Department for Business, Energy & Industrial Strategy

NORFOLK BOREAS OFFSHORE WIND FARM
HABITATS REGULATION ASSESSMENT

Regulation 63 of the Conservation of Habitats and Species Regulations 2017, and

Regulation 28 of the Conservation of Offshore Marine Habitats and Species Regulations 2017

Section 125 of the Marine and Coastal Access Act 2009

December 2021

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1. Introduction

1.1. Background

This is a record of the Habitats Regulations Assessment ("HRA") that the Secretary of State for Business, Energy and Industrial Strategy has undertaken under the Conservation of Habitats and Species Regulations 2017 ("the Habitats Regulations"), the Conservation of Offshore Marine Habitats and Species Regulations 2017 ("the Offshore Habitats Regulations") and the Marine and Coastal Access Act 2009 ("MACAA") in respect of the Development Consent Order ("DCO") and Deemed Marine Licences ("dMLs") for Norfolk Boreas and its associated infrastructure (the "Project"). For the purposes of these Regulations the Secretary of State is the competent authority (under the Habitats Regulations and the Offshore Habitats Regulations) and the public authority (under the MACAA).

The Project will comprise of an offshore wind generating station of up to 1800 megawatts (MW) installed capacity including up to 158 wind turbines and an offshore substation, a cable connection to the shore at Happisburgh in north Norfolk, an onshore substation and electricity transmission system connection at Necton in west Norfolk. The Project will cover an area of approximately 725km^2 located in the southern North Sea approximately 73km from the Norfolk coast at its closest point to land. The landfall cable connection would have an underground cable route approximately 60km in length to connect the Necton National Grid substation. The Project is described in more detail in Section 2.

The Project constitutes a Nationally Significant Infrastructure project (NSIP) as defined by s.14(1)(a) of the Planning Act 2008 as it is for a generating station of over 100 MW.

The Project was accepted by the Planning Inspectorate ("PINS") on 4 July 2019 and a five-member Panel of Inspectors ("the Panel") was appointed as the Examining Authority ("ExA") for the application. The Examination of the Project application began on 12 November 2019 and completed on 2 October 2020. The Panel submitted its report of the Examination, including its recommendation ("the ExA's Report"), to the Secretary of State on 12 January 2021.

Following receipt of the ExA's report, the Secretary of State requested further information relevant to this HRA on 28th April, 9th July, and 24th September 2021.

The Secretary of State's conclusions contained in this report have been informed by the ExA's Report, and further information and analysis provided by the Applicant in response to requests made by the Secretary of State for further information (BEIS 2021)[1] [2] [3], including further details of compensation strategies for impacts on Alde-Ore Estuary SAC, Flamborough and Filey Coast SPA and Haisborough, Hammond and Winterton SAC, as well as updates to the collision risk models, displacement models and population viability assessments to account for the changes in in-combination project parameters and updated bird mortality figures for Hornsea Project Three.

The report also contains analysis and assessment of the potential effects of the Project upon designated sites in European Economic Area States ("transboundary sites"). This is included under the transboundary assessment section of the report (Section 7).

[1] BEIS (2021). *Request for Information. Letter Dated 28 April 2021.*

[2] BEIS (2021). *Request for Information. Letter Dated 9 July 2021.*

[3] BEIS (2021). *Request for Information. Letter Dated 24 September 2021.*

1.2. Habitats Regulations Assessment (HRA)

The Conservation of Habitats and Species Regulations 2017 ("the Habitats Regulations") and the Conservation of Offshore Marine Habitats and Species Regulations 2017 ("the Offshore Habitats Regulations") aim to ensure the long-term conservation of certain species and habitats by protecting them from possible adverse effects of plans and projects.

In the UK, the Habitats Regulations apply as far as the 12 nautical miles (nm) limit of territorial waters. Beyond territorial waters, the Offshore Habitats Regulations serve the same function for the UK's offshore marine area. Following the UK's departure from the European Union, these domestic regulations continue to apply. The Secretary of State notes the Application covers areas within and outside the 12nm limit, so both sets of Regulations apply and hereafter will be referred to collectively as the Habitats Regulations.

The Habitats Regulations provide for the designation of sites for the protection of habitats and species of international importance. These sites are called Special Areas of Conservation ("SACs"). The Regulations also provide for the classification of sites for the protection of rare and vulnerable birds and for regularly occurring migratory species within the UK and internationally. These sites are called Special Protection Areas ("SPAs"). SACs and SPAs together, referred to as European sites in legislation, form part of the UK's national site network.

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. Government policy is to afford Ramsar sites in the United Kingdom the same protection as sites within the national site network (collectively referred to in this HRA as "protected sites").

Regulation 63 of the Conservation of Habitats and Species Regulations 2017 provides that:

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

And that: *In the light of the conclusions of the assessment, and subject to regulation 64 [IROPI], the competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site or the European offshore marine site (as the case may be).*

Regulation 28 of the Conservation of Offshore Marine Habitats and Species Regulations 2017 contains similar provisions:

Before deciding to undertake, or give any consent, permission or other authorisation for, a relevant plan or project, a competent authority must make an appropriate assessment of the implications of the plan or project for the site in view of that site's conservation objectives.

And that:

In the light of the conclusions of the assessment, and subject to regulation 29 [IROPI], the competent authority may agree to the plan or project only if it has ascertained that it will not adversely affect the integrity of the European offshore marine site or European site (as the case may be).

This application is not directly connected with, or necessary to, the management of a protected site. The Habitats Regulations require the Secretary of State to consider whether the project is likely to have a significant effect ("LSE") on any such site, alone or in-combination with other plans and projects. Where the potential for LSE cannot be excluded, an appropriate assessment ("AA") of the implications of the project for that site in view of its conservation objectives must be completed. Therefore, the Secretary of State must determine whether the project will have an adverse effect on the integrity of the site(s). In this document, the first stage assessment of LSEs and, where required, the second stage assessment ("the AA") to determine whether there is an adverse effect on the integrity of a site, are collectively referred to as the Habitats Regulations Assessment ("HRA").

1.3. RIES and Statutory Consultation

Under the Habitats Regulations and the Offshore Habitat 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 specifies.

Natural England is the Statutory Nature Conservation Body ("SNCB") for England and for English waters within the 12 nm limit. The Joint Nature Conservation Committee ("JNCC") is the SNCB beyond 12 nm, but this duty has been discharged by Natural England following the 2013 Triennial Review of both organisations (Defra, 2013). However, JNCC retains responsibility as the statutory advisor for protected sites that are located outside the territorial sea and UK internal waters (i.e., more than 12 nautical miles offshore) and as such, continues to provide advice to Natural England on the significance of any potential effects on interest features of such sites.

The ExA prepared a Report on the Implications for European Sites ("RIES"), with support from the Planning Inspectorate's Environmental Services Team. The RIES was based on matrices provided by the Applicant and relevant information provided by Interested Parties. The RIES signposted relevant information provided in the DCO application and documented the information received during the Examination (up until 31 March 2020) and presented the ExA's understanding of the main facts regarding the HRA to be carried out by the Secretary of State.

The RIES was published on PINS planning portal website and the ExA notified Interested Parties that it had been published. Consultation on the RIES was undertaken between 31 March 2020 and 19 April 2020. The RIES was issued to ensure that Interested Parties, including the SNCBs, were consulted formally on Habitat Regulations matters, as required under regulation 63(3) of the Habitats Regulations and regulation 28(4) of the Offshore Habitats Regulations.

The Secretary of State is content to accept the ExA's recommendation that the RIES, and consultation on it, represents an appropriate body of information to enable the Secretary of State to fulfil his duties in respect of protected sites.

This HRA was compiled using evidence from the application documents and consultation responses, which are available on the Planning Inspectorate's Nationally Significant Infrastructure Project web pages[4]. In particular:

- The ExA's Report
- The RIES
- The Applicant's Environmental Statement
- The Applicant's Information to Support Habitats Regulations Assessment
- Written responses to Secretary of State's requests for further information

Plus, other information submitted during the Examination and during the Secretary of State's consideration of the Application.

Key information from these documents is summarised and referenced in this report.

[4] https://infrastructure.planninginspectorate.gov.uk/projects/eastern/norfolk-boreas/?ipcsection=docs

2. Development Description

Figure 1 shows the Project location in the southern North Sea. The array area of the Project occupies approximately 725km^2 and is around 73km from the Norfolk coast. Figure 2 shows the shows the location of the onshore infrastructure, including the onshore cable corridor.

The Applicant put forward two scenarios in its application:

- Scenario 1 – The Norfolk Vanguard offshore wind farm project would proceed to construction first, and would install ducts onshore and other shared works enabling the Project; and
- Scenario 2 – The Norfolk Vanguard offshore wind farm project does not proceed to construction and the Project would proceed alone. The Project would undertake all works required to connect it to the national electricity transmission grid as an independent project.

As such, some of the proposed works are the same in both scenarios, whilst others are unique to Scenario 1 or Scenario 2. The main offshore elements of the Project comprise:

- An offshore wind turbine generating station with an electrical export capacity of up to 1,800MW which includes one offshore service platform, up to two meteorological masts, up to two LIDAR measurement buoys and up to two wave measurement buoys;
- A network of subsea array cables and fibre optic cables between the wind turbine generators. (Work No. 1 for both scenarios); and
- Scenario 1 only would also include a network of subsea cables and fibre optic cables connecting the turbines to an offshore electrical platform within Norfolk Vanguard offshore wind farm.

The Associated Development onshore would comprise:

- Up to two transition jointing pits and up to four cables and fibre optic cables laid in ducts from MHWS (Work No. 4C for both scenarios);
- Up to four cables and fibre optic cables pulled through existing ducts (for Scenario 1: Work No. 5(a) - District of North Norfolk, No. 6(a) – District of Broadland, No. 7(a) – District of Breckland);
- Up to four cables and fibre optic cables laid in ducts underground (for Scenario 2: Work No. 5(b) – District of North Norfolk, No. 6(b) – District of Broadland, No. 7(b) – District of Breckland);
- An onshore project substation and associated water management, bunding and landscape works and up to 12 interface cables and fibre optic cables laid underground (Work No. 8A, 8B, 9 for both scenarios and access connections, Work No. 12A for Scenario 1 and Work No. 12B for Scenario 2) – all in the District of Breckland;
- National Grid substation extension, surface water management and landscape works (Work No. 10A(a), 10B(a), 10C for Scenario 1 and Work No. 10B(a), 10B(b), 10C for Scenario 2 – District of Breckland); and
- Removal of one pylon and construction of two new pylons and fittings (Work No. 11A for Scenario 1), overhead line modifications (Work No. 11B for Scenario 2) – District of Breckland.

Offshore further Associated Development would comprise scour protection, cable protection, removal of seabed material and disposal of arisings, cable installation preparation and excavation of horizontal directional drilling HDD exit pits. Onshore further Associated Development would comprise works associated with construction onshore, associated mitigation measures, habitat creation and archaeological works, and under Scenario 2, temporary overhead line diversion local to the Necton National Grid substation. Ancillary works would comprise offshore and onshore temporary works to facilitate construction and/or maintenance of the Project or protect land or structures affected.

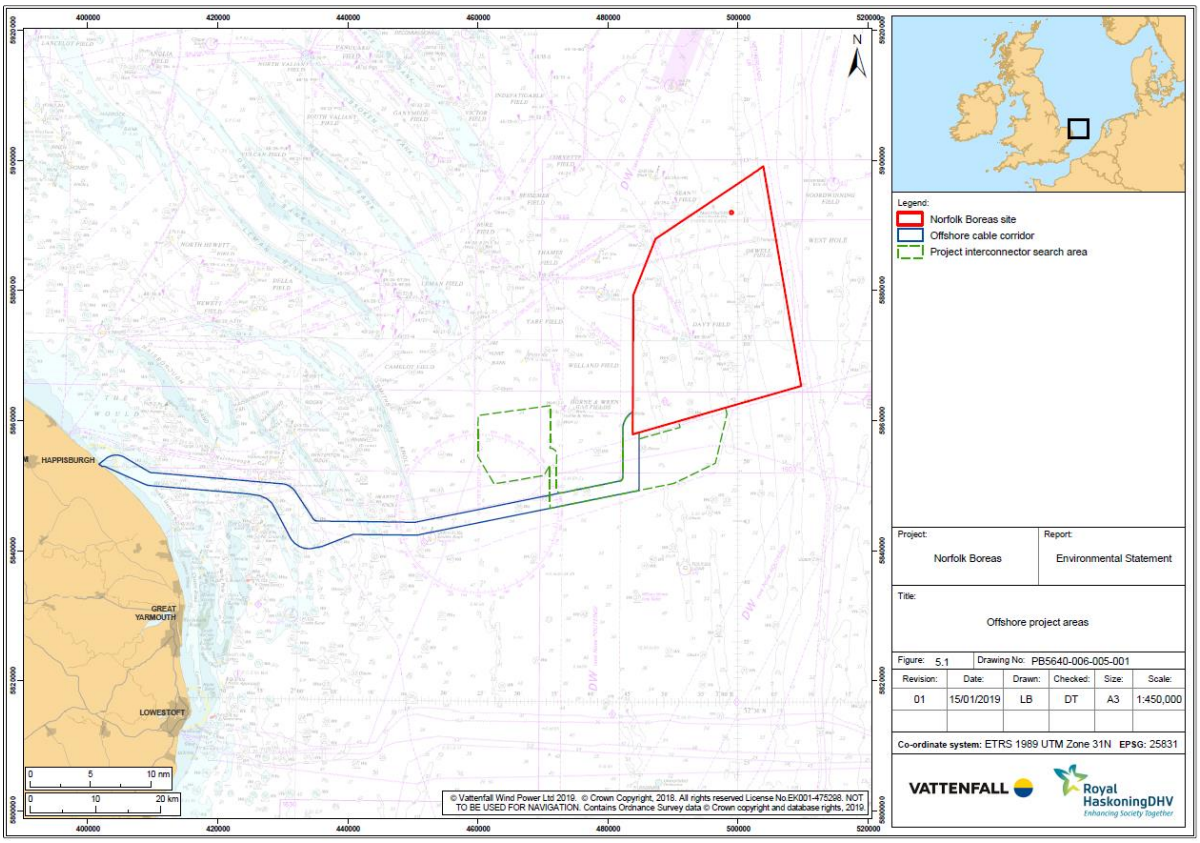

Figure 1: Proposed Location of the Project (Offshore Works).

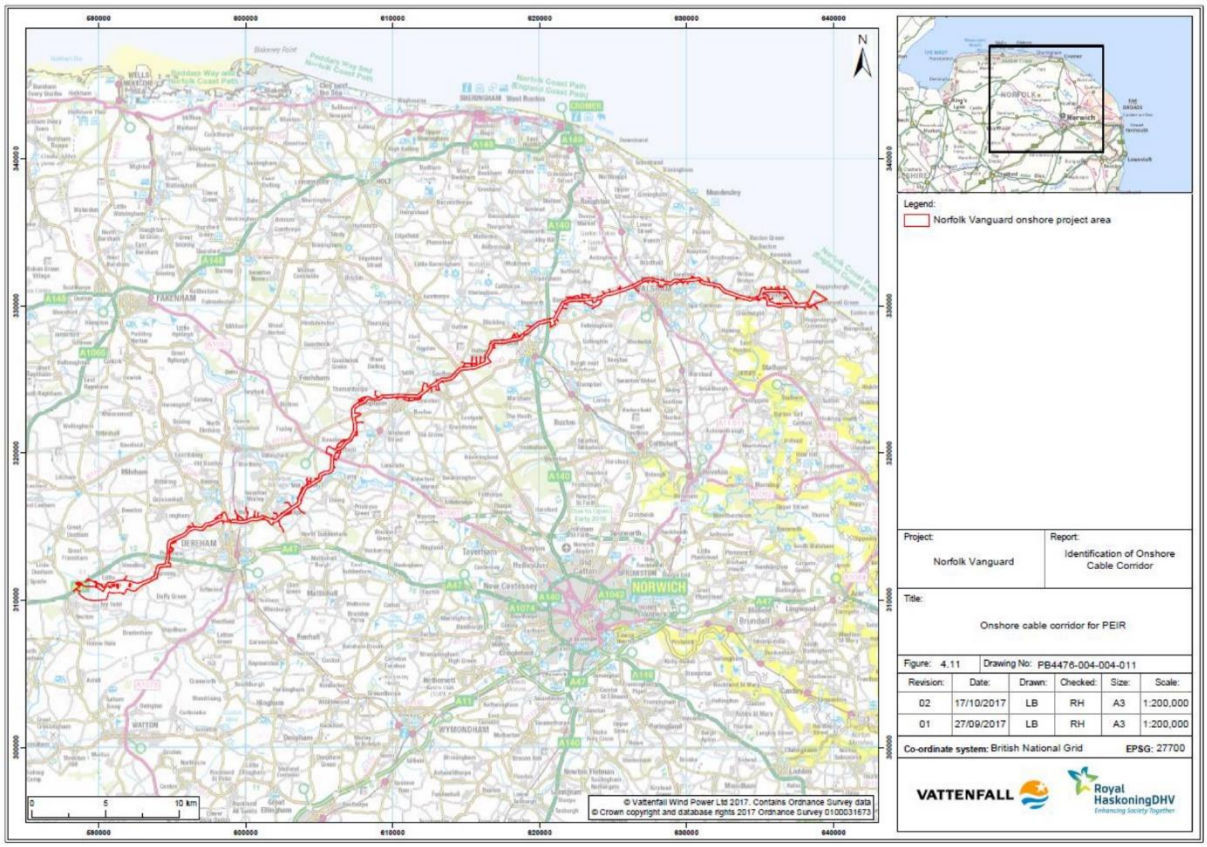

Figure 2: Proposed Location of the Project (Onshore Works Scenario 1 and 2).

The final offshore construction programme will be submitted to the Marine Management Organisation ("MMO") under condition 14(1)(b) of the generation assets deemed marine licence and condition 9(1)(b) of the transmission assets deemed marine licence in the draft DCO. The construction programme must include details of a proposed construction start date; proposed timings for mobilisation of plant delivery of materials and installation works; proposed pre-construction surveys, baseline report format and content, construction monitoring, post-construction surveys and monitoring and related reporting; and an indicative written construction programme for all wind turbine generators, offshore service platforms, meteorological masts, measurement buoys, offshore electrical platforms and cables (including fibre optic cables) comprised in the works in Part 3 (licenced marine activities) of the Deemed Marine Licence.

3. Likely Significant Effects Test

Under regulation 63 of the Habitats Regulations and regulation 28 of the Offshore Habitats Regulations, the Secretary of State must consider whether a project will have a LSE, either alone or in combination with other plans or projects on each of the interest features of the protected sites identified in the RIES to determine whether significant effects are likely.

