out. The Applicant assumed that the installation of the export cables for project 2 would be similar in methodology to that of project 1. The location of the installation would be within the northern temporary working area adjacent to the project 1 convergence zone thereby avoiding impacting upon non-disturbed areas of habitat within the SAC. The timing of the cabling works for project 2 was uncertain, the applicant estimated it was likely to take place in one of four possible scenarios relative to project 1 (concurrently, overlapping, sequentially, or independently).

8.18 The Applicant concluded that the in combination effects of projects 1 and 2 would not have an adverse effect upon the integrity of the Humber Estuary SAC as the works were temporary in nature and habitat recovery would take place relatively quickly.

8.19 NE agreed that the Hornsea project in combination with other plans or project would not have an adverse effect on the integrity of the Humber Estuary SAC.

8.20 The ExA's view was that the Hornsea project, in combination with other plans and projects, would not have an adverse effect upon the integrity of the Humber Estuary SAC. However, in their recommendation, the ExA recognised the uncertainty regarding the cumulative impacts of Hornsea Project 1 and Hornsea Project 2. The ExA wished to make it clear that "the Hornsea Project 2 is a separate matter for consideration…and that nothing in this report seeks to predetermine any matter on that project".

8.21 The SoS has considered all of the representations and is satisfied that the Hornsea project, either alone or in combination with other plans and projects (except Hornsea Project 2), will not have an adverse effect upon the integrity of the Humber Estuary SAC. The SoS has not included Hornsea Project 2 within the in combination assessment as there is too much uncertainty about this project to carry out the assessment at this time. The SoS is satisfied that

the impacts of this proposal will be considered in full at the time of determination, noting that it could not be lawfully consented should it not be possible to exclude an adverse effect upon the integrity of the Humber Estuary SAC.

9 Humber Estuary Special Protection Area and Ramsar site

9.1 The Humber Estuary SPA and Ramsar site protects the avian interest features (and their supporting habitats) of the Humber Estuary. The extensive mudflats and saltmarsh provide important habitats for many species of birds. The site's conservation objectives and full list of interest features are shown in table 13.

Table 13. The qualifying features and conservation objectives for the Humber Estuary SPA.

Conservation Objectives	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; ➢ The extent and distribution of the habitats of the qualifying features; ➢ The structure and function of the habitats of the qualifying features; ➢ The supporting processes on which the habitats of the qualifying features rely; ➢ The population of each of the qualifying features, and, ➢ The distribution of the qualifying features within the site. The qualifying features to which the conservation objectives refer are: ➢ *Botaurus stellaris*; Great bittern (Non-breeding) ➢ *Botaurus stellaris*; Great bittern (Breeding) ➢ *Tadorna tadorna*; Common shelduck (Non-breeding) ➢ *Circus aeruginosus*; Eurasian marsh harrier (Breeding) ➢ *Circus cyaneus*; Hen harrier (Non-breeding) ➢ *Recurvirostra avosetta*; Pied avocet (Non-breeding) ➢ *Recurvirostra avosetta*; Pied avocet (Breeding) ➢ *Pluvialis apricaria*; European golden plover (Non-breeding) ➢ *Calidris canutus*; Red knot (Non-breeding) ➢ *Calidris alpina alpina*; Dunlin (Non-breeding) ➢ *Philomachus pugnax*; Ruff (Non-breeding) ➢ *Limosa limosa islandica*; Black-tailed godwit (Non-breeding) ➢ *Limosa lapponica*; Bar-tailed godwit (Non-breeding) ➢ *Tringa totanus*; Common redshank (Non-breeding) ➢ *Sterna albifrons*; Little tern (Breeding) ➢ Waterbird assemblage

9.2 A LSE upon the Humber Estuary SPA and Ramsar site was identified because of the potential for construction works (where the export cable comes onshore) to cause disturbance and displacement of bird species as well as potentially affecting their supporting habitats.

9.3 The wide range of non-breeding bird species (shown in table 13) are particularly sensitive to works within the overwintering period. During the overwintering period, birds use more energy keeping warm than they do at other times of the year. It is therefore important that they are able to source enough food to meet the additional energy requirements otherwise they risk starvation. The works have the potential to displace and disturb birds which would otherwise be feeding in intertidal areas likely to be affected by the export cabling work.

9.4 The displacement, caused by birds avoiding the area around the cable works, has the potential to have an adverse effect upon the integrity of the site. By displacing those birds, the amount of feeding habitat available is reduced; this could cause the density of birds feeding in other areas

to increase such that there may be less food available per individual than there would have been otherwise.

9.5 Outside of the wintering period, this effect is not as significant because the energy requirements of the birds are lower as they are expending less energy on keeping warm. There is typically sufficient food available to meet the required energy needs.

9.6 The effects of disturbance are similar to displacement effects as it prevents birds from feeding in an area which they would otherwise use. This can mean that birds can struggle to get sufficient food to meet their energy requirements. Ultimately, if these requirements cannot be met then the birds will starve to death. Depending on the nature of the disturbance, the impacts on the birds can be exacerbated. If the disturbance is sufficient to cause birds in surrounding areas to fly away then not only are the birds not spending their time feeding but they are also using extra energy to fly away.

9.7 Different species of birds will respond differently to disturbance, some are more tolerant than others. There are also various forms of disturbance (e.g. noise, visual), different species may react differently to noise disturbance than they would to a visual disturbance; however no species will tolerate all forms of disturbance within an area.

9.8 The key question this assessment must address is whether the works to bring the cable onshore would disturb and displace bird species for a period sufficient to cause an adverse effect upon the populations. Because of the intrinsic link between the birds and the habitats upon which they rely, the conservation objectives (shown in table 13) focus on protecting the supporting habitats.

9.9 As with the Humber Estuary SAC, many of the concerns raised by NE and the RSPB about the impacts upon the SPA and Ramsar site were resolved during the Examination, particularly once the Applicant made a commitment to undertake the intertidal works outside of the overwintering period (i.e. between 01 April and 30 September inclusive).

9.10 The Applicant also committed to not undertaking works (between 01 April and 31 May, and between 01 August and 30 September, inclusively) within 1 km of the seawall during the 2 hour period either side of high water. These licence conditions (secured in the DML 4, part 2, condition 23) are in place to prevent the disturbance of waders and wildfowl during the overwintering period and the disturbance of roosting birds during Spring and Autumn (an important time for breeding and passage species).

9.11 The inclusion of timing restrictions within the DML was sufficient to satisfy NE and the RSPB's concerns about the impacts upon the SPA as a result of the Hornsea project alone. However further concerns were raised by these consultees in response to the potential for in combination impacts with other plans and projects, particularly the Phillips 66 Sealine replacement, Tetney to Saltfleet Tidal Flood Defence scheme and Hornsea project 2. Following further submissions by the Applicant, and the inclusion of timing restrictions within the DML (as detailed within paragraph 9.10), NE and the RSPB were satisfied that an adverse effect upon the integrity of

the Humber Estuary SPA and Ramsar site could be excluded, when the impacts of the Hornsea project are considered in combination with other plans and projects.

9.12 The ExA, noting the agreement between the Applicant and NE regarding the magnitude of impacts, was satisfied that the Hornsea project, either alone or in combination with other plans and projects, would not have an adverse effect upon the integrity of the Humber Estuary SPA and Ramsar site.

9.13 The SoS is satisfied that the DML has sufficient safeguards built into place to ensure that the impacts of the Hornsea project, either alone or in combination with other plans and projects, will not have an adverse effect upon the integrity of the Humber Estuary SPA and Ramsar site.

10 Habitats Regulations Assessment Conclusions

10.1 The SoS has carefully considered all of the information presented before and during the Examination, including the ES, the Applicant's HRA, the RIES, representations made by Interested Parties, and the ExA's report itself.

10.2 The SoS considers that the Hornsea project, when considered both alone and in combination with other plans and projects, has the potential to have a likely significant effect upon 5 European sites protected by the Conservation of Habitats and Species Regulations 2010.

10.3 Those sites are:

- Flamborough and Filey Coast pSPA
- Flamborough Head and Bempton Cliffs SPA
- Humber Estuary SAC
- Humber Estuary SPA
- Humber Estuary Ramsar site

10.4 In accordance with Regulation 61 of the Habitats Regulations and Regulation 25 of the Offshore Habitats Regulations, the SoS has undertaken an AA in respect of those 5 sites' conservation objectives to determine whether the project, either alone or in combination with other plans and projects, will result in an adverse effect upon the sites' integrity.

10.5 When assessing the in combination impacts of the Hornsea project with other plans and projects, this AA has considered 2 different scenarios. Firstly, the AA has considered the in combination impacts using the building block approach for all projects up to and including Hornsea. Secondly, the AA has considered the in combination impacts using the building block approach for all projects up to Dogger Bank Creyke Beck.

10.6 The SoS has undertaken a robust assessment using all of information available to him, including the views of the various Interested Parties. Having considered all of the information available, and the mitigation measures secured within the DCO and DMLs, the SoS has determined that the Hornsea project will not have an adverse effect upon the sites' integrity either alone or in combination with other plans or projects.

11 Transboundary Assessment

11.1 Given the potential for this development to affect mobile features across a wide geographical area (as identified within the RIES); the SoS believes it important to consider the potential impacts on European sites in other EU member states, known as transboundary sites, in further detail. The ExA also considered the implications for these sites, in the context of looking at the wider EIA considerations. The results of the ExA's considerations and the SoS own views on this matter are presented below.

11.2 The application was screened by PINS for transboundary effects under Regulation 24 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 on 14 January 2013 and a screening matrix was published. This matrix concluded that the Hornsea project is likely to have a significant effect on the environment of several European Economic Area (EEA) states. Those states are:

- Denmark;
- Netherlands;
- Norway;
- Germany;
- France;
- Belgium;
- Iceland.