The purpose of this section is to identify any LSEs on protected sites and to record the Secretary of State's conclusions on the need for an AA and his reasons for including activities, sites or plans and projects for further consideration in the AA.

Of all the protected sites identified during Examination, the ExA concluded that significant effects were likely for 19 sites and their qualifying features either alone or in-combination [PD-020]:

- Alde-Ore Estuary SPA
- Alde-Ore Estuary Ramsar site
- Breydon Water SPA
- Breydon Water Ramsar site
- Broadland SPA
- Broadland Ramsar site
- Flamborough and Filey Coast SPA
- Greater Wash SPA
- North Norfolk Coast SPA
- North Norfolk Coast Ramsar site
- Outer Thames Estuary SPA
- Haisborough Hammond and Winterton SAC
- Humber Estuary SAC
- Southern North Sea SAC
- The Wash and North Norfolk Coast SAC
- Norfolk Valley Fens SAC
- Paston Great Barn SAC
- River Wensum SAC
- The Broads SAC

Table 1: Protected Sites for which Significant Effects cannot be Excluded, when the Project is considered Alone or In Combination with other Plans or Projects, on the Listed Qualifying Features (summarised from the RIES and ExA Report). summarises the features for which significant effects, either alone or in combination, cannot be excluded for each site. The ExA report and the RIES provide further information on sites and features which were considered, but for which LSE were screened out.

During the examination Natural England and other interested parties raised concerns about the potential for LSE on sites or qualifying features which had initially been excluded by the Applicant.

The Applicant's HRA Report screened out Broadland SPA and Ramsar site for LSE on the grounds that bird species which are qualifying features of the site have only been recorded in low numbers in the areas likely to be affected by the Project. Natural England disputed this and was not satisfied with the survey data upon which the Applicant had based its conclusions. The Applicant subsequently provided its screening matrix and integrity matrices for Bewick's swan, pink-footed goose, whooper swan, greylag goose and wildfowl assemblage. In response to a query on the RIES, the Applicant confirmed the wildfowl assemblage feature had been added in error and provided a revised screening matrix. Natural England advised that pink-footed goose is not a designated feature of the SPA. The Applicant stated this had been added on a precautionary basis as reviews carried out by JNCC identified the pink-footed goose as a species which should be added to the list of qualifying features of the SPA. The Applicant also added

greylag goose on the same basis for the Ramsar site. The ExA disagreed that these species should be screened into the LSE assessment for these sites.

The RSPB noted in its Relevant Representation ("RR") that the Applicant's HRA Report had not provided an assessment of the seabird assemblage feature of the Flamborough and Filey Coast SPA. NE advised that LSE could not be excluded on the assemblage feature due to the potential impacts on individual components of assemblage including kittiwake, gannet, guillemot, and razorbill. The Applicant agreed to screen in LSE for operational collision risk modelling and revised its screening matrices accordingly.

The Applicant initially screened out LSE on the common scoter feature of the Greater Wash SPA. The offshore cable corridor would overlap with the SPA boundary, however the Applicant concluded that distribution data from Natural England and JNCC demonstrated that there would be limited overlap between the species and the cable corridor. The Applicant revised its screening matrices to include the species following advice from Natural England that potential LSE could arise from disturbance and/or displacement during cable installation.

Natural England raised concerns that the Applicant had not identified a LSE for the sandbanks feature of the Haisborough Hammond and Winterton SAC as a result of increased suspended sediment and smothering of this feature, despite identification of an impact pathway in the Environmental Statement. The Applicant responded stating these effects were screened out for the Norfolk Vanguard offshore wind farm and this was not disputed during Examination. The effects of the Norfolk Vanguard offshore wind farm, in a worst-case scenario, are expected to have a similar effect on suspended sediment as the Project. In addition, the Applicant stated that the assessment presented in the Environmental Statement established that there would be no impacts because "*the relevant receptors are dominated by processes that are active along the seabed and are not affected by sediment suspended in the water column*", and deposition would not cause a detectable change in the sandbanks. The ExA noted the Applicant's position, but given Natural England's advice, concluded that LSE on the sandbanks feature from increased suspended sediment and smothering of this feature cannot be excluded.

The Applicant excluded LSE from habitat loss on the reef feature of the Haisborough Hammond and Winterton SAC as it considered that it would colonise any cable protection. Upon the advice of Natural England, the Applicant screened in habitat loss and updated its screening matrices accordingly, although it maintained that this would not lead to LSE.

Direct effects within the River Wensum SAC were initially screened out by the Applicant on the grounds that HDD would be used to install the onshore cable under the river. Both Natural England and the Environment Agency raised concerns about the potential damage from leaks of bentonite during the drilling. Natural England advised that this had occurred often enough in previous projects should be considered a likely impact. The Environment Agency was concerned that there was insufficient detail to assess the risk of a breakout. The Applicant maintained that a LSE could be ruled out because of the commitment to HDD, but screened in the effect on the advice of Natural England and updated its screening matrices accordingly.

The ExA noted the Applicant had considered LSE alone and in-combination with other projects, rather than the requirements of the Habitats Regulations which require identification of LSE alone or in-combination. However, Natural England did not raise any particular concerns about the Applicant's approach.

Table 1: Protected Sites for which Significant Effects cannot be Excluded, when the Project is considered Alone or In Combination with other Plans or Projects, on the Listed Qualifying Features (summarised from the RIES and ExA Report).

Name of Protected Site	Features for which Likely Significant Effects have been Identified
Alde-Ore Estuary SPA and Ramsar site	Lesser black-backed gull *Larus fuscus* (breeding) population

Name of Protected Site	Features for which Likely Significant Effects have been Identified
Breydon Water SPA	Bewick's swan *Cygnus columbianus bewickii* (non-breeding) Pied avocet *Recurvirostra avosetta* (non-breeding) European golden plover *Pluvialis apricaria* (non-breeding) Northern lapwing *Vanellus vanellus* (non-breeding) Ruff *Philomachus pugnax* (non-breeding) Waterbird assemblage
Breydon Water Ramsar site	Bewick's swan (overwintering) Northern lapwing (overwintering) Waterbird assemblage (winter)
Broadland SPA	Bewick's swan (non-breeding) Whooper swan *Cygnus cygnus* Bittern *Botaurus stellaris* European marsh harrier *Circus aeruginosus* Hen harrier *Circus cyaneus* Ruff Gadwall *Anas strepera* Northern shoveler *Spatula clypeata* European wigeon *Anas penelope*
Broadland Ramsar site	Bewick's swan (non-breeding) Gadwall Northern shoveler European wigeon
Flamborough and Filey Coast SPA	Gannet *Morus bassanus* (breeding) Kittiwake *Rissa tridactyla* (breeding) Guillemot *Uria aalge* (breeding) Razorbill *Alca torda* (breeding) Waterbird assemblage (breeding)
Greater Wash SPA	Red-throated diver *Gavia stellata* (non-breeding) Little gull *Hydrocoloeus minutus* (non-breeding) Common scoter *Melanitta nigra*
North Norfolk Coast SPA	Great bittern *Botaurus stellaris* (breeding) Pink-footed goose *Anser brachyrhynchus* (non-breeding) Dark-bellied Brent goose *Branta bernicla* (non-breeding) Eurasian wigeon (non-breeding) Eurasian marsh harrier (breeding) Montagu's harrier *Circus pygargus* (breeding) Pied avocet *Recurvirostra avosetta* (breeding) Red knot *Calidris canutus* (non-breeding) Sandwich tern *Sterna sandvicensis* (breeding) Common tern *Sterna hirundo* (breeding) Little tern *Sternula albifrons* (breeding) Bar-tailed godwit *Limosa lapponica* Waterbird assemblage
North Norfolk Coast Ramsar site	Great bittern (breeding) Pink-footed goose (non-breeding) Dark-bellied Brent goose (non-breeding) Eurasian wigeon (non-breeding) Northern pintail *Anas acuta* (non-breeding)

Name of Protected Site	Features for which Likely Significant Effects have been Identified
	Red knot (non-breeding) Sandwich tern (breeding) Common tern (breeding) Little tern (breeding) Waterbird assemblage
Outer Thames Estuary SPA	Red-throated diver (non-breeding)
Haisborough Hammond and Winterton SAC	Sandbanks slightly covered by seawater at all times Biogenic reef (formed by *Sabellaria spinulosa*)
Humber Estuary SAC	Grey seal *Halichoerus grypus*
Southern North Sea SAC	Harbour porpoise *Phocoena phocoena*
The Wash and North Norfolk Coast SAC	Harbour seal *Phoca vitulina*
Norfolk Valley Fens SAC	Alkaline fens Northern Atlantic wet heaths with *Erica tetralix* European dry heaths *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
Paston Great Barn SAC	Barbastelle bats *Barbastella barbastellus*
River Wensum SAC	Watercourse of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation Desmoulin's whorl snail *Vertigo moulinsiana* White-clawed crayfish *Austropotamobius pallipes* Brook lamprey *Lampetra planeri* Bullhead *Cottus gobio*
The Broads SAC	Hard-oligotrophic waters with benthic vegetation of *Chara* spp Alkaline fens Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* type vegetations Transition mires and quaking bogs Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) Desmoulin's whorl snail Fen orchid *Liparis loeselii* Ramshorn snail *Anisus vorticulus* Otter *Lutra lutra*

The Secretary of State has considered the potential effects of the application on all relevant interest features, in view of their conservation objectives, on existing protected sites including the 19 protected sites listed above to determine whether there will be LSEs in the context of the Habitats Regulations.

3.1. Likely Significant Effects Alone Assessment

The Secretary of State agrees with the recommendations of the ExA and concludes that likely significant effects cannot be excluded at the 19 sites listed in Table 1: Protected Sites for which Significant Effects cannot be Excluded, when the Project is considered Alone or In Combination with other Plans or Projects, on the Listed Qualifying Features (summarised from the RIES and ExA Report)., when the Project is considered alone.

These sites are taken forward to the AA to consider whether the Project will result in an adverse effect upon the integrity of these sites.

3.2. Likely Significant Effects In-Combination Assessment

Under the Habitats Regulations and the Offshore Habitat Regulations, the Secretary of State is obliged to consider whether other plans or projects in-combination with the Project might affect protected sites. In this case there are several other plans or projects which could potentially affect some of the same protected sites. The approach used by the Applicant to assess in combination effects was to select projects which may affect the designated site feature under consideration. The plans or projects included in the in-combination assessment include several planned and existing offshore wind farms within the vicinity of the Project.

The Secretary of State agrees with the recommendations of the ExA and concludes that LSEs cannot be excluded at the 19 sites listed in Table 1 when the impacts of the Project are considered in-combination with other plans or projects.

The 19 sites listed above are taken forward to the AA to consider whether the Project in combination with other plans or projects will result in an adverse effect upon the integrity of these sites.

4. Appropriate Assessment Methodology

The requirement to undertake an AA is triggered when a competent authority, in this case the Secretary of State, determines that a plan or project is likely to have a significant effect on a protected site either alone or in combination with other plans or projects. Guidance issued by Defra states that the purpose of an AA is to assess the implications of the plan or project in respect of the site's conservation objectives, either individually or in combination with other plans and projects, and that the conclusions should enable the competent authority to ascertain whether the plan or project will adversely affect the integrity of the site concerned. The focus is therefore specifically on the species and/or habitats for which the protected site is designated[5].

The purpose of this AA is to determine whether the adverse effects on the integrity of the features of the 19 sites identified can be ruled out as a result of the application alone or in combination with other plans and projects in view of the site's conservation objectives and using the best scientific evidence available.

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

4.1. Conservation Objectives

Defra Guidance indicates that disturbance to a species or deterioration of a protected site must be considered in relation to the integrity of that site and its conservation objectives[6]. It states that "*the integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated*".

The conservation objectives have been established by Natural England. When met, each site will contribute to the overall favourable conservation status of the species or habitat feature across its natural range. Conservation objectives outline the desired state for a protected 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. There are no set thresholds at which impacts on site integrity are considered 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.

Natural England has issued generic conservation objectives, which should be applied to each interest feature of the site. The next stage is the provision of supplementary information to underpin these generic objectives to provide site-specific information and give greater clarity to what might constitute an adverse effect on a site interest feature.

In the interim, Natural England advises that HRAs should use the generic objectives and apply them to the site-specific situation. For SPAs, the overarching objective is to:

[5] https://www.gov.uk/guidance/appropriate-assessment#what-must-an-appropriate-assessment-contain

[6] https://www.gov.uk/guidance/appropriate-assessment

Avoid the deterioration of the habitats of 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. This is achieved by, subject to natural change, maintaining and 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 populations of the qualifying features.
- The distribution of the qualifying features within the site.

For SACs, the overarching objective is to avoid the deterioration of the qualifying natural habitats and the habitats of qualifying species, and the significant disturbance of those qualifying species, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving favourable conservation status of each of the qualifying features. This is achieved by, subject to natural change, maintaining and restoring:

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

The conservation objectives have been used by the Secretary of State to consider whether the Project has the potential to have an adverse effect on the integrity of sites, either alone or in-combination with other plans or projects. The potential for the Project to have an adverse effect on site integrity is considered for each site in turn.

4.2. Appropriate Assessment: Protected Sites on which the Applicant and SNCBs Agree no Adverse Effect on Integrity

Table 1: Protected Sites for which Significant Effects cannot be Excluded, when the Project is considered Alone or In Combination with other Plans or Projects, on the Listed Qualifying Features (summarised from the RIES and ExA Report). sets out the 19 sites and associated features for which the Secretary of State considers that likely significant effects cannot be excluded. The Applicant initially concluded that there would be no adverse effect on integrity of any protected site. These conclusions were disputed by interested parties during the Examination, including Natural England, in relation to the following sites:

- Alde-Ore Estuary SPA and Ramsar
- Flamborough and Filey Coast SPA
- Haisborough Hammond and Winterton SAC
- Southern North Sea SAC

Table 2 presents the protected sites where the Applicant, with agreement from SNCBs (as shown in the RIES Annex 2[7]), considers that there would be no adverse effect on integrity.

Table 2: Protected Sites for which the Applicant and SNCBs Agree there is no Adverse Effect on Integrity from the Project either Alone or In Combination.

Protected Site	Feature with Potential for Adverse Effect	Project Phase	Potential Impact
Breydon Water SPA and Ramsar site	Bewick's swan Pied avocet European golden plover Ruff Northern lapwing Waterfowl assemblage	Operation	Collision mortality
Broadland SPA and Ramsar site	Great bittern Eurasian marsh harrier Ruff Gadwall Northern shoveler Eurasian wigeon Hen harrier	Operation	Collision mortality
	Bewick's swan Whooper swan	Construction/ Decommissioning	Direct effects on ex-situ habitats Indirect effects on ex-situ habitats
		Operation	Collision mortality
Greater Wash SPA	Red-throated diver	Construction	Displacement/disturbance from offshore cable installation
		Operation	Displacement due to operation and maintenance vessel movements
	Little gull	Operation	Collision mortality

[7] Examining Authority (2020): *Report on the Implications for European Sites. Proposed Norfolk Boreas Offshore Wind Farm*. Planning Inspectorate Reference: EN010087.

[7] Examining Authority (2020): *Report on the Implications for European Sites. Proposed Norfolk Boreas Offshore Wind Farm.* Planning Inspectorate Reference: EN010087.

Protected Site	Feature with Potential for Adverse Effect	Project Phase	Potential Impact
	Common scoter	Construction	Displacement/disturbance from offshore cable installation
North Norfolk Coast SPA and Ramsar site	Pied avocet Great bittern Common tern Little tern Eurasian marsh harrier Montagu's harrier Sandwich tern Dark-bellied Brent goose Red knot Pink-footed goose Eurasian wigeon Bar-tailed godwit Northern pintail Waterbird assemblage	Operation	Collision mortality
Outer Thames Estuary SPA	Red-throated diver	Operation	Displacement due to operation and maintenance vessel movements
Humber Estuary SAC	Grey seal	Construction/ Decommissioning Operation	Disturbance from underwater noise Disturbance at haul-out sites Collision mortality (vessel interactions) Changes to prey resource
		Construction/ Decommissioning	Changes to water quality
The Wash and North Norfolk Coast SAC	Harbour seal	Construction/ Decommissioning Operation	Disturbance from underwater noise Collision mortality (vessel interactions) Changes to prey resource Disturbance at haul-out sites
		Construction/ Decommissioning	Changes to water quality

Protected Site	Feature with Potential for Adverse Effect	Project Phase	Potential Impact
Norfolk Valley Fens SAC	Alkaline fens Northern Atlantic wet heaths with *Erica tetralix* European dry heaths *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*	Construction/ Decommissioning Operation	Indirect effects on features present within ex-situ habitats of the SAC arising from air quality and groundwater/ hydrology effects*.
Paston Great Barn SAC	Barbastelle bats	Construction/ Decommissioning Operation	Direct effects on bats present in ex-situ habitats of SAC (hedgerow/ watercourses) Indirect effects on bats present in ex-situ habitats from light and groundwater/ hydrology effects.
River Wensum SAC	Watercourse of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation Desmoulin's whorl snail White-clawed crayfish Brook lamprey Bullhead	Construction/ Decommissioning Operation	Direct effects within the SAC boundary Direct effects within the ex-situ habitats of the SAC. Indirect effects within the SAC from geology/contamination/groundwater/hydrology effects. Indirect effects within ex-situ habitats of the SAC from geology/ contamination/ groundwater/ hydrology effects.

Protected Site	Feature with Potential for Adverse Effect	Project Phase	Potential Impact
The Broads SAC	Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp*. Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* – type vegetation Transition mires and quaking bogs Calcareous fens with *Cladium mariscus* and species of the *Caricion davalliaenae* Alkaline fens Alluvial forests with *Alnus glutinosa* (*Alno-Padion, Alnion incanae, Salicion albae*) *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) Desmoulin's whorl snail Fen orchid Ramshorn snail	Construction/ Decommissioning Operation	Indirect effects upon habitats and species within the SAC boundary arising from changes in local groundwater/hydrology conditions.
	Otter	Construction/ Decommissioning Operation	Direct effects upon ex-situ habitats which may support otter due to suitable ex-situ habitats for this feature being present. Indirect effects upon ex-situ habitats which may support otter, from changes in groundwater/ hydrology conditions.

*In-combination effects on features at Norfolk Valley Fens SAC were for construction/ decommissioning only.