11.3 A second screening exercise was undertaken on 03 April 2013; this reached the same conclusion as the previous exercise, i.e. that the Hornsea project is likely to have a significant effect on the environment of several EEA states.

11.4 Following further consideration of the issues, the ExA was satisfied that all transboundary matters had been sufficiently addressed and that there were no matters outstanding which would prevent the DCO from being made.

11.5 The SoS, noting the recommendation by the ExA, believes it is important to fully consider the impacts upon transboundary sites. The RIES identified a total of 26 transboundary European sites for which a LSE could not be excluded; the SoS considers the impacts upon those sites in the following paragraphs.

11.6 The transboundary sites and the interest features considered to be at risk from the Hornsea project by the SoS are shown in table 14. Most of the transboundary sites identified were several hundreds of kilometres away from the location of the proposed Hornsea project, the exception being 2 sites in the Netherlands' waters (Doggersbank pSCI and Klaverbank pSCI which are 64 km and 44 km away, respectively).

11.7 All of the transboundary sites were identified because of the potential for the Hornsea project to affect species of marine mammals. All but 2 of the sites identified in the transboundary screening exercises were identified solely because of the potential for the Hornsea project to affect harbour porpoises. The other 2 sites (Doggersbank pSCI and Klaverbank pSCI) identified

potential impacts upon harbour seals and grey seals in addition to the potential impacts upon harbour porpoises.

Table 14. The transboundary sites and the interest features considered to be at risk from the Hornsea project (Source: RIES).

Transboundary Site	Location	Interest feature at risk	Distance from Hornsea to Site
SBZ 1 / ZPS 1 SCI	Belgium	Harbour porpoise	276 km
SBZ 2 / ZPS 2 SCI	Belgium	Harbour porpoise	276 km
SBZ 3 / ZPS 3 SCI	Belgium	Harbour porpoise	276 km
Vlakte van de Raan pSCI	Belgium	Harbour porpoise	271 km
NTP S-H Wattenmeer und angrenzende Kustengebiete SCI	Germany	Harbour porpoise	386 km
Doggerbank SCI	Germany	Harbour porpoise	209 km
Ostliche Deutsche Bucht SCI	Germany	Harbour porpoise	347 km
Sylter AuBenriff SCI	Germany	Harbour porpoise	293 km
Steingrund SCI	Germany	Harbour porpoise	378 km
Helgoland mit Helgolander Felssockel SCI	Germany	Harbour porpoise	367 km
Hamburgisches Wattenmeer SCI	Germany	Harbour porpoise	393 km
Unterelbe SCI	Germany	Harbour porpoise	424 km
Borkum-Riffgrund SAC	Germany	Harbour porpoise	254 km
Nationalpark Niedersachsisches Wattenmeer SCI	Germany	Harbour porpoise	287 km
Gule Rev SAC	Denmark	Harbour porpoise	517 km
Sydlige Nordso SAC	Denmark	Harbour porpoise	347 km
Falaises du Cran aux oeufs et du cap gris-nez, dunes du chatelet, marais de tardinghen et dunes de wissant pSCI	France	Harbour porpoise	299 km
Bancs des Flandres pSCI	France	Harbour porpoise	263 km
Recifs Gris-nez Blanc-nez pSCI	France	Harbour porpoise	286 km
Ridens et dunes hydrauliques du Detroit du pas-de-calais pSCI	France	Harbour porpoise	288 km
Baie de canche et couloir des trois estuaires pSCI	France	Harbour porpoise	331 km
Doggersbank (Dutch Dogger Bank) pSCI	Netherlands	Grey seal Harbour seal Harbour porpoise	64 km
Klaverbank pSCI	Netherlands	Grey seal Harbour seal Harbour porpoise	44 km
Vlakte van de Raan SAC	Netherlands	Harbour porpoise	259 km
Noordzeekustzone SAC	Netherlands	Harbour porpoise	179 km
Noordzeekustzone II pSCI	Netherlands	Harbour porpoise	180 km

11.8 Rather than consider the impacts of the Hornsea project on each transboundary site individually (and to avoid unnecessary repetition), the SoS considers it appropriate to make an assessment for each of the affected species and then apply those conclusions to the relevant site.

Harbour Porpoises (*Phocoena phocoena*)

11.9 Harbour porpoises are the most abundant cetacean in the UK waters, and the North Sea is considered to be a geographically important area for the species (Reid *et al*, 2003). In the North Sea, the harbour porpoise population is estimated as being 247,631 individuals (Hammond *et al*, 2013).

11.10 Harbour porpoises forage over very large areas (up to 11,289 km^2; Johnstone *et al*, 2005), feeding on a wide range of fish species, typically small shoaling species from demersal or pelagic habitats such as whiting and sand eels (Santos and Pierce, 2003; Santos *et al*, 2006).