For the reasons set out below and because of the agreement between the Applicant and SNCBs, with no objections from any other interested parties, the Secretary of State considers there will be no adverse effects, either alone or in combination, on the integrity of the following sites:

- Breydon Water SPA
- Breydon Water Ramsar site
- Broadland SPA
- Broadland Ramsar site
- Greater Wash SPA
- North Norfolk Coast SPA
- North Norfolk Coast Ramsar site
- Outer Thames Estuary SPA
- Humber Estuary SAC
- The Wash and North Norfolk Coast SAC
- Norfolk Valley Fens SAC

- Paston Great Barn SAC
- River Wensum SAC
- The Broads SAC

The Applicant's conclusions were disputed by the interested parties in relation to the remainder of the sites identified at the LSE stage. As such the Secretary of State has considered in turn the SPAs and SACs in more detail.

4.3. Marine Mammals

The following section explains the approach taken to assessing the impacts of the Project on marine mammals.

The Applicant's assessments for all the marine mammal SACs are based on a realistic worst-case scenario, with the parameters listed in Table 8.8 of [APP-201]. These include the expected number of UXO requiring removal, the maximum number of piled foundations, and maximum hammer energies used in piling.

The potential effects considered by the Applicant in relation to marine mammals is broadly described as:

- Injury or disturbance from increases in underwater noise from piling, UXO clearance and vessel movements
- Increased collisions with vessels
- Changes to the availability of prey as a result of habitat loss, increases in underwater noise and changes in water quality
- Changes in water quality
- Disturbance at haul-out sites (for seal species only)

The Applicant initially proposed the following mitigation for marine mammals in [APP-201]:

- Use of a soft-start and ramp-up protocol so that each piling event would begin with soft-start for a minimum of 10 minutes at 10% of the maximum hammer energy, followed by a gradual ramp-up for at least 20 minutes to the maximum hammer energy. This would allow marine mammals to move away from the area before the maximum hammer energy was reached.
- A Marine Mammal Mitigation Protocol (MMMP) for Piling to be developed pre-construction in consultation with the relevant SNCBs and the MMO. This would present details of measures to reduce permanent auditory injury.
- A Marine Mammal Mitigation Plan for UXO clearance – the dDCO does not seek powers to undertaken UXO clearance, this would be subject of a separate Marine Licence. However, the Applicant has included an assessment of the anticipated effects of UXO clearance and the relevant mitigation in [APP-201].

The Applicant has also relied on the Outline Project Environmental Management Plan (OPEMP), which was submitted with the Application and updated during Examination [REP5-035], to deliver mitigation measures for marine mammals to control the accidental release of pollutants during construction.

4.4. Offshore Ornithology

The following sections explain how the impacts of the Project on birds have been quantified and assessed through the modelling of collision and displacement risks.

4.4.1. Collision Risk

Collision risk modelling was undertaken for bird species that were both considered vulnerable to collision with turbine blades, and qualifying features of SPAs. These species are gannet, kittiwake, and lesser black-backed gull. The Applicant noted that the collision risk was greatest for the 14.7MW turbine with a 30m draught height. This represented the worst-case scenario, so collision estimates were calculated for this option.

Natural England recommended the use of the Marine Scotland Science (MSS) stochastic collision risk model; however, it was subsequently noted by both the Applicant and Natural England that there were problems with the functioning of the MSS model. The modelling was undertaken using the Band model Option 2 (2012) deterministic collision risk model. Natural England agreed that use of the Band model Option 2 was appropriate but advised that this approach does not allow for uncertainty and/ or variability to be incorporated.

There are two approaches to calculating collision risk in the Band model which are commonly referred to as the "basic" model and the "extended" model. The former assumes a uniform distribution of flights through the turbine rotor blades which equates to the same collision risk across the whole of the swept area. The latter assumes a non-uniform distribution of flights through the turbine blades which equates to a variable collision risk which is skewed towards the lower quadrants of the swept area. Option 2 utilises the basic model and consequently assumes a uniform collision risk.

Natural England advised that uncertainty in seabird density, flight height data, and avoidance rates should be included in the collision mortality estimates. To do this the collision risk model was run using the mean values for each parameter as well as using the upper and lower 95% confidence interval values.

The Applicant [REP2-021] and [REP2-035] explained that tagging studies showed that most offshore wind farm collision assessments have used overestimates of nocturnal activity and that adjustments for these for consented offshore wind farms would reduce collision risks by up to 30%. However, Natural England [REP4-039] stated that the offshore surveys would have missed activity around dawn and dusk, therefore it is not appropriate to apply empirically derived rates from tracking studies to offshore survey recorded results. The Applicant confirmed that it had used Natural England's advised nocturnal activity rates in its assessments [REP5-051].

4.4.2. Flight Heights

Collision risk is directly related to the size of the wind turbine rotor blades and the proportion of birds flying within the rotor swept area. This is termed potential collision height (PCH). For this study, the flight heights were obtained from the British Trust for Ornithology (BTO) generic flight height dataset[8].

4.4.3. Flight Speed

The collision risk model is sensitive to changes in flight speed as there is a direct relationship between the number of birds that pass through a turbine swept area per unit of time and the flight speed[9].

The Applicant submitted that an empirical study of flight speed by Skov, Heinänen, Norman, Ward, Méndez-Roldán and Ellis (2018)[10] now provides the best available evidence on flight speeds for collision

[8] Johnston, A., Cook, A.S.C.P., Wright, L.J., Humphreys, E.M. & Burton, E.H.K. (2014). *Modelling Flight Heights of Marine Birds to more Accurately Assess Collision Risk with Offshore Wind Turbines.* Journal of Applied Ecology, 51,31-41.

[9] Masden, E.A. (2015) *Developing an Avian Collision Risk Model to Incorporate Variability and Uncertainty.* Environmental Research Institute North Highland College – UHI University of the Highlands and Islands.

[10] Skov, H., Heinänen, S., Norman, T., Ward, R.M., Méndez-Roldán, S. & Ellis, I. (2018). *ORJIP Bird Collision and Avoidance Study.* Final report – April 2018. The Carbon Trust. 247 pp.

risk modelling [REP1-188]. This study measured the flight speed of seabirds using laser range finders at Thanet offshore windfarm, near Foreness Point. The Applicant cited the large sample sizes for each species, but it was clarified at Issue Specific Hearing 7 [EV-024] that each track related to an individual bird which was measured multiple times. Consequently, only a limited range of individual birds was sampled.

The empirical observations of Skov *et. al*. (2018) showed consistently lower flight speeds across all species compared with those recommended by the SNCBs (13.3 m/ sec vs 14.9 m/ sec for gannet, 8.7 m/ sec vs 13.1 m/ sec for kittiwake, and 9.8 m/ sec for the gulls). Natural England does not accept that this study provides best available flight speeds because the results are based on a single site outside the breeding season [REP3-075]. Natural England also highlighted that no gannet or kittiwake breeding colonies are within foraging range of the Thanet array [REP7-064].

The revised flight speeds from Skov *et al*. (2018) were used in the second [REP1-188] and third [REP6-042] iterations of the collision risk model that were based on the Applicant's preferred parameterisation. The revised flight speeds were not used in either the first [REP4-049] or second [REP6-043] iteration of the collision risk models and were based on Natural England's preferred parameterisation.

4.4.4. Avoidance Rates

The Applicant [REP2-035] considered that currently advised avoidance rates used in collision risk models are too low. Natural England [REP4-039] confirmed that the SNCBs are currently reviewing this; nevertheless, its position remained to use the current SNCB guidance of 98.9% for gannet and kittiwake in Band model Option 2.

The RSPB [AS-041] did not agree with the Applicant's use of a 98.9% avoidance rate for gannet [RR-054], [REP2-095], [REP3-028], [AS-041] and [REP15-013]. It advised a 98% rate be applied for the breeding season to reflect time and energy constraints on foraging birds. It noted that the 98.9% rate was based on avoidance behaviour from non-breeding gannets. The Applicant [REP2-021], [REP3-003], [AS-041], [REP5-051] and [REP9-010] explained that the 98.9% rate was advised by Natural England and did not amend the avoidance rate used in its updated assessments. Natural England [REP2-080] confirmed that it agreed with the Applicant's 98.9% rate.

4.4.5. Displacement Mortality

The Applicant [REP2-035] and [REP5-051] considered Natural England's advice to assess displacement rates of 30% to 70% across the offshore windfarm and a 2 km buffer to be over precautionary. It concluded that an evidence-based, but still precautionary, assessment of displacement of auks by offshore windfarms might assume that their densities would be reduced inside offshore windfarms by 50% relative to densities in the surrounding area, and by 30%, on average, across a 1 km buffer zone surrounding the offshore windfarm. It also considered that increasing space between larger turbines would be likely to reduce displacement rates as there would be considerable opportunity for species to forage between turbines.

However, Natural England [REP4-039] noted that evidence for auk displacement is variable, and therefore advised that a range of displacement rates should be used. It did not agree that there was evidence to support a position that spacing and turbine size had a bearing on displacement rates.

The mortality rate following displacement was also disputed. The Applicant [REP2-035] and [REP5-051] acknowledged that the consequences of displacement are less well understood than rates of displacement and noted that Natural England adopted precautionary values in the range of 1 to 10%. However, it considered realistic levels of mortality for displaced birds would be less than 1% for all species considered.

Natural England [RR-099], [REP2-080] and [REP4-039] stated that definitive mortality rates are not known and that mortality rates are a crude method of capturing the range of potentially deleterious effects that could arise from displacement, including reduced fitness for migration and reduced productivity during the breeding season. It stated that empirical evidence of energetic consequences of displacement

is limited and the role of overwinter survival on population dynamics is poorly understood. It considered there to be no evidence to suggest that 10% is a precautionary mortality rate.

In respect of auks, Natural England stated that although mortality is likely to be at the low end of the range, it did not agree the Applicant's approach was sufficiently precautionary. Similarly, it did not agree that a 1% mortality rate for red-throated diver from offshore export cable laying to be sufficiently precautionary.

The RSPB [REP2-095], [REP2-096] and [REP15-013] supported Natural England's position. It noted [AS-041] and [REP15-013] that the Applicant's evidence does not acknowledge energetic bottlenecks in winter. The higher weights of birds during the non-breeding period is part of recovery and preparation for breeding and does not allow birds to be subjected to greater disturbance without consequence. The RSPB also noted that recent evidence suggests that the extent of displacement caused by offshore windfarms is far greater than that arising from shipping traffic [REP15-013].

4.4.6. Population Viability Analysis

The Applicant assessed the significance of the predicted in-combination collision impacts by reference to the population viability analysis (PVA) undertaken during the Norfolk Vanguard offshore windfarm examination for lesser black-backed gull at the Alde-Ore Estuary SPA; and the PVAs undertaken during the Hornsea Project Three offshore windfarm examination for gannet, kittiwake, razorbill and guillemot of the Flamborough and Filey Coast SPA.

Natural England highlighted concerns with the Hornsea Project Three offshore windfarm PVA relating to the number of simulations and demographic data. It also identified concerns with the lesser black-backed gull PVA, namely regarding the adjustment of the productivity data to take account of the proportion of birds that miss breeding each year. However, it considered the models to represent the best available evidence on which to base an assessment but recommended the Hornsea Project Three offshore windfarm models be updated using the Natural England commissioned Seabird PVA Tool once updates to it are completed. At D7, Natural England confirmed the update was available as of 3 March 2020 and advised that the models be re-run.

The Applicant presented modelling for the guillemot population for the Flamborough and Filey Coast SPA population using the updated PVA tool and stated that model runs of 1,000 and 5,000 simulations produced similar outputs to those produced by 500 runs. The Applicant therefore considered the current outputs in to be robust and appropriate.

4.4.7. Density Dependence and Independence

The Applicant's HRA report presented population modelling results for both density-dependent and density-independent models. It considered that the density-dependent model was more realistic for gannet and kittiwake. For guillemot, razorbill and lesser black-backed gull, the Applicant drew its conclusions using the density-independent model, which it considered to be more precautionary.

The Applicant considered that density-independent models are biologically unrealistic as they permit unlimited population growth. It explained that density-dependence is known to exist in seabird populations and that a density-dependent PVA generates more realistic predictions. It presented outputs from both models in its D2 ornithology update.

Natural England and the RSPB both acknowledged that density-dependence is likely operating at seabird colonies. However, they considered the density-independent model outputs to be the most appropriate as there is no clear evidence to support the application of any particular form or magnitude of density-dependence; therefore, there is no way of verifying whether predictions from a density-dependent model are robust or accurate. The RSPB also noted that density-dependence can also lead to a slowing in population growth at very small population sizes.

4.4.8. Counterfactuals

Natural England [REP4-039] recommended that both metrics of the counterfactual of population growth rate and the counterfactual of population size be considered to quantify the relative changes in a population in response to anthropogenic impacts. It reported on both metrics in its ornithology advice [REP4-040].

The Applicant's HRA Report [APP-201] presented both the counterfactual of growth rate and the counterfactual of population size.

The RSPB [REP2-035], [AS-041] and [REP9-052] advised that the counterfactual of population size is most appropriate for a density-independent PVA, as the counterfactual of growth rate does not account for a high probability that future population growth rate will be different from the current growth rate. It defined the counterfactual of population size as describing the size of the population after additional mortalities arising from the offshore windfarm. It considered that the Applicant had misapplied the counterfactual of growth rate output by setting it against the recent growth rate of the SPA colony which does not account for the probability that future population growth could be different from the current rate.

4.5. In-Combination Assessment Methodology

The assessment will present effects from the Project in combination with other projects. Due to the range of receptors being assessed, the projects which are relevant to the in-combination assessments will be different for each receptor. The in-combination projects are selected from the following:

- Operating projects
- Projects that are under construction
- Permitted application(s) not yet implemented
- Submitted application(s) not yet determined
- All refusals subject to appeal procedures not yet determined

Throughout the Examination, Natural England [RR-099], [REP7-047] and [REP9-057] noted concerns regarding incomplete baseline surveys for the Hornsea Project Three. It also noted [REP7-047] that the available figures for Hornsea Project Four offshore windfarm were those from the Preliminary Environmental Information Report (PEIR) and were likely to change.

Due to the uncertainty around the final parameters of some future projects, the Secretary of State considers that the impacts of collision and displacement on birds should be limited to offshore windfarms that are operational, under-construction, consented, or in determination. Whilst several projects have issued PEIRs, the predicted bird mortality figures are subject to change and there is a high level of uncertainty in any assessment which includes these figures. This was acknowledged by Natural England in their final consultation response[11].

Therefore, the final in-combination assessment of impacts on gannet, kittiwake, lesser blacked-gull, razorbill and guillemot were updated post-examination to exclude the following projects: Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension. Furthermore, the updated assessment also includes the revised figures for Hornsea Project Three [12] which were not available during the Examination.

[11] Natural England (2021): *Appendix 2: Cumulative and In-Combination Effects with the Dudgeon and Sheringham Shoal Extension Projects.*

[12] Ørsted (2021): *Hornsea Three. Calculation of Effect Estimates*.

5. Appropriate Assessment

5.1. Appropriate Assessment: Alde-Ore Estuary SPA and Ramsar

The Alde-Ore Estuary SPA and Ramsar covers 2,417 ha on the Suffolk coast. It is 111 km from the Project at its closest point.

Alde-Ore Estuary qualifies as an SPA by regularly supporting the following populations of Annex I species of European importance: breeding populations of little tern, marsh harrier and Sandwich tern; and breeding and wintering avocet. The site also qualifies by supporting two Annex II species: wintering redshanks, breeding lesser black-backed gull, a breeding seabird assemblage of international importance, and a wintering waterbird assemblage of international importance.

Alde-Ore Estuary Ramsar, which is coincident with the SPA, qualifies under Ramsar Criterion 2a for nationally scarce plants and British Red Data Book invertebrates; Criterion 3b for a notable assemblage of breeding and wintering wetland birds; and Criterion 3c for breeding lesser black-backed gull; and wintering redshank and avocet.

The Secretary of State has considered the potential for the Project to constitute an adverse effect on site integrity for each feature for which a significant effect is likely. The only potential impact identified at this site was from collision mortalities on the lesser black-backed gull feature during the operational phase. The effect of this impact on the population of lesser black-backed gull was assessed for the Project alone and in combination with other offshore windfarms.

In addition to the generic conservation objectives for SPAs presented in Section 4.1, specific targets for the Alde-Ore Estuary SPA, relating to lesser black-backed gull, include:

- Restoring the size of the breeding population to a level which is above 14,074 whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.
- Maintaining safe passage of birds moving between nesting and feeding areas.
- Reducing the frequency, duration and/ or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/ or loafing birds so that they are not significantly disturbed.
- Reducing predation and disturbance caused by native and non-native predators[13].

The Applicant predicted that the total number of lesser black-backed gull collisions predicted for the Project alone was 14.3 birds (1.4 – 38.9 95% confidence interval (CI)) per year [REP5-059]. It is expected that a proportion of these birds would be associated with the SPA/ Ramsar. The Applicant presented a range of apportionment values from 10% to 30%, which Natural England confirmed was appropriate. However, the Applicant suggested that only 2.1% of the birds would be from the Alde-Ore Estuary SPA/ Ramsar population during the breeding season, based on a review of population estimates, combined with use of the Scottish Natural Heritage apportioning method. Natural England advised that a 30% apportionment rate was more appropriate. The Applicant argued that 30% was overly precautionary and Natural England conceded this point [REP5-077].

The Applicant concluded that during the autumn and spring migration periods, birds from the SPA/ Ramsar make up 3.3% of the Biologically Defined Minimum Population Scales (BDMPS), and in winter these birds make up 5% of the BDMPS. It calculated the total number of annual collisions apportioned to

[13] https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9009112&SiteName=alde-ore&SiteNameDisplay=Alde-Ore+Estuary+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=8

the SPA/ Ramsar would be 1.6 (0.3–3.9 95% CI) birds, using its preferred methods, and 2.1 (0.4–5.3 95% CI) using the methods preferred by Natural England.

The Applicant stated that the background mortality for the SPA/ Ramsar population (assuming approximately 4,000 adults) would be around 460 individuals, using an average adult mortality rate of 11.5%. A worst-case mean annual collision mortality of 2.1 birds (using Natural England's preferred rate of 30%) from the Project would increase the background mortality rate by 0.4%.

The Applicant's PVA modelling of 15 adult bird mortalities per year predicted the population growth rate would be 0.4% lower (0.996) than the baseline using a density-independent model, and 0.1% lower (0.999) using a density-dependent model. The Applicant and Natural England agreed that these levels of mortality would be unlikely to have a detectable effect on the population and would not lead to an adverse effect on the integrity of the SPA.

By close of the examination, in relation to in-combination effects, it was estimated that 54.2 collision mortalities would be apportioned to the SPA each year when the impacts of other offshore windfarms were considered. The additional in-combination mortalities would increase the background mortality rate by 11.8%. Population models indicated that an adult mortality of 55 would reduce the growth rate of the SPA population by 0.3% or 1.4% (for density-dependent and density-independent simulations, respectively) after 30 years. The Applicant concluded that such a reduction in the population growth rate would be very unlikely to cause a population decline.