11.11 Harbour porpoise was the species of marine mammal most frequently recorded within the Hornsea site during the baseline characterisation survey work. Over a 2 year survey period (24 surveys), 3,443 harbour porpoise sightings were recorded within the boundary of the site. This represents an average harbour porpoise density of approximately 1.683 individuals per km^2.

11.12 Harbour porpoise are considered to be at risk (both alone and in combination) because of the potential for the Hornsea project to cause physical injury, disturbance and displacement, behavioural changes, and cause changes in their prey availability during construction.

11.13 The Applicant considered that the risk of causing injury to harbour porpoises was very low because it would require an animal to be in close proximity (<600 m for 2300 kJ hammer energy) to the pile driving. The Applicant also proposed a number of mitigation measures to further reduce the risk.

11.14 The mitigation measures, secured as conditions (13(2)) within the DMLs, include using trained marine mammal observers to establish that there are no marine mammals within the immediate area. The conditions also require the use of soft-start approach when commencing piling activity. This involves slowly ramping up the pile driving energy to give any unseen marine mammals the opportunity to leave the area before injury occurs at maximum piling energy.

11.15 The Applicant also estimated the potential impact of piling works to cause the displacement of harbour porpoises. The potential for piling works to displace harbour porpoises may occur, as whilst the works may not be loud enough to cause injury or death, they might still be loud enough to invoke a behavioural response form harbour porpoises such that they leave and subsequently actively avoid an area. The Applicant estimated that the worst case scenario was that this avoidance could cover a total area of 46.6 km^2 around the piling works. The Applicant's view was that whilst this is a very large area, it should be viewed in the context of the wider North Sea and the foraging ranges for harbour porpoises.

11.16 The Applicant also considered the potential for in combination effects from other plans and projects to exacerbate the impacts upon harbour porpoises. The other projects in the North Sea have the potential to affect harbour porpoises, either through undertaking concurrent or sequential piling works. Concurrent piling works could have the effect of further reducing the available spatial extent of foraging habitat available to harbour porpoises, whilst sequential works could ensure that preferred foraging grounds are unavailable for a longer extent (temporal effects).

11.17 The Applicant has undertaken calculations to estimate the number of harbour porpoises which might be displaced by the piling activity in the North Sea. Those results estimate a worst case displacement scenario of approximately 7100 harbour porpoises. This is the equivalent of approximately 2.83 % of the North Sea population. The Applicant has also estimated the effects

of the Hornsea project 2. Given the potential for concurrent piling for Hornsea project 1 and project 2, the applicant estimated a worst case displacement scenario of 10,687 harbour porpoises, the equivalent of 4.28 % of the North Sea population.

11.18 The Applicant felt that given the potential range of harbour porpoises, the potential for porpoises to return once piling ceases and the wide extent of alternative available habitats and prey species there is the potential for harbour porpoises from the European sites identified in table 14 to avoid the disturbed areas.

11.19 The SoS has considered the information available to evaluate the impacts of the Hornsea project, both alone and in combination, on the harbour porpoise interest feature of the sites listed in table 14. Given that most of the European sites identified in table 14 are several hundred kilometres away from the Hornsea project, it is unlikely that harbour porpoise from these European sites are solely using the Hornsea area to feed in. This is particularly unlikely given the highly mobile and wide foraging nature of harbour porpoises and their ability to feed on a range of prey sources.

11.20 The SoS is also satisfied that the conditions within the DMLs (13(2)) are sufficient mitigation measures to protect any harbour porpoises that are using the immediate area when piling works commence.

11.21 Whilst there are 2 European sites which are significantly closer to the Hornsea project (Doggersbank pSCI, 64 km, and the Klaverbank pSCI, 44 km), the SoS considers that for the reasons identified in 11.19 the impacts of the Hornsea project (both alone and in combination with other plans and projects) will not result in an adverse effect upon the integrity of these sites.

Harbour Seal (*Phoca vitulina*)

11.22 The majority of the harbour seal population is found within Scottish waters although the densest concentration of haul-out sites is found along the tidal sandbanks and mudflats of the Wash (SMRU, 2004). Other important haul-out sites include Donna Nook, Blakeney Point and Scroby Sands.

11.23 These haul-outs are used by females during the breeding season to give birth and by all individuals during August during the annual moult. Most haul-out sites are used on a daily basis, with individuals showing a high degree of site fidelity (Yochem *et al*, 1987). Tagged UK harbour seals have been shown to typically forage within 40 or 50 km of their haul-out sites (SCOS, 2011) however individuals from the Greater Wash area were found to typically forage offshore between 75 and 150 km from their haul-outs with some individuals foraging much further (up to 220 km) (SMRU, 2011)

11.24 Harbour seals are generalist feeders, with their diet varying geographically and seasonally (Hammond *et al*, 2001). They feed on a wide range of animals including sandeels, whitefish, herring, sprat, octopus and squid (SCOS, 2010).

11.25 Harbour seals (*Phoca vitulina*) were recorded during the Hornsea project baseline surveys (64 individuals were recorded in the 24 surveys over a 2 year period) albeit at relatively low densities (0.020 individuals per km^2).