Natural England advised that the conservation objective is to restore the size of the breeding population whilst avoiding deterioration from its current level: therefore, any additional mortality which would reduce the population growth rate would be counter to the restoration objective.

In the Applicant's view, while there is a risk that the in-combination mortality would delay the time to achieve the conservation objective of restoring the population to 14,000 pairs, the actual contribution to this delay resulting from the in-combination mortality would be very small. Natural England expressed concerns about the concept of *de minimis* effects in relation to in-combination effects, particularly where impacts have already reached a level where the integrity of a site is affected. Natural England cited a Court of Justice of the European Union judgement (linked cases C-293/17 and C-294/17) which stated that where the conservation status of a habitat is poor, the capacity to grant consents for further damaging activities is limited.

In response to the Secretary of State's request to refine the assessment post-examination[3], the Applicant presented an updated in-combination assessment[14] which excluded the contributions of Hornsea 4, Dudgeon Extension and Sheringham Shoal Extension offshore windfarms to the lesser black-backed gull mortality figures. The Applicant also applied Natural England's revised avoidance rate for lesser black-backed gull[15] which was issued in August 2021; however, in October 2021, Natural England withdrew its advice to use the revised avoidance rate and instead advised that the Applicant should revert to the previous avoidance rate issued in 2014[16].

[14] MacArthur Green (2021): *Norfolk Boreas Offshore Windfarm: Alde-Ore Estuary Collision Risk Modelling and Population Viability Analysis.* ExA.AS-2.D22.V1.

[15] Cook, A.S.C.P. (2021) *Additional Analysis to Support SNCB Recommendations Regarding Collision Risk Modelling.* BTO Research Report 739.

[16] Cook, A.S.C.P., Humphreys, E.M., Masden, E.A., & Burton, W. (2014): *The Avoidance Rates of Collision Between Birds and Offshore Turbines.* BTO Issue No. 656.

Due to the change in advice, this assessment is based on the results of the CRM and PVA presented by the Applicant in April 2020[17] (as summarised above) which used the 2014 avoidance rate, and did not include the contributions of Hornsea 4, Dudgeon Extension and Sheringham Shoal Extension to the lesser black-backed gull mortality figures.

The Secretary of State considered the different potential outcomes of the population models and concluded that the Project alone would not have an adverse effect on the integrity of the Alde-Ore Estuary SPA and Ramsar from impacts upon the lesser black-backed gull feature. In relation to in-combination effects, the Secretary of State notes that the conservation objectives for the SPA require restoration of the lesser black-back gull population to the level for which it was designated and any adverse impacts on the population are likely to prevent or delay the achievement of the objectives. The Secretary of State therefore concludes that an adverse effect on the integrity of the Alde-Ore Estuary SPA and Ramsar from the effects of the Project in combination with other offshore windfarms on lesser black-backed gull cannot be excluded.

5.2. Appropriate Assessment: Flamborough and Filey Coast SPA

The Flamborough and Filey Coast SPA covers 8,040 ha of the North Yorkshire coast, including approximately 7,472 ha of marine habitats. It is located approximately 218 km from the Project at the closest point.

The SPA qualifies for supporting over 1% of the biogeographical populations of four regularly occurring migratory species: kittiwake (estimated breeding population of 44,520 pairs) gannet (8,469 pairs), guillemot (41,607 pairs) and razorbill (10,570 pairs). It also qualifies for its breeding seabird assemblage (*c.*216,730 individuals), which is of European importance. The breeding seabird assemblage comprises herring gull, fulmar, shag, cormorant, and puffin, as well as the gannet, kittiwake, guillemot, and razorbill populations detailed above.

In addition to the generic conservation objectives for SPAs presented in Section 4.1. Natural England has provided supplementary conservation objectives for the individual qualifying features of the site, which include:

- Restoring the size of the kittiwake breeding population to above 83,700 pairs, whilst avoiding deterioration from the current level indicated by the latest mean peak count or equivalent.
- Maintaining the size of the gannet breeding population to above 8,469 pairs, whilst avoiding deterioration from the current level indicated by the latest mean peak count or equivalent.
- Maintaining the size of the razorbill breeding population above 10,570 pairs, whilst avoiding deterioration from the current level indicated by the latest mean peak count or equivalent.
- Maintaining the size of the guillemot breeding population to above 41,607 pairs whilst, avoiding deterioration from the current level indicated by the latest mean peak count or equivalent.
- Maintaining the overall abundance of the seabird assemblage above 216,730 individuals, whilst avoiding deterioration from the current level indicated by the latest mean peak count or equivalent.
- Maintaining the diversity of the seabird assemblage: the total number of species should not be reduced.

The Secretary of State has considered the potential for the Project to have an adverse effect on site integrity for each feature for which a significant effect is likely. Likely significant effects from collision and displacement during operation were identified for the kittiwake, gannet, razorbill, guillemot, and the

[17]Royal Haskoning DHV (2020*):Offshore Ornithology: Assessment Update Cumulative and In-Combination Collision Risk Modelling.*

seabird assemblage features. The effect of these impacts was assessed for the Project alone and in combination with other offshore windfarms.

5.2.1. Breeding Kittiwake

The Secretary of State identified a potential LSE on kittiwake from collision with wind turbines during the breeding season.

5.2.1.1. Collision Mortality

The Applicant's approach to the impact assessment for this species was challenged by Natural England and the RSPB. The key areas of dispute were the size of the kittiwake population at the time that the site was designated; kittiwake flight speeds; and the apportionment of breeding kittiwake to the SPA.

The Applicant stated that the population estimates at the time of the SPA designation confused the number of pairs with the number of individual birds present. The target population for the conservation objective is 83,700 pairs, in the Applicant's view this should be 44,520 pairs. Natural England confirmed that the estimate of 83,700 pairs should be used to inform the assessment. The Secretary of State does not agree that there is sufficient reason to dispute the conservation objective target and has considered the effects on the population in the light of the need to restore the population to 83,700 pairs.

The Applicant estimated that 26.1% of the kittiwake observed in the Project site during the breeding season were potentially from the SPA [APP-201]. However, Natural England [RR-099] advised a range of apportionment rates (up to 100%) for the breeding season should be considered and recommended using a precautionary rate of 86% [REP4-039]. The RSPB [RR-054], [REP2-096] and [REP3-028] also advised an apportionment of 86% to account for kittiwake tracking data from 2017. The Secretary of State has considered the predicted impacts for a range of apportionment rates when undertaking this assessment.

Following changes to the design of the Project, the Applicant provided revised collision figures for the Project alone [REP5-059] and in combination with other offshore windfarms [REP8-025] and [REP8-026]. The Applicant estimated the annual collision related mortality for the Project alone to be 57.5 (24.4 to 100.5 95% CI) for the 14.7 MW turbine design with a 30 m draught height. The numbers apportioned to the SPA were 6.1 (2.1–11.5 95% CI) based on an apportion rate of 26%, and 14 (4.2–27.9 95% CI) for Natural England's preferred apportionment rate of 86%.

The Applicant [REP2-035] stated that the SPA population at designation was 44,520 pairs. It calculated the background mortality for this population to be 13,000 birds, using an adult mortality rate of 0.146. To attain an increase in mortality of greater than 1% would require an additional mortality of at least 130 birds per year. The Applicant concluded that even if 100% of the birds present in the Project array area came from the SPA, there would be no detectable increase in mortality. Natural England agreed that, at its preferred apportionment rate, the predicted mortality from the Project alone would not lead to an adverse effect on the integrity of the SAC.

In relation to in-combination effects, the Applicant calculated 669.4 kittiwake collision mortalities would be apportioned to the SPA per year. This would equate to an increase in background mortality of 5.1% (assuming that the SPA population was 44,520 pairs at the time of designation). If Natural England's preferred apportionment rate is used this would be 782 collision mortalities.

The Applicant calculated that, using the counterfactual of population growth rate, if adult mortality was 750 birds, the reduction in the population growth rate would be 0.8% using a density-independent model.

Natural England [REP4-040] advised that, in the context of a population trajectory that is currently stable or increasing at less than 1% per year, an additional mortality of 700 to 750 birds over 30 years, would cause the population to decline and the relevant conservation objective is for the population at designation to be restored [REP9-049].

Natural England also advised [REP7-050] that due to design changes to Hornsea Project Three offshore windfarms (i.e., lower tip height and reduction in turbine numbers), which were not taken into account before the close of the Examination, it was unable to agree on what contribution this project would make to the total in-combination mortality rates for kittiwake.

Post-examination, as part of their consultation response, Natural England provided their advice on the in-combination assessment[18] which included the revised collision mortality estimates for Hornsea Project Three. The assessment was based on the updated in-combination collision mortality figures presented by the Applicant[19], which excluded the contributions from Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension.

Natural England confirmed that if the Hornsea Project Three contribution of 74 kittiwakes is included, then the in-combination mortality total is 432 kittiwakes from the Flamborough and Filey Coast SPA per year for all projects excluding Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension. This predicted level of in-combination collision impact equates to more than 1% of baseline mortality of the colony.

Furthermore, if the mortality from the windfarms is 432 adults per year, then the population of the SPA after 30 years will be 14.3% lower than it would have been in the absence of the Projects and the population growth rate would be reduced by 0.5%. This reduction in the population would be counter to the restore conservation objective for this feature of the SPA and would result in an adverse effect on the integrity of the site.

The Applicant, Natural England and the RSPB concluded that the collision related mortality of kittiwake from the Project alone would not lead to an adverse effect on the integrity of the SPA. The Secretary of State agrees with this conclusion.

The contribution from the Project to the in-combination collision total will be small, but the Secretary of State notes that the Habitats Regulations do not include any reference to the exclusion of small-scale effects, or to treating effects as *de minimis*. The relevant test in Regulation 63 of the Habitats Regulations is whether there would be effects from a project alone or in-combination with other projects. This implies that however small an effect is, it may still contribute to an adverse effect on integrity. The Secretary of State therefore concludes that an adverse effect on the integrity of the Flamborough and Filey Coast SPA from the effects of the Project in combination with other plans or projects on kittiwake cannot be excluded.

5.2.2. Breeding Gannet

The Secretary of State identified a potential LSE on gannet from collision with wind turbines and displacement in the breeding, pre-breeding and post-breeding seasons during the operation of the Project.

5.2.2.1. Collision Mortality

The Applicant used collision risk models to estimate collision mortality impacts on the gannet feature of the Flamborough and Filey Coast SPA. The analysis predicted that 15.1 individuals (95% CIs 1.1–36.3), from a population of approximately 22,122 birds (the SPA population at the time of designation), would collide with the turbines per year. The background adult mortality rate is predicted to be 0.081, which equates to approximately 1,792 birds per year. The addition of 15.1 birds increases the mortality rate by 0.8%, which is below the 1% threshold of detectability. The most recent count for the colony is 26,782

[18] Natural England (October 2021*): Appendix 1: Updated Population Viability Analyses and Implications for In-Combination Assessments for Flamborough and Filey Coast Special Protection Area.*

[19] MacArthur Green (2021): *Updated Population Viability Analysis Flamborough and Filey Coast SPA. V1*.

birds. Natural England [EV9-003] and [REP7-048] agreed that there would be no adverse effects on the integrity of the SPA from collisions attributable to the Project alone.

The RSPB [REP2-069, AS-041 and REP6-038] stated that if its preferred avoidance rate of 98% was applied then the SPA population would decline by up to 18%; however, at D15, it agreed that an adverse effect on integrity could be excluded for the Project alone.

In relation to in-combination collision related mortality, it was estimated that 359 collision mortalities could be attributed to the SPA. The Applicant's density-independent population modelling for 325 and 400 mortalities [REP2-035] based on the counterfactual of population growth found that these levels of mortality would reduce the median population growth rate by a maximum of 1.8%. The actual annual growth rate of this population over the last 25 years has been 10%.

The Applicant concluded that the predicted in-combination gannet collision mortalities attributed to the SPA is not at a level which would trigger a population decline, and in fact population modelling indicates that the in-combination mortalities predicted would only slow the population increase currently seen at this colony. Natural England agreed that an adverse effect on integrity can be ruled out if the contributions from Hornsea Projects Three and Four are excluded from the in-combination assessment, but not if these two offshore windfarms are included [REP4-040].

5.2.2.2. Displacement Mortality

The Applicant estimated that the number of gannets from the SPA which would die because of displacement by the Project would be 10.8 (95% CIs of 0.5-17) per year, based on an 80% displacement rate and a 1% mortality rate: and 8.1 (95% CIs 0.7–23) per year for 60% displacement and 1% mortality. This would increase the background mortality by a maximum of 1.3%, based on 80% displacement, 1% mortality and the upper 95% CI [REP2-035]. This would reduce the population growth rate by a maximum of 0.01%, compared to the actual annual growth rate of this population of 10% [REP2-035]. It concluded that there would be no adverse effect on the integrity of the SPA from gannet displacement mortalities from the Project alone [REP2-035]. Natural England [REP4-040] agreed with this conclusion.

The in-combination effect of displacement on the SPA gannet population was estimated to be between 61 (60% displacement and 1% mortality) and 82 (80% displacement and 1% mortality) mortalities per year, when Hornsea Projects Three and Four were included. This would increase the background mortality rate by a maximum of between 3.4% and 4.6% [REP2-035]. These levels of mortality would reduce the median population growth rate by a maximum of 0.03% [REP2-035]. The Applicant concluded that there would be no adverse effect on integrity of the SPA as a result of displacement of gannet from the Project in-combination with other projects.

Natural England was unable to advise no adverse effect on the integrity of the SPA if Hornsea Projects Three and Four were included in the assessment. This was due to Natural England's concerns regarding the incomplete baseline surveys for Hornsea Project Three, and the uncertainty associated with the effects for Hornsea Project Four, due to the information being derived from the PEIR [REP4-040].

5.2.2.3. Combined and Displacement and Collision Mortality

The combined mortality impact was estimated by adding the displacement and collision mortality risks together. The combined annual gannet displacement and collision mortality for the Project alone was up to 26 birds per year (8.1-10.8 from displacement and 15.1 from collision) [REP5-059]. This would increase the background mortality rate by 1.4%. Density-independent population modelling found that a mortality of 75 (i.e., three times higher) would reduce the median population growth rate by a maximum of 0.3% [REP6-007].

The in-combination mortality from displacement and collision together was 343 to 441 birds per year (displacement 61-82 and collisions of 359 [REP6-007]). This would reduce the population growth rate by a maximum of 2.3%, compared to the actual annual growth rate of this population of 10% [REP2-035].

The Applicant concluded that this level of in-combination mortality represents a negligible risk to this population's status because the number of predicted in-combination gannet collisions and displacement mortalities attributed to the SPA is not at a level which would trigger a population decline.

Natural England [REP4-040] explained that the conservation objective for the gannet population of the SPA is to maintain the size of the breeding population at a level which is above 8,469 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or of 24,594 adults. It also advised that the SPA gannet population is believed to be robust enough to allow the conservation objective to maintain the population at (or above) designation levels and sustain additional alone and in-combination mortalities from the offshore windfarms if Hornsea Projects Three and Four offshore windfarms are excluded from the in-combination totals: however, the uncertainty about the impacts of Hornsea Projects Three and Four offshore windfarms precluded it advising that an adverse effect on integrity could be excluded if these two offshore windfarms were included in the assessment of in-combination effects [REP4-040], [REP9-049] and [REP9-057].

Post-examination, as part of their final consultation response, Natural England provided an updated in-combination impact assessment for gannet[18]. The assessment was based on the updated in-combination collision mortality figures presented by the Applicant[20], which excluded the contributions from Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension.

Natural England confirmed the in-combination collision mortality total is 293 gannets from the Flamborough and Filey Coast SPA per year for all projects excluding Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension. This predicted level of in-combination collision impact equates to more than 1% of baseline mortality of the colony.

Furthermore, if the mortality from the windfarm is 293 adults per year, then the population of the SPA after 30 years will be 33.2% lower than it would have been in the absence of the Projects and the population growth rate would be reduced by 1.3%.

Natural England confirmed that in-combination displacement mortality total for the worst-case scenario of 80% displacement and 1% mortality is 62 gannets from the Flamborough and Filey Coast SPA per year for all projects excluding Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension. This predicted level of in-combination displacement impact equates to more than 1% of baseline mortality of the colony.

Furthermore, if the displacement mortality from the windfarm is 62 adults per year, then the population of the SPA after 30 years will be 8.2% lower than it would have been in the absence of the Projects and the population growth rate would be reduced by 0.3%.

The combined in-combination impact of collision and displacement to gannet from the SPA is predicted to be up to 355 mortalities per year (293 from collisions and up to 62 from displacement). This would equate to more than 1% of baseline mortality of the colony.

If the in-combination mortality is 355 per year, then the population of SPA after 30 years will be 38.7% lower than it would have been in the absence of the projects and the population growth rate would be reduced by 1.6%. The future population growth rate of the SPA population is unknown, therefore Natural England considered the counterfactuals of final population size for the predicted future growth rates between 1% and 5% per year.

For in-combination collision and displacement mortalities of 355 gannets per year, the SPA colony would reduce from its current size of 24,594 adults (based on a growth rate of 1% and 1.3%) but would still be

[20] MacArthur Green (2021): *Updated Population Viability Analysis Flamborough and Filey Coast SPA*. V1.

above the size of the 8,469 pairs or 16,938 adults. The colony would be predicted to continue to grow for any growth rate above 2% per year.

Natural England concluded that as the current annual growth rate of the colony is around 11%, the Flamborough and Filey Coast SPA gannet population is likely to be robust enough to allow the conservation objective to maintain the population at (or above) designation levels with the Project alone and in-combination with other projects.

The Secretary of State has considered the information presented by the Applicant and Natural England in light of the conservation objectives for the SPA and the growth of the gannet population. The Secretary of State is satisfied that an adverse effect on the integrity of the Flamborough and Filey Coast SPA from the Project alone and in-combination with other plans or projects on the gannet feature can be excluded.

5.2.3. Non-Breeding Razorbill

The Secretary of State identified a potential LSE on razorbill from displacement in the non-breeding season during the operation of the Project.

5.2.3.1. Displacement Mortality

The Secretary of State identified a potential LSE on razorbill in the non-breeding season from displacement during the operational phase of the Project and disturbance from construction and decommissioning.

The annual displacement mortality for razorbills apportioned to the SPA was estimated for a range of displacement and mortality rates:

a. 0.1 (0 to 0.2 95% CIs) for 30% displacement and 1% mortality.
b. 3.5 (1.0 to 5.7 95% CIs) for 70% displacement and 10% mortality and 95% CIs 1.0-5.7).
c. 0.2 (0.1 to 0.4 95% CIs) for 50% displacement and 1% mortality (the Applicants preferred parameters).