11.26 The harbour seal is an interest feature of 2 transboundary European sites identified in table 14 (Doggersbank pSCI, 64 km, and the Klaverbank pSCI, 44 km). It is possible that harbour seal from these sites may occur within Hornsea project area, either on-route to somewhere else or actively using the site for foraging and other activities.

11.27 The Applicant has assessed the likelihood of the Hornsea project impacting upon harbour seals. The main risks to harbour seals are considered to be injury or displacement because of the piling works, reductions in prey availability and the potential for collision with vessels. Given the distance offshore of the Hornsea project, it is not thought that the project will act as barrier to seals travelling between foraging grounds and haul-out sites.

11.28 The potential for impacts upon harbour seals which might result in injury will be highly localised around the piling activity (<100 m using a hammer energy of 2300 kJ). As with the harbour porpoises, the marine mammal mitigation measures (included as conditions within the DMLs) should ensure that no harbour seals are injured by the piling works. As the piling energy is gradually increased, harbour seals (if present in the area) will have the opportunity to move away from the source of the sound and thereby avoid injury.

11.29 The piling works, whilst unlikely to injure harbour seals, might still be sufficient to cause displacement over a relatively large area. The applicant predicts that displacement of harbour seals could occur up to 1.7 km from the piling works (using a hammer energy of 2300 kJ). However, this should not adversely affect the population recognising the distance between the Hornsea project and the European sites (referenced in paragraph 11.26) and given the large extent of alternative foraging areas available to those populations.

11.30 There is the potential for the in combination effects of the Hornsea project along with other plans and projects in the North Sea to affect harbour seals from the Doggersbank pSCI, and the Klaverbank pSCI.

11.31 Given the relatively small maximum displacement rate (1.7 km from piling work) predicted for harbour seals relative to their typical foraging range (40-50 km), it is unlikely that even if all the offshore wind farms in the North Sea are undertaking concurrent or sequential piling activity that harbour seals from Doggersbank pSCI, and the Klaverbank pSCI will be without sufficient foraging habitat given their diverse diet preferences and foraging range.

11.32 The SoS is satisfied that the conditions (13(2)) within the DMLs are sufficient mitigation measures to protect any harbour seals that are using the immediate area when piling works commence. The SoS is also satisfied that the potential displacement effects of the piling works will not have an adverse effect upon site integrity given the highly mobile and wide foraging nature of harbour seals and their ability to feed on a wide range of prey sources.

11.33 The SoS has considered the information available to evaluate the potential impacts of the Hornsea project, both alone and in combination, on the harbour seal interest feature of the Doggersbank pSCI, and the Klaverbank pSCI. The SoS considers that for the reasons identified in paragraph 11.32 the impacts of the Hornsea project (both alone and in combination with other plans and projects) will not result in an adverse effect upon the integrity of these sites.

Grey Seal (*Halichoerus grypus*)

11.34 It is estimated that there are approximately 70,000 grey seals in the North Sea, around 90 % of this population breed in Scotland (Baxter *et al*, 2011). The east coast of England is considered to be important for this species with significant breeding populations at Donna Nook, Blakeney Point and East Horsey.

11.35 Grey seal movements tend to occur on two distinct scales, long distance travel (up to 2100 km) and local repeated trips to discrete offshore areas (88 % of trips), most seals tend to forage within 145 km from their haul-out sites (Thompson *et al*, 1998). Grey seals prey on a wide range of species such as sandeels, gadoids (such as cod and haddock) and flatfish, these species are typically found where the seabed sediment is primarily gravel and sand (DTI, 2001).

11.36 Harbour seals display a high fidelity to specific haul-out sites, which they use to rest, breed and moult on. The nearest UK haul out point to the Hornsea project is at Donna Nook on the Lincolnshire coast but there are also significant populations using haul-outs in the Wash, Blakeney Point (in Norfolk) and upon Scroby Sands.

11.37 As with harbour seals, the Applicant identified the potential for an impact upon grey seals from 2 transboundary European sites. Those sites were the Doggersbank pSCI, and the Klaverbank pSCI.

11.38 The Applicant recorded 92 grey seals in the Hornsea project area during the 2 years of baseline survey work. This resulted in an estimated density of approximately 0.04 individuals per km^2. It is possible that grey seals from the Doggersbank pSCI and from the Klaverbank pSCI may occur within Hornsea project area, either on-route to somewhere else or actively using the site for foraging and other activities.

11.39 The Applicant has assessed the likelihood of the Hornsea project impacting upon grey seals. As with harbour seals, the main risks to grey seals are considered to be injury or displacement because of the piling works, reductions in prey availability and the potential for collision with vessels.

11.40 The potential impacts upon grey seals will be highly localised around the piling activity (within 100 m using a hammer energy of 2300 kJ). As with the harbour seal, the marine mammal mitigation measures (included as conditions within the DMLs) should ensure that no grey seals are injured by the piling works. As the piling energy is gradually increased, grey seals (if present in the area) will have the opportunity to move away from the source of the sound thereby avoiding injury.

11.41 The piling works, whilst unlikely to injure grey seals, might still be sufficient to cause displacement over a relatively large area. The applicant predicts that displacement of grey seals could occur up to 1.7 km from the piling works (using a hammer energy of 2300 kJ). However, this should not adversely affect the population recognising the distance between the Hornsea project and the European sites (referenced in paragraph 11.38) and given the large extent of alternative foraging areas available to those populations.

11.42 There is the potential for the in combination effects of the Hornsea project along with other plans and projects in the North Sea to affect grey seals from the Doggersbank pSCI, and the Klaverbank pSCI.

11.43 Given the relatively small maximum displacement rate (1.7 km from piling work) predicted for grey seals relative to their typical foraging range (145 km), it is unlikely that even if all the offshore wind farms in the North Sea are undertaking concurrent or sequential piling activity that harbour seals from Doggersbank pSCI, and the Klaverbank pSCI will be without sufficient foraging habitat given their diverse diet preferences and foraging range.

11.44 The SoS is satisfied that the conditions (13(2)) within the DMLs are sufficient mitigation measures to protect any grey seals that are using the immediate area when piling works commence. The SoS is also satisfied that the potential displacement effects of the piling works will not have an adverse effect upon site integrity given the highly mobile and wide foraging nature of grey seals and their ability to feed on a wide range of prey sources.

11.45 The SoS has considered the information available to evaluate the potential impacts of the Hornsea project, both alone and in combination, on the grey seal interest feature of the Doggersbank pSCI, and the Klaverbank pSCI. The SoS considers that for the reasons identified in paragraph 11.44 the impacts of the Hornsea project (both alone and in combination with other plans and projects) will not result in an adverse effect upon the integrity of these sites.

Transboundary summary

11.46 The SoS has considered the potential for the Hornsea project to affect 26 transboundary European sites in Germany, France, Belgium, Denmark and the Netherlands. Those sites support harbour porpoises, grey seals and harbour seals.

11.47 The SoS has considered all of the information available, particularly noting the lack of objections from any of the Member States potentially affected by the development and the recommendation made by the ExA.

11.48 The SoS is satisfied that the Hornsea project, either alone or in combination with other plans or projects, will not adversely affect the integrity of any of the transboundary European sites identified in table 14.

12 Assessment of Impacts upon Gulls

12.1 The Hornsea project, both alone and cumulatively has the potential to have a significant impact upon 3 species of gull (herring gull (*Larus argentatus*), lesser black-backed gull (LBBG, *Larus fuscus*) and greater black-backed gull (GBBG, *Larus marinus*).

12.2 These species of gull are interest features of several UK SPAs; the preceding HRA in this document has already concluded that the impact upon herring gulls from the Flamborough and Filey Coast pSPA does not constitute an adverse effect upon site integrity. In this section of the Environmental report, it is the wider impacts on the gull populations of the North Sea which are considered by the SoS.

12.3 The potential the Hornsea project, both alone and cumulatively, to increase collision risk mortality for these 3 species of gull was considered during the Examination.

Herring Gulls

12.4 The predicted herring gull collision mortality for the Hornsea project alone is shown in table 15. The predicted mortality rate was considered to not represent a significant impact as all estimates were well below the most precautionary estimates of the PBR threshold. As such this impact was discounted from further consideration.

Table 15. The potential collision mortality estimates (Band model option 1) for herring gull, lesser black-backed gull and greater black-backed gull from the Hornsea project, alone and cumulatively. The PBR thresholds (and associated f values) for those species are also provided (numbers indicate total number of birds). Where NE and the Applicant have produced different mortality estimates, the higher value has been presented on a precautionary basis. Mortality estimates are based on a project configuration of 240 X 5 MW.

	Herring Gull		LBBG		GBBG	
Avoidance Rate (%)	98	99	98	99	98	99
Mortality estimate (alone)	58	29	87	44	343	171
Mortality estimate (cumulatively building block)	1890	945	2091	1046	2733	1367
Mortality estimate (cumulatively all projects)	2247	1124	2440	1220	3386	1693
PBR threshold	5083 - 15528		3111		2109 – 3515	
F value	0.1 – 0.3		0.3		0.3 – 0.5	

12.5 The cumulative herring gull collision mortality, when using the most precautionary avoidance rates, is significantly lower than that of the thresholds generated by conservative PBR estimates (below estimates for f values of 0.1 and well below estimates based on f values of 0.3).

Lesser Black-Backed Gulls

12.6 The predicted LBBG collision mortality for the Hornsea project alone is shown in table 15. The predicted mortality rate was considered to not represent a significant impact as all estimates were well below the most precautionary estimates of the PBR threshold. As such this impact was discounted from further consideration.