These levels of mortality would increase the background mortality at the SPA by up to 0.26% [REP2-035] for the Project alone [REP2-035]. Natural England agreed that this would not lead to an adverse effect on the integrity of the SPA [REP2-080] and [REP4-040].

In-combination effects on razorbills apportioned to the Flamborough and Filey Coast SPA from operational displacement were estimated to be:

a. 21 for 30% displacement and 1% mortality.
b. 497 for 70% displacement and 10% mortality.
c. 35 for 50% displacement and 1% mortality (the Applicants preferred parameters).

The impact of the in-combination displacement effect would be an increase the background mortality rate of up to 18.9% [REP2-035]. An increase in mortality up to 500 (70% displacement and 10% mortality) would reduce the median population growth rate by up to 2.4%, compared with the actual annual population growth rate of 7.2%. The Applicant concluded that this level of in-combination mortality would not trigger a population decline and there would be no adverse effect on the integrity of the SPA from the displacement of razorbill [REP2-035].

The conservation objective for the razorbill population of the SPA is to maintain the size of the breeding population above 10,570 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent which was *c.*40,506 breeding adults [REP4-040].

Natural England confirmed [REP4-040] it did not expect the additional mortalities to exceed a level where the population growth rate would decline by more than approximately 0.5% per year. This would

approximate to the population being 13% lower after 30 years when compared to the unimpacted population (based on a mortality rate of 100 birds per year).

Based on this, the current population trend, and productivity levels for the colony, Natural England agreed an adverse effect on the integrity of the SPA can be ruled out from displacement in-combination with other plans and projects when Hornsea Projects Three and Four offshore windfarms are excluded from the in-combination total [REP4-040] and [REP9-057]; however, uncertainty associated with these projects prevented Natural England from advising that an adverse effect on the integrity of the SPA could be excluded when these two projects were included in the in-combination assessment.

Post-examination, as part of their final consultation response, Natural England provided an updated in-combination impact assessment**Error! Bookmark not defined.**. The assessment was based on the updated in-combination mortality figures presented by the Applicant[21] which excluded the contributions from Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension.

Natural England confirmed that the in-combination displacement mortality total for the recommended rate of 30-70% displacement and 1-10% mortality is between 19 and 435 razorbills from the Flamborough and Filey Coast SPA per year for all projects, excluding Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension. This predicted level of in-combination displacement impact equates to 0.44-10.24% of baseline mortality of the colony.

For a displacement mortality of between 20 and 350 razorbills per year, Natural England calculated that the population of the SPA after 30 years will be between 1.8% and 27.3% lower than it would have been in the absence of the Projects and the population growth rate would be reduced by 0.06% and 1.02%.

Whilst Natural England presented counterfactuals for mortality rates between 1% and 10%, they did not anticipate that the razorbill mortality rates would be at the top of this range and proposed that the mortality rate was unlikely to exceed a level where the population growth rate would decline by more than approximately 0.5% per year. They suggested that under a reasonable scenario of 70% displacement and 2% mortality, there would be 90 additional mortalities per year and at these levels the PVA predicted a decline in the population growth rate of 0.3%, which is below the 0.5% threshold which would cause a population decline.

Based on this advice, the Secretary of State concludes that an adverse effect on the integrity of the Flamborough and Filey Coast SPA from the in-combination effects on guillemot can be excluded.

5.2.4. Non-Breeding Guillemot

The annual displacement mortality for guillemot apportioned to the SPA was estimated for a range of displacement and mortality rates:

a. 1.8 (1.1. to 2.6 95% CI) for 30% displacement and 1% mortality.
b. 42.4 (25.1 to 60.5 95% CI) for 70% displacement and 10% mortality.
c. 3.0 (1.8 to 4.3 95% CI) for 50% displacement and 1% (Applicant's preferred parameters).

These levels of mortality would increase the background mortality at the SPA by up to 1.2% [REP2-035] for the Project alone [REP2-035]. Natural England agreed that this would not lead to an adverse effect on the integrity of the SPA [REP2-080] and [REP4-040].

In-combination effects on guillemot apportioned to the Flamborough and Filey Coast SPA from operational displacement were estimated to be:

[21]MacArthur Green (2021): *Updated Population Viability Analysis Flamborough and Filey Coast SPA*. V1.

a. 130 for 30% displacement and 1% mortality.
b. 3,037 for 70% displacement and 10% mortality.
c. 217 for 50% displacement and 1% mortality (Applicant's preferred parameters).

The impact of the in-combination displacement effect would be an increase the background mortality rate by between 2.65 and 60% [REP2-035]. An increase in mortality up to 3,050 would reduce the median population growth rate by up to 4.1%, compared with the actual annual population growth rate of 3.05 and 4.0%. The Applicant concluded that this level of in-combination mortality would not trigger a population decline and there would be no adverse effect on the integrity of the SPA from the displacement of guillemot.

The conservation objective for the guillemot population of the SPA is to maintain the size of the breeding population above 41,607 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent which was *c.*121,754 breeding adults [REP4-040].

Natural England advised that only a decline in growth rate of less than 0.4% would avoid an adverse effect on the integrity of the SPA and it did not expect the mortality to exceed a level where the population growth rate would decline by more than approximately 0.5% per year; however, at the end of the examination insufficient evidence was presented to conclude that effects would remain within these ranges.

Post-examination, as part of their final consultation response, Natural England provided an updated in-combination impact assessment[Error! Bookmark not defined.]. The assessment was based on the updated in-combination mortality figures presented by the Applicant[22] which excluded the contributions from Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension.

The Flamborough and Filey Coast SPA guillemot colony increased by 2.8% per year between 1987-2008. Furthermore, the 2017 colony count was approximately 121,754 breeding adults, compared to the designated population size is 83,214 breeding adults. The conservation objective for the guillemot population of the SPA is to maintain the size of the breeding population at a level which is above 41,607 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.

Natural England confirmed that the in-combination displacement mortality total for the recommended rates of 30-70% displacement and 1-10% mortality is between 80 and 1,750 guillemots from the Flamborough and Filey Coast SPA per year for all projects, excluding Hornsea Project Four, Dudgeon Extension and Sheringham Shoal Extension. After 30 years, these mortality rates would result in the population being 2.3% to 39.7% lower than it would be without the projects and the population growth rate would be reduced by 0.07% and 1.6%.

Whilst Natural England presented counterfactuals for of mortality rates between 1% and 10%, they did not anticipate that the guillemot mortality rates would be at the top of this range and proposed that the mortality rate was unlikely to exceed a level where the population growth rate would decline by more than 0.5% per year. They suggest that under a reasonable scenario of 70% displacement and 2% mortality, there would be 350 additional mortalities per year and at these levels the PVA predicted a decline in the population growth rate of 0.3%, which is below the 0.5% threshold which would cause a population decline.

Natural England concluded that, based on the current population trend for the colony and the restore conservation objective, that an adverse effect on the integrity of the SPA from the displacement of guillemots from the Project in-combination with other projects can be excluded.

[22] MacArthur Green (2021): *Updated Population Viability Analysis Flamborough and Filey Coast SPA*. V1.

Based on this advice, the Secretary of State concludes that an adverse effect on the integrity of the Flamborough and Filey Coast SPA from the in-combination effects on guillemot can be excluded.

5.2.5. Seabird Assemblage

The seabird assemblage comprises fulmar, puffin, herring gull, shag and cormorant as well as gannet, kittiwake, guillemot and razorbill, which are assessed above.

The Applicant considered that herring gull, shag and cormorant from the SPA have no connectivity to the Project site due to their limited foraging ranges or coastal preferences and are not considered to be at risk of impacts at offshore windfarms. Fulmar, which flies at very low levels, has negligible collision risk and is not considered to be at risk of displacement; and puffin were recorded in such low numbers in the Project area that there is no risk of an impact on the population.

The Applicant concluded there would be no adverse effect on the integrity of the species populations which are components of the assemblage feature from the Project alone or in-combination with other plans or projects and therefore there would be no adverse effect on the integrity of the assemblage feature [REP2-035].

Natural England [REP4-040] agreed with this conclusion in relation to the effects from the Project alone, but not for in-combination effects. It advised that effects on the assemblage feature should be assessed against the conservation objectives for abundance and diversity of the feature. It advised [REP4-040] that an adverse effect on the integrity of the seabird assemblage feature of the SPA can be ruled out for collision and displacement impacts in-combination with other plans and projects when the Hornsea Projects Three and Four are excluded from the in-combination totals.

The RSPB advised that it could not agree that adverse effect on the integrity of the seabird assemblage of the SPA could be excluded because of its outstanding concerns on in-combination effects on kittiwake, gannet, guillemot, and razorbill [REP9-052], [REP10-068] and [REP15-013].

The Secretary of State is content that as adverse effects on the integrity of individual components of the assemblage can be excluded for the Project alone, there would be no effect on the integrity of the assemblage feature.

Post-examination Natural England presented updated assessments indicating that if the PEIR projects were excluded from the assessment, then an adverse effect on the integrity could be excluded[18]. Based on this advice, the Secretary of State concludes that an adverse effect on the integrity of the Flamborough and Filey Coast SPA from the effects of the Project in-combination with other plans or projects as a result of impacts upon the seabird assemblage can be excluded.

5.2.6. Overall conclusions on Flamborough and Filey Coast SPA

The Secretary of State is satisfied that adverse effects on the integrity of the Flamborough and Filey Coast SPA can be excluded for the Project alone. However, adverse effects on integrity from the Project in-combination with other plans and project in relation to kittiwake cannot be excluded.

5.3. Appropriate Assessment: Greater Wash SPA

The Greater Wash SPA covers 353,578 ha and is located between Bridlington Bay, East Yorkshire and the area just north of Great Yarmouth on the Norfolk coast. The SPA has a landward boundary at Mean High Water and an offshore extent of around 30 km. It is 59 km from the Project at its closest point.

The Greater Wash qualifies as an SPA for regularly supporting populations of Annex I species of European importance: breeding populations of Sandwich tern, common tern and little tern; non-breeding red-throated diver and little gull; and the regularly occurring migratory species common scoter.

The Secretary of State has considered the potential for the Project to constitute an adverse effect on site integrity for each feature for which a significant effect is likely. Likely significant effects from construction disturbance, disturbance from cable laying, and displacement from operation and maintenance vessel movements on non-breeding red-throated diver were assessed for the Project alone and in combination with other plans or projects.

5.3.1. Non-Breeding Red-Throated Diver

The Secretary of State identified a potential LSE on red-throated diver from displacement in the non-breeding season during the construction and operation of the Project.

Red-throated diver have the potential to be disturbed by the cable installation works. The revised Project parameters, as detailed in Schedules 11 and 12, Part 4, Condition 19 of the dDCO, restrict the cable installation works to one cable laying vessel at any one-time between January and March, inclusive. Natural England [REP4-040] and [REP7-050] agreed this would eliminate any adverse effects on the red-throated diver feature from the Project alone or in-combination with other plans or projects.

The vessel movements associated with the operation of the Project (approximately 1.2 vessel movements per day) represent a small increase in the disturbance from shipping, which generates an average of almost 100 vessel movements per day. The following mitigation measures were included in the OPEMP [REP5-035], and secured through Schedules 9 and 10, Part 4, Condition 14(1)(d); Schedules 11 and 12, Part 4, Condition 9(1)(d); and Schedule 13 Part 4, Condition 7(1)(d) of the dDCO:

- Avoid and minimise maintenance vessel traffic, where possible, during January, February/ March;
- Restrict vessel movements, where possible, to existing navigation routes;
- Avoid over-revving of engines; and
- Avoid rafting birds either en-route to the array and within the array and, where possible, avoid disturbance to areas with consistently high diver densities.

Natural England [REP4-040] and [REP7-050] concluded that there would be no adverse effects on the integrity of the SPA due to impacts on red-throated diver. The Secretary of State, having considered the evidence submitted, is satisfied that an adverse effect on the integrity of the Greater Wash SPA from the effects of the Project both alone and in combination with other plans or projects from the potential effects on red-throated diver from displacement and disturbance can be excluded.

5.4. Appropriate Assessment: Breydon Water SPA and Ramsar Site

The Breydon Water SPA and Ramsar covers 1,203 ha and is an inland tidal estuary on the River Yare and its confluence with the Rivers Bure and Waveney, adjoining The Broads. It is 76 km from the Project at its closest point.

Breydon Water qualifies as an SPA for regularly supporting populations of the following Annex I species of European importance: breeding populations of common tern; and wintering Bewick's swan, pied avocet, European golden plover, northern lapwing, and ruff. The site also qualifies for supporting a wintering waterfowl assemblage of international importance.

Breydon Water Ramsar, which is coincident with the SPA, qualifies under Criterion 5 for waterfowl assemblages of international importance; and Criterion 6 for wintering species/ populations occurring at levels of international importance, including Bewick's swan and northern lapwing.

The Secretary of State has considered the potential for the Project to result in an adverse effect on site integrity for each feature for which a significant effect is likely. The potential impacts identified at this site were through collision risk mortalities on Bewick's swan, pied avocet, European golden plover, northern lapwing, ruff, and the waterbird assemblage during operation. The effects of these impacts were assessed for the Project alone and in-combination with other plans or projects.

5.4.1. Non-Seabird Migrants

Non-seabird migrant collisions predicted for birds apportioned to the Breydon Water SPA and Ramsar were below one individual per year [APP-556]. These levels of additional mortality would not increase the background mortality rate by more than 1% and would be undetectable against natural variations. In-combination collision mortalities with Norfolk Vanguard offshore windfarm and East Anglia Three offshore windfarm were also very low and the predicted increases in background mortality rates were below 1%.

Natural England advised that there would be no adverse effect on the integrity of the SPA from the Project alone or in-combination with other plans and projects [REP7-050].

The Secretary of State is satisfied that an adverse effect on the integrity of Breydon Water SPA and Ramsar site from the effects of the Project alone or in combination with other plans or projects can be excluded.

5.5. Appropriate Assessment: Broadland SPA and Ramsar Site

Broadland is a low-lying wetland complex between east Norfolk and north Suffolk. The area is of international importance for a variety of wintering and breeding raptors and waterbirds associated with lowland marshes.

Broadland qualifies as an SPA for regularly supporting populations of the following Annex I species of European importance: whooper swan, bittern, marsh harrier, hen harrier, ruff, and non-breeding Bewick's swan. The site also qualifies for the regularly migrating non-Annex 1 species: gadwall, shoveler and wigeon.

Broadland Ramsar, which is coincident with the SPA, qualifies under Criterion 6 for the following species/ populations of wintering birds occurring at levels of international importance: Bewick's swan, gadwall, shoveler and wigeon.

The Secretary of State has considered the potential for the Project to cause an adverse effect on site integrity for each feature for which a significant effect is likely. The potential impacts identified at this site were from onshore habitat loss during construction and decommissioning on Bewick's swan and whooper swan; and collision risk mortalities Bewick's swan, whooper swan, bittern, marsh harrier, hen harrier, ruff, gadwall, shoveler and wigeon during operation. The effects of these impacts were assessed for the Project alone and in-combination with other offshore wind farms.

5.5.1. Swans and Geese

The temporary loss of ex-situ crop stubble was identified as a potential impact pathway for a likely significant effect on swans and geese because such habitats provide overwintering forging habitat for these species. The Outline Landscape and Ecological Management Strategy (OLEMS) [REP14-020] included the following measures to mitigate these effects:

- An additional year of wintering bird surveys in advance of construction to be supported by a review of future cropping regimes. This will assess whether the affected areas might otherwise have supported foraging swans and geese.

- Specific mitigation if the additional surveys are not undertaken, or potential effects cannot be ruled out, including:

  - Only one section of the site will be worked at any one time between October and March, with the other managed as suitable bird foraging habitat; or

  - identification and management of a suitable area of land outside the Order Limits (and no restriction on works within two areas).

Requirement 24 of the dDCO was also revised to stipulate that construction works within 5km of the Broadland SPA and Ramsar site must be carried out in accordance with OLEMS.

Natural England concluded that the measures proposed in the OLEMS would negate any adverse effects on foraging swans and geese [REP3-022] and [REP7-050].

5.5.2. Non-Seabird Migrants

The Applicant concluded that the increase in mortality rates from collisions during the operation of the Project would be undetectable against natural variations [APP-556] and there would be no adverse effect on the SPA or Ramsar site because of collisions alone or in combination with other plans or projects. Natural England confirmed that it did not anticipate an adverse effect on the integrity of the SPA/ Ramsar from collision mortalities from the Project alone or in-combination with other plans and projects.

The Secretary of State is satisfied that adverse effects on the integrity of the Broadland SPA and Ramsar site from the effects of the Project alone or in combination with other plans or projects can be excluded.

5.6. Appropriate Assessment: North Norfolk Coast SPA

The North Norfolk Coast SPA is a coastal site covering an area of approximately 78.87 km^2. The site is situated along the northern coastline of Norfolk, between Holme and Weybourne and comprises a wide variety of coastal and intertidal habitats [REP1-213]. The site is approximately 0.32 km from the onshore cable corridor [APP-051].

The North Norfolk Coast qualifies as an SPA for regularly supporting populations of the following Annex II species of European importance: breeding populations of common tern, little tern, sandwich tern, pied avocet, marsh harrier and bittern; and wintering dark-bellied brent goose, pink-footed goose, pied avocet, red knot and wigeon. The site also qualifies for supporting a wintering waterfowl assemblage of international importance.

The North Norfolk Coast Ramsar, which is largely coincident with the SPA, qualifies under Criterion 5 for its internationally important assemblages of wintering waterfowl; and Criterion 6 for species/ populations of wintering birds occurring at levels of international importance; breeding common tern, sandwich tern and little tern; migrating red knot; and wintering pink-footed goose, dark-bellied brent goose, pintail and wigeon.

The Secretary of State has considered the potential for the Project to cause an adverse effect on site integrity for each feature for which a significant effect is likely. The potential impacts identified at this site were from collision risk mortalities during operation on the non-seabird migrants: common tern, little tern, sandwich tern, pied avocet, marsh harrier and bittern, dark-bellied brent goose, pink-footed goose, pied avocet, red knot and wigeon, northern pintail, and the waterbird assemblage. The effects of these impacts were assessed for the Project alone and in-combination with other plans or projects.

5.6.1. Non-Seabird Migrants

The Applicant concluded that the increase in mortality rates from collisions during the operation of the Project would be undetectable against natural variations [APP-556] and Natural England confirmed that

it did not anticipate an adverse effect on the integrity of the SPA or Ramsar from collision mortalities from the Project alone or in-combination with other plans or projects.

The Secretary of State is satisfied that adverse effects on the integrity of the North Norfolk Coast SPA and Ramsar site from the effects of the Project alone or in combination with other plans or projects can be excluded.

5.7. Appropriate Assessment: Haisborough Hammond and Winterton SAC

The Haisborough Hammond and Winterton SAC is a marine site in the Southern North Sea. The site covers an area of approximately 1,467km^2 and overlaps with approximately two thirds of the export cable corridor [APP-051].

The Annex 1 features which are the primary reason for the selection of the SAC are sandbanks which are slightly covered by sea water all the time and biogenic reefs.

The site contains a series of sandbanks which run parallel to the coast. The fauna of the sandbank crests is predominantly low-diversity polychaete and amphipod communities that are typical of mobile sediment environments. The banks are separated by troughs containing more gravelly sediments supporting diverse infaunal and epifaunal communities with ross worm *S.spinulosa* reefs. Aggregations of *S. spinulosa* provide additional hard substrate for the development of rich epifaunal communities.

The conservation status of both Annex I features are currently unfavourable and the conservation objective for this site is to maintain and restore these features to favourable condition by restoring their extent, distribution, structure, function and any supporting processes upon which they rely. The favourable condition of Annex I sandbanks which are slightly covered by seawater all the time and Annex I reefs requires the long-term maintenance of:

- the extent of the habitat (and elevation and patchiness for reef);
- the diversity of the habitat;
- the community structure of the habitat (population structure of individual species and their contribution to the functioning of the habitat); and
- the natural environmental quality (e.g., water quality and suspended sediment levels).

Natural England recently undertook a condition assessment of the features within Haisborough Hammond and Winterton SAC (provided to the Norfolk Vanguard Examination) and their latest view (unpublished) is:

The "*condition of the sandbank feature is in unfavourable condition and needs to be restored to favourable condition. Restoration of the feature requires an overall reduction, or removal, of pressures associated with human activities that cause impacts to the sandbanks' extent and distribution, delineated by both substratum and biological communities. As such, any human activities which can cause pressures resulting in changes to substratum or biological communities to the sandbank feature may present a risk to the site's restoration*"[23].

The Secretary of State has considered the potential for the Project to constitute an adverse effect on site integrity for each feature for which a significant effect is likely. The potential impacts identified at this site were through temporal physical disturbance, permanent habitat loss, the introduction of new substrates, and sediment smothering of the sandbank and reef features. The effects of these impacts were assessed for the Project alone and in combination with other projects and plans.

[23] Royal Haskoning (2019): *Norfolk Vanguard Offshore Wind Farm: Applicant's Comments on Written Representations: Appendix 1 Comments on Annex C of Natural England's Deadline 1 Submission. Document Reference:* ExA; WQRApp1; 10.D2.3.

The assessment takes the following avoidance and mitigation measures into account [APP-201]:

- The use of high voltage direct current (HVDC) to reduce the number of cables and therefore reduce trenching and associated operations, as well as the space required for cable installation;
- A pre-construction survey in advance of cable installation to plan the routeing of the cables;
- Micro-siting of the cables where possible to avoid features such as reef or unexploded ordnance (UXO) identified in the pre-construction survey: the cable route would be agreed with the relevant SNCBs;
- A commitment to bury offshore export cables, where possible, to reduce the need for surface cable protection; cable protection would be limited to 10% of the cable length within the SAC;
- Use of sandwave levelling as a dredging operation to reduce the risk of cables becoming unburied and requiring cable protection installed during the operational phase;
- All seabed material arising from cable installation within the SAC would be placed back in the SAC to ensure that the sediment is available to replenish the sandbank features: sediment would not be disposed of within 50m of the reef feature; and
- Production of a Site Integrity Plan (SIP) for the SAC to provide a framework to develop and agree the mitigation and monitoring measures required to avoid an adverse effect on integrity. Activities under the relevant DMLs would not begin until the Marine Management Organisation, in consultation with the relevant SNCB, was content that the SIP would provide adequate mitigation.

Delivery of the SIP would be secured through a Grampian condition in the DMLs, preventing construction beginning until the Marine Management Organisation was satisfied, in consultation with Natural England that *"there was no adverse effect beyond reasonable scientific doubt on the SAC*" [REP1-033].

5.7.1. Annex I Sandbanks which are Slightly Covered by Sea Water all the Time: Alone Assessment

As the offshore cable corridor overlaps with the SAC, impacts on this feature could arise from: the levelling of sandwaves during cable installation; cable repairs during operation; and permanent habitat loss from cable protection.

It is predicted that the area to be impacted will be less than 2.4km^2, which equates to approximately 0.17% of the SAC.

5.7.1.1. Sandbank Levelling, Cable Installation, and Repairs

Natural England, in the Statement of Common Ground [REP16-010] agreed that the mobile nature of the SAC sandbank system would make it more likely to recover from changes than other less dynamic systems, although scarring may remain in areas of coarser sediment. However, it noted that there is no empirical data relating to works on a similar spatial or temporal scale for this sandbank system.

To minimise impacts on the structure of the sandbanks and/ or changes in the composition of the biological communities the Project will dispose of all sediments from cable burial within the SAC, so that the overall area of sandbank habitat will not change. Natural England agreed that it would be possible to dispose of sandwave levelling material at locations that would keep material within the local sediment transport system [REP9-57], but there would be changes to sediment composition because the proposed mitigation does not ensure that the sediment would be disposed of in areas of similar particle size. Natural England advised that 95% of the dredged material should be of a similar particle size to the material at the disposal locations.

Furthermore, Natural England noted that sandwave levelling does not always ensure that cables remain buried, and cable protection or reburial may be required. Such repeated disturbance could impede sandbank recovery. The Applicant concluded that the areas of sandbank affected represent a small proportion of the SAC and would not have a significant effect on the supporting processes of this feature,

or the associated biological communities; furthermore, cable repairs are only likely to be required once every 10 years.

Natural England and the Marine Management Organisation advised that sandbank recovery should be monitored. The Applicant confirmed that monitoring for sandbanks would be agreed with the Marine Management Organisation, in consultation with Natural England, prior to construction.

The Secretary of State recognises that the site has an unfavourable conservation status arising in part from human activities and that the conservation objectives for the site include the need to restore the sandbank feature to favourable condition. The Secretary of State considers that due to the uncertainties related to sandbank modelling and changes to sediment composition, associated with the disposal of dredged material, there remains doubt over whether the sandbanks would fully recover following cable installation. Therefore, while accepting that biological communities associated with the sandbanks are relatively resilient to disturbance, the doubts about the recovery of the sandbank leads it to conclude that the conservation objectives relating to extent and distribution and structure and function of the feature could be undermined.

Post-examination, in response to the Secretary of State's request for further information on the recovery of sandbanks after levelling and cable installation[2], the applicant submitted additional evidence of sandbank recovery including information from Larsen et., al. (2019)[24] and The Crown Estates (2019)[25].

Larsen et., al (2019) analysed data from 19 different surveys at the Race Bank offshore wind farm to assess the recovery of sandwaves from pre-sweeping undertaken as part of the cable installation. The analysis showed full recovery had occurred or was progressing within one year of the impact occurring. The results of this study are relevant to this assessment because Race Bank offshore wind farm is located in the Race Bank-North Ridge-Dudgeon Shoal sandbank system which exhibits very similar environmental conditions to that experienced within the SAC: furthermore, the approach to seabed preparation for cable installation at these sites would be similar.

The Crown Estate (2019) report reviewed monitoring data from numerous offshore wind farms in UK waters and collated information on how the seabed has recovered from different impacts under different marine conditions. The report demonstrates that areas with sandy seabed types usually recover rapidly and in full following seabed levelling and trenching. The report concludes that sandy sediments recover well following cable installation as evidenced by a lack of cable trenches observed at a number of offshore wind farms including Barrow, Burbo Bank, sand areas of Sheringham Shoal and Robin Rigg. The section of the Project offshore cable corridor which crosses the SAC is dominated by sandy sediments, and therefore, the sandbank feature of the SAC would be expected to recover in a similar timeframe as those at Barrow, Burbo Bank, Sheringham Shoal and Robbin Rig offshore windfarm.

The Secretary of State concludes that the information above represents the best scientific evidence available on the potential for Annex I sandbank features to recover. Based on this evidence, the Secretary of State concludes that the impacts of sandbank levelling cable installation and repairs from the Project alone would be a short-term and temporary and would not have an adverse effect upon the conservation objectives of the Haisborough Hammond and Winterton SAC.

5.7.1.2. Cable Protection

Cable protection is used in areas where the offshore export cable cannot be buried (due to unsuitable benthic conditions) and where the export cable crosses other cables and pipelines.

[24] Larsen, S.M., Roulund, A., and McIntyre, D.L., (2019). *Regeneration of Partially Dredged Sandwaves*. World Scientific Publishing Company.

[25] RPS (2019). *Review of Cable Installation, Protection, Mitigation and Habitat Recovery.* V3. The Crown Estate.

Natural England considered that the addition of any hard substrate is incompatible with the conservation objectives for the SAC, because permanent, long-lasting and irreversible habitat loss would lead to an adverse effect unless the following can be demonstrated that:

- There is no loss of the priority habitat/feature/ sub-feature/ supporting habitat; and/or
- The loss is temporary and reversible; and/or
- The scale of loss is so small as to be *de minimus* alone; and/or
- The scale of loss is inconsequential including other impacts on the site/ feature/ sub-feature.

The Applicant considered that the scale of habitat loss was *de minimis*: however, it proposed additional changes and controls on the extent of cable protection, including:

- A reduction in the extent of cable protection within the SAC from 10% to 5%, after an interim cable burial study demonstrated that at least 95% of the export cable within the SAC could be buried;
- An attempt to rebury cables that become exposed within the SAC during operation before installing cable protection;
- To seek a separate Marine Licence if new areas of cable protection are required during maintenance;
- To decommission cable protection at the end of the Project, where it is associated with unburied cables due to ground conditions (although cable protection would be left in place at crossings);
- To progress agreements for the removal of disused cables to minimise the number of crossing that would require cable protection; and
- To avoid the use of rock armouring for cable protection within the SAC;

These commitments are secured through the CSIMP and SIP. The Applicant also provided information on the feasibility of decommissioning cable protection [REP6-018]. The Applicant [REP10-043] confirmed that it had also agreed with BT Subsea and Deutsche Telekom AG to cut several out of service cables, reducing the requirement for cable crossings within the SAC to two.

Natural England advised that the measures reduced the risk of an adverse effect on integrity but did not eliminate it. It requested that a pre-construction survey be secured through Condition 9 of Schedules 11 and 12.

Natural England agreed that impacts associated with decommissioning cable protection within the SAC could be viewed as long-term rather than permanent and for removal at decommissioning to be considered as mitigation, cable protection would need to be restricted to concrete mattresses or similar. However, cable protection at crossings would be left in place and this would represent a permanent impact [REP14-065].

As no offshore windfarm has been decommissioned after 30 years of operation, there is little evidence that cable protection can be decommissioned after this time, or to support the conclusion that the sandbanks will recover after cable decommissioning.

The Applicant concluded that the areas of the sandbank feature affected represent such a small proportion of the SAC that they would not have a significant effect on the supporting processes of the sandbank feature or the associated biological communities alone, or in combination with Norfolk Vanguard offshore windfarm. This conclusion was not disputed during the Examination.

The worst-case scenario predicted is that cable protection will result in the loss of 2.4ha of benthic habitats within the SAC [Rep10-043]. The Applicant proposed several additional changes and controls on the extent of cable protection which have been secured in the CSIMP and SIP. However, Natural England advised that while the area of cable protection may be quite small-scale in relation to the whole SAC area, there was a high probability that the conservation objectives would be hindered, and that cable protection within 5% of the cable corridor route would have a lasting effect.

The Secretary of State has considered the information presented above and considers that habitats which are subjected to cable protection, will experience the effects of habitat loss and habitat modification. As the cable protection will be in place for 30 years, this is considered a long-term effect, and at crossing points it will be permanent. Furthermore, cable protection measures are likely to impede the restoration of the Annex 1 habitats for the duration that they are in place. These habitats are currently in an unfavourable condition, and delays to their restoration would be contrary to the conservation objectives of the SAC. The Secretary of State concludes that adverse effects on the integrity of the Haisborough Hammond and Winterton SAC from cable protection from the Project alone cannot be excluded.

5.7.1.3. Increased Suspended Sediments

The Applicant maintained that an adverse effect on the integrity of the site would note arise from increased suspended sediment smothering the sandbank features because:

- Increases in suspended sediment would be small, localised and only temporarily exceed normal background levels;
- Deposition of the material would be limited, only changing the level of the sandbanks by between 0.2 – 0.8mm which would not lead to a detectable change in the form of the sandbanks;
- Sandwave levelling would only take place on the sandbanks and not the troughs between so only one sub-feature of the SAC would be affected;
- The level of smothering on the biological communities would be very low; and
- The typical biological communities are made up of species which are adapted to disturbance and which can re-establish quickly.

Natural England agreed with the Applicants conclusions [REP9-057].

The Secretary of State concludes that adverse effects on the integrity of the Haisborough Hammond and Winterton SAC from increased suspended sediment from the Project alone can be excluded.

5.7.2. Annex I Sandbanks which are Slightly Covered by Sea Water all of the Time: In-Combination Assessment

5.7.2.1. Sandbank Levelling, Cable Installation, and Repairs

The only project screened into the in-combination assessment was Norfolk Vanguard offshore wind farm. The Project and Norfolk Vanguard share an offshore cable corridor and there is potential for in-combination effects associated with the construction, operational maintenance, and decommissioning of these projects.

The cable installation programmes indicate that the Project export cables will follow shortly after the installation of the Norfolk Vanguard export cables, with no temporal overlap. The work associated with the export cable installation and therefore with potential to affect the SAC would take approximately 18 months for each site, therefore the total period over which effects could occur would be up to four years. The spatial footprint of installation works for both the Project and Norfolk Vanguard is likely to be double that of the Project alone, as a worst-case scenario. Based on this scenario, the total area impacted by temporary habitat loss/ disturbance within the Haisborough Hammond and Winterton SAC during the construction phase is 4.8km^2.

The cumulative impacts are predicted to effect around 0.3% of the SAC for up to four years, with the potential for further intermittent disturbance from repair works in discrete areas throughout the duration of the Project.

Additional information received from the Applicant post-Examination[24 24] indicated that the sandbanks are likely to recover quickly from levelling, cable installation, and repair and therefore any impacts would be short-term and temporary. Based on the current information available regarding sandbank recovery, the Secretary of State is satisfied that adverse effects on the integrity of the Haisborough Hammond and Winterton SAC from the effects of sandbank levelling, cable installation and repairs from the Project in-combination with the Norfolk Vanguard offshore wind farm on Annex I Sandbanks can be excluded.

5.7.2.2. Cable Protection

The only project considered in the Applicant's assessment of in-combination effects is the Norfolk Vanguard offshore wind farm. The worst-case scenario for the spatial footprint is for the area affected by the two projects to be exactly twice the area that would be affected by the Proposed Development alone [APP-201].

The Secretary of State concludes that adverse effects on the integrity of the Haisborough Hammond and Winterton SAC from cable protection from the Project in-combination with Norfolk Vanguard offshore wind farm cannot be excluded.

5.7.2.3. Increased Suspended Sediments

The only project considered in the Applicant's assessment of in-combination effects is the Norfolk Vanguard offshore wind farm. The Applicant's assessment assumed that the Norfolk Vanguard offshore cables would be installed first. The offshore cables for the Project would be installed later and there would be no temporal overlap between the two. As stated in section 5.7.1.3 above, the Applicant maintained that increases in suspended sediments would be very limited compared to background levels and the biological communities would recover quickly.

The Secretary of State concludes that adverse effects on the integrity of the Haisborough Hammond and Winterton SAC from increased suspended sediment from of the Project in-combination with Norfolk Vanguard offshore wind farm can be excluded.

5.7.3. Annex I Reefs: Alone Assessment

Impacts on reefs could arise from: cable installation; cable repairs during operation; permanent habitat loss from cable protection; and the introduction of new substrates.

The Applicant concluded that there would be no adverse effect on the integrity of the reef feature based on the following assumptions [APP-201]:

- *S. spinulosa* reef is known to recover rapidly after disturbance.
- The use of micro-siting would allow the avoidance of reef features from the Project alone or in combination with Norfolk Vanguard offshore windfarm.
- The approach to depositing material cleared during sandwave levelling would ensure that sediment remained in the local transport system so that the sandbank feature would be maintained but would avoid smothering reef features.
- Published scientific evidence shows that *S. spinulosa* is tolerant of disturbance and sediment smothering.
- *S. spinulosa* would rapidly colonise any cable protection and lead to the creation of new reefs.
- Effects from decommissioning would be similar, or of lesser magnitude, than those from construction.
- When the combined effects of the Project and Norfolk Vanguard offshore windfarm are considered, the percentage of the feature area or SAC area impacted would still be very small.
- Both projects would use micro-siting to avoid reef features so there would be no in-combination effects on reef features. Even if micro-siting could not be undertaken, the total extent of reef feature lost would be no more than 3.7% of the entire feature.

5.7.3.1. Cable Installation

Natural England [RR-099] expressed concerns that it may not be possible to avoid all reefs by micro-siting the offshore cables. As this feature is already in unfavourable condition with a conservation objective to restore it to favourable condition, the project would only be consistent with conservation objectives if all areas of reef are avoided. Furthermore, Natural England considered that to restore reefs to favourable condition, it would also be necessary to protect any areas where reefs may return.

Two areas within the SAC have been identified as priority areas for reef management through the introduction of restrictions on fishing: these are the Eastern Inshore Fisheries and Conservation Authority (EIFCA) Restricted Area 36 of the draft Marine Protected Areas Byelaw 2019, and the Defra fisheries management area within the SAC [RR-099]. The proposed cable corridor is coincident with part of Area 36. Natural England and EIFCA [RR-035], [REP2-045] and [REP5-069] requested micro-siting of the cable to avoid Area 36.

The Applicant [AS-024], [REP2-021], [REP4-022], [REP4-014], [REP6-013], [REP6-016], [REP8-014], [REP10-043] and [REP13-013] stated that micro-siting should be possible because the space available within the offshore cable corridor is approximately 1.05km where the corridor width is 2km, rising to 3.75km where the corridor width is 4.7km [REP10-043].

Whilst there is sufficient space to microsite around Area 36, it may not be possible to avoid Area 36 altogether if the results of the pre-construction surveys find that reef is more extensive in the area south of the byelaw area.