12.7 The estimates of cumulative LBBG collision mortality evolved during the Examination until positions were agreed on which Band model option and AR and to use and which projects should be included within the cumulative assessment. Estimated collision mortality impacts, even when using the most precautionary avoidance rates and including the impacts of all projects, would be significantly lower than that of the thresholds generated by conservative PBR estimates (below estimates based on f values of 0.3).

Greater Black-Backed Gulls

12.8 The predicted GBBG collision mortality for the Hornsea project alone is shown in table 15. The predicted mortality rate was considered to not represent a significant impact as all estimates were well below the most precautionary estimates of the PBR threshold. As such this impact was discounted from further consideration.

12.9 The estimates of cumulative GBBG collision mortality evolved during the Examination until positions were agreed on which Band model option and AR and to use and which projects should be included within the cumulative assessment. Initially NE advised that the cumulative collision mortality estimate based on Band model option 1 and a 98 % AR exceeded the PBR of 2109 (using an f value of 0.3), as shown in table 15. Following comments from the Applicant that this approach was too precautionary, NE amended its position such that it endorsed the use of an f value of 0.5.

12.10 Using an f value of 0.5 produced a PBR estimate of 3515 birds, this was sufficient for NE to agree with the Applicant that the cumulative collision mortality estimates would be lower than the predicted PBR threshold for GBBG. However NE wished to add a caveat to this agreement to advise that the cumulative collision mortality estimate did not include the impacts for a number of projects for which there was no GBBG collision mortality estimates available.

Summary

12.11 The ExA has considered the potential impacts upon herring gulls, LBBG and GBBG and supports the conclusions agreed between the Applicant and NE that the Hornsea project will not have a significant effect upon the populations of these species, either alone or cumulatively.

12.12 The SoS has considered the information and is satisfied that the Hornsea project, either alone or cumulatively, will not have a significant effect upon the North Sea populations of herring gulls, LBBG and GBBG. This is based on the predicted collision mortality estimates being below the level at which could be sustainably removed without detrimentally affecting the population in the long term.

12.13 The Hornsea Environmental Assessment Report has adopted a more precautionary approach for 3 species (kittiwakes, herring gulls, LBBG, GBBG) than has been recently endorsed by the SNCBs in their response to the Cook *et al* (2014) report. The SoS remains satisfied that the conclusions reached within the report in respect to these species are still appropriate.

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REP 171: SMart Wind Ltd – Appendix T clarification note relating to the impacts of the export cable installation on intertidal;

REP 242: Natural England – Comments on the WRs and response to comments on RRs – Section A of submission for deadline III;

REP 266: SMart Wind Ltd – Appendix K response to Natural England's written representation;

REP 304: Natural England - responses to ExA's second written questions;

REP 305: Royal Society for the Protection of Birds – Responses to ExA second written questions of 20 March 2014;

REP 322: SMart Wind Ltd – Appendix O table of enhancement, mitigation and monitoring commitments;

REP 326: SMart Wind Ltd – Appendix 6 updated collision risk assessment note;

REP 327: SMart Wind Ltd – Appendix T extract pages from 'The Kittiwake';

REP 329: SMart Wind Ltd – Appendix V clarification note on in combination impacts of the onshore cable connection;

REP 345: SMart Wind Ltd – Appendix HH Natural England – update on matters not agreed;

REP 357: Natural England. Written proofs of oral cases at issue specific hearings. Includes summary of oral case made at ISH on 29 and 30 April 2014, comments on response to rule 17 request, plus other documents;

REP 365: SMart Wind Ltd – Appendix F. Response to Natural England's representation submitted at deadline IV;

REP 367: SMart Wind Ltd – Appendix H. Ornithological summary.

REP 377 – SMart Wind Ltd – Appendix M. Updated clarification note relating to cumulative and in combination assessment.

REP 380: SMart Wind Ltd – Appendix P. Coulson email on kittiwake counts;

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REP 430: SMart Wind Ltd – Appendix H of Applicant's response to deadline VII: comments on the RIES;

REP 432: SMart Wind Ltd – Appendix J. Updated ornithological summary;

REP 437: SMart Wind Ltd – Appendix O. Environmental information signposting document v4;

REP 442: Natural England – Sections A, C, D and E of submission for deadline VII. Comments on Applicant's submission for deadline V and response to rule 17 and draft DCO v5. And the JNCC's response regarding kittiwake counts;

REP 445: SMart Wind Ltd – Updated memorandum of understanding between the Applicant and Natural England. Submitted 03 June 2014;

REP 446 – SMart Wind Ltd – Updated in combination auk displacement note. Submitted 03 June 2014;

REP 450 – Natural England. Section A – comments on the applicant's updated in combination auk displacement note and updated ornithological summary;

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ANNEX A: European Sites identified for the purposes of the HRA and their qualifying features (Source: RIES Matrices)