Natural England [RR-099] advised that it may not be practical for the cable route to completely avoid the Defra fisheries management area, but the area of high confidence reef should be avoided in its entirety. However, it confirmed [REP5-081] that reef within fisheries management areas are no more important than any other reef and that all reef within the SAC should be conserved.

Natural England stated that the correct test is whether there would be an adverse effect on the integrity of the site, rather than whether the adverse effects are large or small. On this basis, it could not rule out an adverse effect on integrity.

Natural England [RR-099], [REP2-080] and [REP4-014] expressed concern that there is no evidence on how Annex I reefs recover from the effects of cable installation. It also highlighted evidence from the Wadden Sea indicating that the reefs had not recovered from the impacts of bottom trawling activities.

In the Applicant's view cable installation is a one-off activity, unlike fishing where trawling damage is likely to be repeated. The EIFCA agreed that cable installation was temporary in duration, but noted that the magnitude of effects was much greater than the effects from trawling [REP9-019]. Natural England cited evidence from research in Morecambe Bay in areas subject to intensive trawling, indicating that *S. spinulosa* reef has not recovered [REP14-065].

Natural England stated that the reef could be repeatedly impacted during construction, and then again from cable repair/reburial during operation. It also highlighted the potential for reef to establish across the cable corridor post-installation which could be affected during maintenance cable remediation activities.

The Secretary of State has considered the evidence presented regarding the effects of cable installation on reef features, and how the confidence around the ability to microsite to avoid these features is compromised by the ephemeral nature of the reef and the inability to predict its presence and extent prior to construction. The Secretary of State understands that while there is potentially enough space for the cables to avoid reef features, there is currently a high degree of uncertainty as to what archaeological features might also require avoidance, and the likely discovery of further areas of reef once fisheries management measures are implemented.

The Secretary of State acknowledges that there is insufficient scientific evidence to fully understand the impact of disturbance to reef features from cable installation and their ability to recover. He has carefully considered the advice given by Natural England, as the Government's statutory advisors, and the fact

that the Applicant accepts that scientific certainty is not possible to obtain. The Secretary of State therefore concludes that an adverse effect on the integrity of Haisborough Hammond and Winterton SAC from the effects of the cable installation from Project alone on Annex I Reefs cannot be excluded.

5.7.3.2. Cable Protection

The Applicant considered that permanent loss of reef should be excluded because there is evidence to suggest that cable protection was likely to be colonised by *S. spinulosa*. Furthermore, it considered that reef was likely to be avoided by micro-siting, making the issue of cable protection within existing reef features irrelevant. Natural England stated that colonisation of substrate by reef does not count as a proper reef feature and that the addition of any hard substrata is often incompatible with the conservation objectives for the SAC and could result in lasting change.

Natural England also considered that the areas mostly likely to require cable protection are within mixed sediment areas between the sandbanks which are the most likely to support reef [REP9-039].

Natural England agreed that if micro-siting is possible so that all reef features were fully avoided, and no cable protection is required within the fisheries management areas it would be possible to reach a conclusion of no adverse effects on the integrity of reef features [REP9-057]. The Applicant suggested Condition 3(1)(g) for the dDCO to limit rock protection. The wording was agreed by Natural England and the Marine Management Organisation:

"(g) in the Haisborough, Hammond and Winterton Special Area of Conservation, cable protection must not take the form of rock or gravel dumping where it is deployed to protect export cables apart from at cable crossing locations with existing cables and pipelines."

The Applicant and Natural England and the Marine Management Organisation agreed a revised version of Condition 20, to provide confidence that cable protection could be decommissioned, to be included as a Requirement in the dDCO, as additional paras (2) to (4) under Requirement 14, and not in the DMLs:

(1) No offshore works may commence until a written decommissioning programme in compliance with any notice served upon the undertaker by the Secretary of State pursuant to section 105(2) of the 2004 Act has been submitted to the Secretary of State for approval.
(2) The obligations under paragraphs (3) and (4) shall only apply in respect of cable protection, apart from at cable crossing locations with existing cables and pipelines, which is installed as part of the authorised project within the Haisborough, Hammond and Winterton Special Area of Conservation as at the date of the grant of the Order.
(3) No later than 4 months prior to each deployment of cable protection in the Haisborough, Hammond and Winterton Special Area of Conservation, except where otherwise stated or unless otherwise agreed in writing by the Secretary of State, the undertaker must submit the following documents for approval by the Secretary of State:

> *(a) A decommissioning feasibility study on the proposed cable protection to be updated at intervals of not more than every ten years throughout the operational phase of the Project.*
> *(b) A method statement for recovery of cable protection;*
> *(c) A Monitoring Plan including appropriate surveys of cables situated within the Haisborough, Hammond and Winterton Special Area of Conservation that are subject to cable protection to assess the integrity and condition of that cable protection and determine the appropriate extent of the feasibility of the removal of such cable protection having regard to the condition of the cable protection and feasibility of any new removal techniques at that time, along with a method statement for recovery of cable protection;*
> *(d) A monitoring plan to include appropriate surveys following decommissioning to monitor the recovery of the area of the Haisborough, Hammond and Winterton Special Area of Conservation impacted by cable protection.*

(4) No cable protection can be deployed in the Haisborough, Hammond and Winterton Special Area of Conservation until the Secretary of State, in consultation with the MMO and the Statutory Nature Conservation Body approves in writing the documents pursuant to (3) above.

At the end of the Examination there was no agreement between the Applicant, the Marine Management Organisation and Natural England on whether the revised Condition 20 should be reinstated, and it was agreed that Condition 3(1)(g) should remain in Schedules 11 and 12 and the additional paragraphs agreed with the Marine Management Organisation should be included in the rDCO as new requirements under Requirement 14.

The Secretary of State agrees with Natural England that the colonisation of introduced substrates by reef does not count as a proper reef feature and that the addition of any hard substrata is incompatible with the conservation objectives for the SAC and could result in the long-term loss of reef. The Secretary of State concludes that an adverse effect on the integrity of Haisborough, Hammond and Winterton SAC from the effects of cable protection from the Project alone on Annex I Reefs cannot be excluded.

5.7.3.3. Increased Suspended Sediments

Whilst dredged sediment from cable installation activities would not be disposed of within 50m of *S. spinulosa* reef, Natural England [RR-099] and the Marine Management Organisation [RR-069] requested a larger buffer zone. In response to this request, the Applicant committed to the following additional mitigation measures:

- Disposing of dredged material from sandwave levelling in a linear “strip” along the cable route;
- Disposing of material close to the seabed via a fall pipe to ensure it remains more than 50m away from the reef; and
- Applying specific criteria when determining the location of disposal areas within the SAC.

These commitments were secured in the SIP and CSIMP. The Secretary of State is satisfied that adverse effects on the integrity of the Haisborough, Hammond and Winterton SAC from suspended sediment from the Project alone on Annex I Reefs can be excluded.

5.7.4. Annex I Reefs: In-Combination Assessment

5.7.4.1. Cable Installation, Cable Protection and Suspended Sediment

The Applicant stated that even if micro-siting is not possible, the maximum area of reef that would be lost to the Project in combination with Norfolk Vanguard offshore windfarm would be 0.004% of the SAC area (or 5.9 ha), and 0% of the priority reef management areas. Natural England acknowledged that the areas of reef affected would be small when expressed as a percentage of site area and actual or potential areas of reef within the site, but any loss of protected habitat is a matter of significance.

The Secretary of State concludes that adverse effects on the integrity of Haisborough, Hammond and Winterton SAC from the effects of temporary physical disturbance and habitat loss from cable protection from the Project in-combination with other plans and projects on Annex I Reefs cannot be excluded; however, due to the additional measures secured to reduce the impacts of suspended sediments on reefs, the Secretary of State concludes that an adverse effect on the integrity of Haisborough, Hammond and Winterton SAC from increased suspended sediments from the Project in-combination with other plans and projects on Annex I Reefs can be excluded.

5.8. Humber Estuary SAC

The Humber Estuary SAC supports the following qualifying features:

- Atlantic salt meadows

- Coastal lagoons
- Dunes with *Hippophae rhamnoides*
- Embryonic shifting dunes
- Estuaries
- Fixed dunes with herbaceous vegetation ("Grey dunes")
- Grey seal
- Mudflats and sandflats not covered by seawater at low tide
- River lamprey
- Salicornia and other annuals colonising mud and sand
- Sandbanks which are slightly covered by sea water all the time
- Sea lamprey
- Shifting dunes along the shoreline with *Ammophila arenaria* ("White dunes")

The Secretary of State has identified a likely significant effect on the grey seal feature due to the potential for disturbance to occur at haul out sites and at sea foraging grounds.

5.8.1. Grey Seal

The SAC is located 175km from the Project array and 112km from the offshore cable route; however, the movements of grey seal along the east coast of England could lead to the SAC population being adversely affected. Donna Nook National Nature Reserve ("NNR") is in the southeast of the SAC and supports a large and increasing grey seal breeding colony. The site consists of dunes, slacks and intertidal areas covering more than 10km of coastline between Grainthorpe Haven in the north and Saltfleet in the south. The site is the most southerly breeding site for grey seal on the east coast and is used from August to December as a breeding ground with pupping occurring between October and January[26].

The Applicant identified areas likely to be affected by underwater noise associated with the Project and then estimated the numbers of grey seals which could be affected as a percentage of a reference population. As the grey seal population exploits a wide area of the North Sea, the assessment considered different reference population sizes.

For the effects from the Project alone, the reference population was the SAC population and the population associated with the southeast England management unit (MU). For the in-combination assessment, the reference population was the combined populations of the southeast England, northeast England and east coast Scotland MUs and the Wadden Sea region.

Table 3: The Following Scenarios were Assessed in APP-201

Source of Noise Disturbance	No. Grey Seals Disturbed	% SAC Population	% Reference Population
UXO detonation (one detonation in cable corridor at same time as piling in offshore windfarm area)	2 in offshore windfarm area 170 in offshore cable corridor	4.3%	2.8%
Piling only (assumed to be taking place in cable corridor and interconnector search area at same time)	2 in offshore windfarm area 26 in offshore cable corridor	1.0%	0.6%
Disturbance during construction from sources other than piling or UXO clearance	1 in offshore windfarm area 36 seal in offshore cable corridor	0.9%	0.6%

[26]https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030170&SiteName=humber&countyCode=&responsiblePerson=&SeaArea=&IFCAArea&HasCA=1&NumMarineSeasonality=8&SiteNameDisplay=Humber%20Estuary%20SAC

Source of Noise Disturbance	No. Grey Seals Disturbed	% SAC Population	% Reference Population
Disturbance during operation	1 in OWF area 36 seal in offshore cable corridor	0.9%	0.6%
Disturbance during decommissioning	1 in OWF area 36 seal in offshore cable corridor	0.9%	0.6%

By taking account of the movements of tagged seals, the Applicant stated that grey seals in the offshore Project area are unlikely to be from the Humber Estuary SAC. Based on the assessments presented in Table 3 above, the Applicant concluded that the level of disturbance would not undermine the delivery of the conservation objectives of the site and would not result in an adverse effect on the integrity of the SAC from the Project alone.

The assessment of in-combination disturbance effects on grey seals was based on estimates of the area of sea likely to experience increased underwater noise due to a combination of:

- One piling event at all UK and European offshore windfarm including the Project;
- Up to two UXO clearances;
- Up to two seismic surveys;
- UK and European offshore windfarm construction activities other than piling; and
- Operation and maintenance of UK and European offshore windfarms.

When the above effects were assessed together, the total number of grey seals that would be disturbed was estimated to be 6.6% of the relevant reference population and 37% of the SAC population, during construction. The effects of operation and decommissioning are predicted to be less than those from construction. The Applicant concluded that it is highly unlikely that the seals affected would all be from the SAC population. In addition, the distance between the Project and the coast makes it unlikely that grey seal would be displaced from foraging areas or haul-out sites to the extent that the integrity of the SAC would be affected.

Furthermore, effects on seals using haul-out sites for pupping and moulting are unlikely: published evidence indicates that seals are unlikely to be affected by sources of disturbance over 300m away[27]. As the vessels associated with all phases of the Project are expected to use existing shipping routes, they would not be within 300m of seal haul-out sites on the coast.

An increase of approximately 1,180 vessel movements is estimated over the two to four year indicative offshore construction window, averaging approximately two vessel movements a day. The Applicant excluded adverse effects on the SAC grey seal population from vessel collisions as it considered this to be a very small increase when compared with existing vessel activity in the area. It stated that in-combination impacts are highly unlikely to occur.

The Applicant identified potential effects on prey availability during construction from increases in underwater noise and decreases in water quality. The Applicant calculated the area of sea where fish would be subject to physical disturbance and/or temporary loss of habitat would be 23.31km^2. Furthermore, the potential increase in suspended sediment and re-deposition, based on the parameters in [APP-201, Table 8.8], is predicted to be 0.054km^3, with only a small proportion of sand and mud staying in suspension long enough to form a plume. The Applicant noted that it is unlikely that any changes in

[27] Wilson, S. (2014): *The Impact of Human Disturbance at Seal Haul-Outs. A Literature Review for the Seal Conservation Society.*

prey resource would occur right across the offshore project area and are more likely to be focussed around working sites.

During operation, the total habitat loss for fish species resulting from the introduction of hard substrate, operational noise and electro-magnetic fields (EMF) is predicted by the Applicant to be up to 11.75km^2. The Applicant cites studies at operational offshore wind farms which indicate that any increase above background noise levels during operation would be small and localised and would not have significant effects on fish populations. EMFs would also be expected to decrease rapidly with distance from any source.

The number of grey seals affected by changes in prey resource was estimated by the Applicant to be 0.9% of the SAC population. This assumes that all the grey seals within the offshore project area could be affected. The Applicant notes that it is unlikely that any changes to prey resource would occur right across the whole offshore project area during construction or operation. In-combination effects from changes to prey resource were excluded by the Applicant on the grounds that there would be no additional effects to those assessed for the disturbance of foraging seals, as the areas and duration of any potential changes in prey resource would be within those assessed for underwater noise disturbance [APP-201].

Natural England initially raised concerns about the predicted in-combination disturbance of 37% of the grey seal SAC population [RR-099]. The Applicant provided an additional submission which reiterated its original position that not all the seals affected would come from the SAC population. It pointed out that the measures proposed to reduce disturbance to harbour porpoise would also benefit the grey seal population [AS-024]. Natural England agreed with the Applicant that it was unlikely that all the grey seals subject to disturbance would come from the SAC population [REP16-10].

Given the conservative nature of the Applicant's assessment and Natural England's final position, the Secretary of State concludes that an adverse effect on the integrity of the Humber Estuary SAC from the Project either alone or in combination with other plans or projects can be excluded.

5.9. Appropriate Assessment: Outer Thames Estuary SPA

The Outer Thames Estuary covers 3,792 km^2 and is located on the east coast of England and extends northward from the Thames Estuary to Great Yarmouth on the East Norfolk Coast.

The Outer Thames Estuary qualifies as an SPA for regularly supporting wintering populations of the Annex I species red-throated diver which are of European importance.

The Outer Thames Estuary SPA supports the largest aggregation of wintering red-throated diver in the UK, an estimated population of 6,466 individuals, which is 38% of the non-breeding population of Great Britain. It also protects foraging areas for common tern and little tern during the breeding season. The conservation objective for red-throated diver is to maintain or enhance favourable condition of the population[28]. The SPA is situated in a busy marine area, subject to large-scale permanent infrastructure, busy shipping lanes, and other vessel movement. Impacts from shipping could cause a displacement of red-throated divers.

The Applicant's assessment [APP-201] identified that the addition of vessels transiting to and from the port and the Project (approximately 1.2 vessel movements per day) would have a negligible effect on the levels of shipping disturbance over and above the average of almost 100 vessel movements per day. Natural England considered that there was potential for an adverse effect on the integrity of the SPA from the additional operation and maintenance vessels.

The Secretary of State has considered the potential for the Project to constitute an adverse effect on site integrity for each feature for which a significant effect is likely. Likely significant effects from displacement

[28] https://jncc.gov.uk/our-work/outer-thames-estuary-spa/

from operation and maintenance vessel movements on non-breeding red-throated diver were identified. The effects of these impacts were assessed for the Project alone and in combination with other plans or projects.

During the Examination, the Applicant confirmed that best practice vessel operations would be adopted to minimise disturbance to red-throated diver during operational and maintenance activities, as included in the OPEMP [REP5-035] which is secured through Schedules 9 and 10 Part 4 Condition 14(1)(d), Schedules 11 and 12 Part 4 Condition 9(1)(d) of the dDCO; and Schedule 13 Part 4 Condition 7(1)(d) of the dDCO. Natural England subsequently agreed that an adverse effect on integrity can be ruled out for all features of the SPA [REP7-050].

The Secretary of State is satisfied that an adverse effect on the integrity of the Outer Thames Estuary SPA from the Project alone or in combination with other plans or projects due to impacts upon red-throated diver, can be excluded.

5.10. Appropriate Assessment: The Wash and North Norfolk Coast SAC

The Wash and North Norfolk Coast SAC covers an area of approximately 1,078 km^2. It comprises a range of coastal, intertidal and marine habitats extending along the Lincolnshire and Norfolk coastlines. It has extensive areas of varying, but predominantly sandy, sediments subject to a range of conditions. The SAC is 110km from the offshore windfarm site and 34km from the offshore cable corridor at its nearest point.

The site is designated for a range of Annex I habitats. The site is also designated for the Annex II species harbour seal and otter.

The Secretary of State has identified on LSE on the harbour seal feature due to the potential for disturbance to occur at haul out sites and at sea foraging grounds. A LSE was also identified for the risk of collision at sea due to the increase in vessel traffic.

5.10.1. Harbour Seal

The Applicant identified likely significant effects on the harbour seal feature because of the known movements of harbour seal along the east coast. The SAC provides key breeding and hauling-out habitat for harbour seals and is home to the largest colony in the UK, around 7% of the breeding population[29].The Applicant's assessment used the same methods as those used to assess the effects of disturbance from underwater noise in the Humber Estuary SAC assessment above.

The reference populations used in the assessment of the effects of the Project alone were the harbour seal population of the south-east England MU. For the in-combination assessment the reference population used is that of the southeast England MU and the Waddenzee MU.