Designated site	Site qualifying features	Distance to Hornsea
The Humber Estuary SPA	Bar-tailed godwit Golden plover Dunlin Knot Redshank Dark-bellied brent goose Sanderling Ringed plover Oystercatcher	0 km
Coquet Island SPA	Common tern *Sterna hirundo* Arctic tern *Sterna paradisaea* Roseate tern *Sterna dougallii* Sandwich tern *Sterna sandvicensis* Puffin *Fratercula arctica* Black-headed gull *Larus ridibundus*	204 km
Farne Islands SPA	Common tern *Sterna hirundo* Arctic tern *Sterna paradisaea* Roseate tern *Sterna dougallii* Sandwich tern *Sterna sandvicensis* Puffin *Fratercula arctica* Guillemot *Uria aalge* Kittiwake *Rissa tridactyla* Shag *Phalacrocorax aristotelis* Cormorant *Phalacrocorax carbo*	235 km
Flamborough and Filey Coast pSPA	Kittiwake *Rissa tridactyla* Razorbill *Alca torda* Guillemot *Uria aalge* Gannet *Morus bassanus* Puffin *Fratercula arctica* Razorbill *Alca torda* Guillemot *Uria aalge* Herring gull *Larus argentatus* Gannet *Morus bassanus*	51 km

Designated site	Site qualifying features	Distance to Hornsea
	Kittiwake *Rissa tridactyla* Fulmar *Fulmarus glacialis*	
Forth Islands SPA	Arctic tern *Sterna paradisaea* Common tern *Sterna hirundo* Roseate tern *Sterna dougallii* Sandwich tern *Sterna sandvicensis* Gannet *Morus bassanus* Lesser black-backed gull *Larus fuscus* Puffin *Fratercula arctica* Shag *Phalacrocorax aristotelis* Razorbill *Alca torda* Guillemot *Uria aalge* Kittiwake *Rissa tridactyla* Herring gull *Larus argentatus* Cormorant *Phalacrocorax carbo* Fulmar *Fulmarus glacialis*	308 km
Humber Estuary SAC	Estuaries Mudflats and sandflats not covered by seawater at low tide Sandbanks which are slightly covered by sea water all the time Coastal lagoons *Salicornia* and other annuals colonizing mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Embryonic shifting dunes Shifting dunes along the shoreline with *Ammophila arenaria* white dunes') Fixed dunes with herbaceous vegetation ('grey dunes') Dunes with *Hippophae rhamnoides*	0 km
River Derwent SAC	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho* vegetation Sea lamprey *Petromyzon marinus* River lamprey *Lampetra fluviatilis* Bullhead *Cottus gobio* Otter *Lutra lutra*	45 km
Berwickshire and North Northumberland Coast SAC	Grey seal *Halichoerus grypus*	208 km
The Wash and North Norfolk Coast SAC	Harbour seal *Phoca vitulina*	40 km

Designated site	Site qualifying features	Distance to Hornsea
	Otter *Lutra lutra*	
SBZ 1 / ZPS 1 (Belgium) SCI	Twait shad Sea lamprey Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	276 km
SBZ 2 / ZPS 2 (Belgium) SCI	Twait shad Sea lamprey Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	276 km
SBZ 3 / ZPS 3 (Belgium) SCI	Twait shad Sea lamprey Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	276 km
Vlakte van de Raan (Belgium) pSCI	Twait shad Sea lamprey Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	271 km
NTP S-H Wattenmeer und angrenzende Küstengebiete SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	386 km
Dogger Bank SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	210 km
Östliche Deutsche Bucht SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	347 km
Sylter Außenriff SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	293 km
Steingrund SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	378 km

Designated site	Site qualifying features	Distance to Hornsea
Helgoland mit Helgoländer Felssockel SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	367 km
Hamburgisches Wattenmeer SCI (Germany)	Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	393 km
Unterelbe SCI (Germany)	Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	424 km
Borkum-Riffgrund SAC (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	254 km
Nationalpark Niedersächsisches Wattenmeer SCI (Germany)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	287 km
Gule Rev SAC (Denmark)	Harbour porpoise *Phocoena phocoena*	517 km
Sydlige Nordsø SAC (Denmark)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	347 km
Falaises du Cran aux oeufs et du cap gris-nez, dunes du chatelet, marais de tardinghen et dunes de wissant pSCI (France)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	299 km
Bancs des Flandres pSCI (France)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	263 km
Recifs Gris-nez Blanc-nez pSCI (France)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	288 km
Ridens et dunes hydrauliques du detroit du pas-de-calais pSCI (France)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	288 km
Baie de canche et couloir des trois estuaries pSCI (France)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	331 km
Doggersbank pSCI (Netherlands)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	64 km
Klaverbank pSCI (Netherlands)	Grey seal *Halichoerus grypus*	44 km

Designated site	Site qualifying features	Distance to Hornsea
	Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	
Vlakte van de Raan SAC (Netherlands)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	259 km
Noordzeekustzone SAC (Netherlands)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	179 km
Noordzeekustzone II pSCI (Netherlands)	Grey seal *Halichoerus grypus* Harbour seal *Phoca vitulina* Harbour porpoise *Phocoena phocoena*	180 km