Table 4: Levels of Disturbance on Seals Foraging at Sea (estimates from [APP-201])

Source of Noise Disturbance	No. of Harbour Seals disturbed	% SAC Population	% Reference Population
UXO detonation (one detonation in cable corridor at same time as piling in offshore windfarm area)	0.2 in offshore windfarm area 42.5 in cable corridor area	1.3%	0.8%

[29]https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0017075&SiteName=was&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&HasCA=1&NumMarineSeasonality=2&SiteNameDisplay=The%20Wash%20and%20North%20Norfolk%20Coast%20SAC

Single pile installation plus disturbance in the interconnector search area and cable corridor	0.2 in offshore windfarm 9 in offshore cable corridor area	0.3%	0.2%
Disturbance during construction from sources other than piling or UXO clearance*	0.07 in offshore windfarm area 9 in offshore cable corridor area	0.3%	0.2%
Disturbance during operation e.g., from operational turbines, maintenance activities & changes prey availability*	No figures given in [APP-201]	0.3%	0.6%
Disturbance during decommissioning*	No figures given in [APP-201]	0.3%	0.6%

The Applicant concluded that, given the small numbers of animals likely to be affected and the known movements of harbour seal along the east coast, the level of disturbance would not undermine the delivery of the conservation objectives and would not lead to an adverse effect on the integrity of the SAC from the Project alone.

The in-combination assessment undertaken by the Applicant predicted that the total number of harbour seals that would be disturbed would be 257. This is 0.6% of the relevant reference population and 7.6% of the SAC population. The effects of operation and decommissioning were predicted to be less than those from construction. The Applicant concluded that as it is highly unlikely that all the seals affected would all be from the SAC population and given the distance between the offshore windfarm and the coast, it is unlikely that harbour seal would be displaced from foraging areas or haul-out sites to such an extent that the integrity of the SAC would be affected.

The Applicant excluded any adverse effects on the integrity of the SAC from disturbance at seal haul-out sites, vessel collision mortalities and changes to the availability of prey, based on similar evidence and reasoning as for the grey seal feature of the Humber Estuary SAC [APP-201].

None of the interested parties raised concerns about the Applicant's conclusions during the Examination. The Secretary of State is content that an adverse effect on the integrity of the Wash and North Norfolk Coast SAC from the Project alone or in combination with other plans or projects due to impacts on harbour seal can be excluded.

5.11. Appropriate Assessment: Southern North Sea SAC

The Southern North Sea SAC was designated on 26 February 2019 for harbour porpoise. The site is located to the east of England and stretches from the central North Sea (north of Dogger Bank) to the Straits of Dover in the south, covering an area of approximately 36,951 km^2. A mix of habitats, including sandbanks and gravel beds, cover the seabed and water depths range from mean low water to 75m. Most of the site has water depths of less than 40m.

The site is designated for the Annex II species harbour porpoise. The site is comprised of two seasonal' components. The northern part of the SAC is mainly used by harbour porpoise in the summer months while the southern part is mainly used in the winter. The offshore windfarm element of the Project is located in the summer SAC area.
Current SNCB guidance states that displacement of harbour porpoise should not exceed 20% of the seasonal component of the SAC at any one time or on average exceed 10% of the seasonal component of the SAC over the duration of that season.

The reference population used in the Applicant's assessment is the North Sea MU population, rather than the SAC population. The Applicant's reasoning for this is that the JNCC Site Selection Report states that the SAC population estimate is based on a one-month survey in 2015 and it should not be relied upon as

an estimated population for the site. By using the North Sea MU population, this assessment considers daily and season movements of the harbour porpoise within the southern North Sea.

The Secretary of State has identified an LSE on the harbour porpoise interest feature of the SAC for the Project alone and in-combination with other plans or projects from:

- Underwater noise (auditory injury and disturbance) (Construction/Decommissioning, Operation);
- Collision mortality (vessel interaction) (Construction/Decommissioning, Operation);
- Changes to prey resource (Construction/Decommissioning, Operation); and
- Changes to water quality (Construction/Decommissioning).

The Secretary of State considers each of these potential impacts below.

5.11.1. Harbour Porpoise: Alone Assessment

5.11.1.1. Underwater Noise (Auditory Injury and Disturbance)

The Applicant's assessment of disturbance from underwater noise considered the area of the SAC affected in relation to the area of the seasonal components, rather than the whole SAC. The assessment assumed that effects could occur up to 26km from individual piling or UXO detonation and up to 10km from seismic operations. The population size was based on an estimate of the UK North Sea MU area and the overall harbour porpoise density from the most recent published survey. Based on discussions held during the Evidence Plan Process, it was estimated that the SAC could support 17.5% of the North Sea MU reference population.

Several sources of underwater noise without mitigation were considered in the Applicant's assessment in relation to risk of permanent auditory injury [APP-201]:

- UXO clearance estimated to affect 690.5 individuals;
- Piling estimated to affect 0.2 - 0.4 individuals;
- Construction activities other than piling (based on modelling of noise from rock placement) estimated to affect 0.7 individuals; and
- Vessel noise estimated to affect 0.03 individuals.

The Applicant concluded that the implementation of the MMMP would be sufficient to avoid permanent auditory injury and would not lead to an adverse effect on the integrity of the SAC from the Project alone. Underwater noise generated by other construction activities and vessel movements was not predicted to lead to permanent injury.

To assess disturbance resulting from increased underwater noise, estimates were presented of the area of the SAC seasonal components and the percentage of the North Sea MU population for various noise sources. None of the estimated areas affected by increased underwater noise would exceed 20% of the seasonal component areas on any given day or 10% of the seasonal component area on average. As a percentage of the North Sea MU, the numbers of individuals disturbed as a percentage of the population would be:

- UXO clearance would disturb 0.55 - 0.65%;
- Single piling event would disturb 0.55 - 0.65%;
- Two concurrent piling events would disturb 1.1 - 1.3%;
- Construction activities other than piling would disturb 0.3%;
- Vessel noise would disturb 0.36%;
- Concurrent UXO clearance and piling at the Project site would disturb 1.3%; and
- One piling event at the Project site plus other construction activities and vessel movements would disturb 0.7 - 0.8%.

With regard to operation and maintenance, the Applicant cited published studies which suggested that there is no lasting disturbance or exclusion of harbour porpoise around offshore windfarms during operation. It estimated that none of the areas affected within the SAC exceeded 20% of the area of either

seasonal components on any given day or 10% of the area across a season. Decommissioning effects were assumed to be similar to those of construction, but of lesser magnitude. The Applicant concluded the Project alone would not lead to an adverse effect on the integrity of the SAC from increased underwater noise [APP-201].

The Wildlife Trusts (TWT) [RR-040], [AS-031], [REP2-057], [REP2-098], [REP6-040] and [REP9-030], and Whale and Dolphin Conservation (WDC) [REP2-048], [REP2-112] and [REP9-029] disputed the approach used by the Applicant to assess the effects of underwater noise. The key concerns regarding the prediction of the effects of the Project alone were:

- They disagreed with the relevant SNCB guidance on assessing underwater noise disturbance to marine mammals;
- The assessments use of the SAC population rather than the North Sea MU reference population;
- While UXO clearance would be done under a separate licence, the dDCO should include requirements/conditions analogous to those included to manage piling impacts and a draft UXO clearance MMMP should be provided by the Applicant; and
- The use of out of date guidance and unproven mitigation measures to inform the MMMP for piling.

The Applicant stated that using the North Sea MU population had been agreed with Natural England during the Evidence Plan Process and was in line with the draft conservation objectives, and its approach to assessment was based on guidance from the SNCBs.

The Marine Management Organisation agreed that there was no need for the Applicant to undertake further noise modelling [REP4-035]. Natural England raised no concerns about the Applicant's approach to the assessment.

WDC cited several studies which demonstrated that harbour porpoise leave offshore wind farm areas during construction and return in limited numbers. The Applicant disputed WDC's interpretation of these papers [AS-024]. WDC also advised in its Relevant Representation that foundations requiring piling should not be used given the potential risk to harbour porpoise from noise generated from piling. It advised that strict limits should be placed on noise levels during construction if piled foundations were to be used, and that work should be halted when marine mammals approached the Project area. It also advised that only measures whose effectiveness is already known should be relied on for mitigation and that noise/visual monitoring should be undertaken throughout construction [REP2-112].

Natural England was content that the Project alone would not lead to an adverse effect on the integrity of the SAC [REP6-033].

The Applicant maintained that the piling MMMP is based on the current SNCB guidance for managing piling impacts and finalising it during construction would allow it to be informed by the latest evidence around mitigation [REP2-048]. The Marine Management Organisation supported the Applicant's approach [AS-027] and [REP16-009].

The Applicant's assessment assumed maximum hammer energies of 5,000kJ for monopile foundations and 2,700kJ for pin piles. Schedules 9 and 10 Condition 14(3) and Schedules 11 and 12 Condition 9(3) of the application version of the dDCO secured the maximum hammer energy for monopiles only. This was noted by both Natural England [AS-028] and the Marine Management Organisation [REP3-016]. The Applicant amended the dDCO to include maximum energies for pin piles and these changes were included in the final version of the dDCO [REP18-009].

The ExA was satisfied that the Applicant had used the assessment methodology recommended by SNCBs. It believed the reasons given for using the North Sea MU reference population were sound and noted that Natural England did not raise any concerns on this point.

Mitigation for the effects of piling in relation to permanent auditory injury is secured through Condition 14(f), Schedules 9, 10 and 11 and Condition 9(f) of Schedule 12 of the dDCO. If piled foundations are used, these requirements/conditions commit the Applicant to produce an MMMP, the final version of which [REP5-033] and [REP5-034] will be listed as a certified document in the dDCO. If piling is proposed,

noise mitigation measurements required through Condition 19 of Schedules 9 and 10 and Condition 14 of Schedules 11 and 12, must be provided to the Marine Management Organisation within six weeks of the installation for the first four piled foundations.

The ExA noted that TWT and WDC did not agree that measures proposed in the piling MMMP would be adequate to avoid risk of permanent auditory injury. The proposed approach is in line with what is recommended by SNCBs and Condition 14(f)/Condition 9(f) allows the final MMMP to be revised in line with SNCB recommendations. As such, the ExA was content to rely on this.

The Marine Management Organisation agreed with the Applicant's approach in seeking a Marine Licence to carry out UXO clearance, despite TWT advocating for an MMMP to cover the effects of clearance as a requirement in the dDCO. The Marine Licence would be subject to provisions under the Habitats Regulations and so could only be granted if the proposed mitigation is adequate to avoid an adverse effect on the integrity of the SAC. The ExA therefore did not think it was necessary or appropriate to add a requirement for a UXO MMMP to the rDCO.

5.11.1.2. Collision Mortality (Vessel Interactions)

Approximately 1,180 two-way vessel movements are predicted to be required for the construction phase, averaging approximately two vessel movements per day. Vessel movements to and from any port would be incorporated within existing vessel routes so any risk of collision would be limited to the offshore windfarm area. The maximum number of vessels on site at any one time would be 57. The estimated figures presented showed the number of individuals at increased risk of collision during construction would be 0.04% of the North Sea MU population, which are predicted to be at a 5-10% increased collision risk. The Applicant's assessment of decommissioning effects assumed that the effects would be similar to those from construction.

Operational and maintenance vessel movements were estimated to be up to a total of 445 vessel movements per year, averaging 1-2 vessel movements per day. The Applicant's worst-case scenario assumed that the number of operation/maintenance vessel movements would be the same as the number during construction.

The Applicant expected that harbour porpoise would be able to detect the presence of vessels, and given that they are highly mobile, would be able to largely avoid vessel collision. The Applicant concluded no adverse effects on the integrity of the SAC based on this [APP-201]. WDC did not agree that there was sufficient evidence to support this conclusion. No other IPs raised concerns on this point.

5.11.1.3. Changes to Prey Resource

The Applicant identified the potential indirect effects on fish species during construction as physical disturbance, loss or changes of habitat, increases in underwater noise, and increased suspended sediment concentrations. During operation and maintenance, the potential effects on fish species were identified as resulting from permanent loss of habitat, the introduction of hard substrate, operational noise, and EMF. The effects of decommissioning were assumed to be comparable to that of construction but of a lower magnitude.

The Applicant concluded that any changes in prey availability which resulted in the displacement of harbour porpoise would be less than 20% of the area of either seasonal component of the SAC at any one time or 10% of the area of either seasonal component of the SAC over the duration of that season. The total number of animals that could be affected by any decrease in prey availability was predicted to be 0.36% of the North Sea MU population. The Applicant concluded there would be no adverse effects on the integrity of the SAC from the Project alone [APP-201].

5.11.1.4.Changes to Water Quality

Changes to water quality from the disturbance of seabed sediments during construction were not predicted to be significant by the Applicant, based on the assessment in the ES. The Applicant would rely on the OPEMP [REP5-035] to secure measures to deal with any accidental release of pollutants during

construction. The worst-case scenario assumed all animals estimated to be present within the Project area would be displaced. The Applicant's assessment of decommissioning effects assumed the effects would be similar to those from construction.

The effects were determined to not exceed 20% of the seasonal component of the SAC at any one time to 10% of the seasonal component of the SAC over the duration of that season. The Applicant concluded no adverse effects on the integrity of the SAC as a result of the Project alone [APP-201].

5.11.1.5. Conclusions

The ExA concluded that, subject to the implementation of the mitigation discussed, no adverse effects on the integrity of the SAC would arise from the Project alone.

The Secretary of State has considered the representations made by the Applicant, Natural England, the Marine Management Organisation, TWT, and WDC and has considered the recommendation as made by the ExA. The Secretary of State notes that Natural England agreed with the Applicant's conclusions in its assessment of no adverse effects on the integrity of the SAC from the Project alone.

The Secretary of State is therefore satisfied that an adverse effect upon the integrity of the Southern North Sea SAC from the Project alone due to impacts on harbour porpoise can be excluded.

5.11.2. Harbour Porpoise: In-Combination Assessment

The in-combination assessment considered plans or projects where the predicted effects had the potential to interact with effects from the proposed construction, operation and maintenance or decommissioning of the Project.

TWT raised concerns about how the effects of commercial fishing were included in the Applicant's assessment [RR-040], [AS-031] and [REP2-098], as this treated the effects from commercial fishing as part of the baseline. TWT stated that Defra policy requires existing and potential fishing operations to be managed in line with Article 6 of the Habitats Directive and that it had been assured that fishing would be included in future offshore windfarm assessments. The Applicant's position throughout Examination was that fishing had occurred in the SAC for many years and there was no reason to expect fishing to increase beyond the current baseline. It also noted that the same approach had been used in the Hornsea Project Three offshore windfarm Examination and the draft Review of Consents undertaken by BEIS [AS-024]. The National Federation of Fishermen's Organisations and VisNed raised similar concerns to TWT [REP2-043].

Natural England considered that the assessment had adequately captured the effect on ongoing conservation activity for the purposes of undertaking an HRA. It was not aware of any activities which would have significantly altered the level of fishing activity within the SAC or any proposals which were likely to do so in the future.

The ExA concluded there was no evidence to suggest an alteration of fishing activity within the SAC. The inclusion of fishing activity in the in-combination assessment would introduce an element of double-counting which would not assist the Secretary of State in determining if an adverse effects on the integrity of the SAC would arise.

The Secretary of State shares the ExA's view and considers that commercial fishing can be considered in the environmental baseline and should not be considered as an in-combination effect.

The Applicant's approach to the in-combination assessment and definitions of the Tiers used (as outlined in Table 5 below) were agreed at the Evidence Plan Process meeting in February 2017 and based on guidance issued by JNCC and NE [APP-201]. The parties engaged as part of the Evidence Plan Process include the Marine Mammal Expert Topic Group whose membership was comprised of Natural England, Centre for Environment Fisheries and Aquaculture Science (Cefas), TWT, and WDC.

Table 5: Tiers for Undertaking a Staged In-Combination Assessment (JNCC and Natural England)

Tier description	Consenting or Construction Phase	Data Availability
Tier 1	Built and operational projects should be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e., they were not operational when baseline surveys were undertaken, and/or any residual impact may not have yet fed through to and been captured in estimates of "baseline" conditions e.g., "background" distribution or mortality rate for birds.	Pre-construction (and possibly post-construction) survey data from the built project(s) and environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project).
Tier 2	Tier 1 + projects under construction.	As Tier 1 but excluding post-construction survey data.
Tier 3	Tier 2 + projects that have been consented (but construction has not yet commenced).	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project) and possibly pre-construction.
Tier 4	Tier 3 + projects that have an application submitted to the appropriate regulatory body that have not yet been determined.	Environmental characterisation survey data from proposed project (including data analysis and interpretation within the ES for the project).
Tier 5	Tier 4 + projects that the regulatory body are expecting an application to be submitted for determination (e.g. projects listed under the Planning Inspectorate programme of projects).	Possibly environmental characterisation survey data (but strong likelihood that this data will not be publicly available at this stage).
Tier 6	Tier 5 + projects that have been identified in relevant strategic plans or programmes (e.g. projects identified in Round 3 wind farm zone appraisal and planning (ZAP) documents).	Historic survey data collected for other purposes/by other projects or industries or at a strategic level.

An in-combination assessment of changes to water quality was not included in the Applicant's assessment. No IPs raised concerns about this.

5.11.2.1. Underwater Noise (Disturbance)

The Applicant concluded that its commitment to delivering MMMPs for piling and UXO clearance would prevent the Project from contributing to any increased in-combination risk of auditory injury. As such, the Applicant's assessment of in-combination impacts for underwater noise only considered the effects of disturbance.

All offshore wind farms which were considered for the potential worst-case scenario in the in-combination assessment are set out in detail in Table 8.39 of the Information to Support Habitats Regulations Assessment Report [APP-201].

The worst-case scenario for piling at the same time as the Project, in and within 26km of the Southern North Sea SAC, included the following projects:

- Tier 3
  - Dogger Bank Creyke Beck A
  - Dogger Bank Teesside A
- Tier 4
  - Hornsea Project Three
- Tier 5
  - East Anglia ONE North

The assessment assumes that piling could occur at any time during the construction period, although it is expected to occur for 4% of the total construction period. The assessment also assumed that there would not be an overlap in piling activities between the offshore windfarms apart from for the Dogger Bank offshore windfarms projects.

With consideration given to lost work due to poor weather conditions, piling was assumed to occur on 173 days in the summer season and 154 days in the winter season. The extent of the seasonal components of the SAC which would be affected are presented in Table 6.

Table 6: Estimated Maximum, Minimum and Average Overlap with Summer and Winter Areas in the Southern North Sea SAC for Potential Worst-Case Scenarios for Single and Concurrent Piling [APP-201]

Scenario	Minimum Overlap with SAC	Maximum Overlap with SAC	Average Overlap with SAC
Single piling at all 5 offshore windfarm	9.2% of summer SAC area 16.7% of winter SAC area	20.1% of summer SAC area 18.9% of winter SAC area	13.4% of summer SAC area 17.8% of winter SAC area
Concurrent piling at all 5 offshore windfarm	9.6% of summer SAC area 17% of winter SAC area	28% of summer SAC area 25.6% of winter SAC area	18.8% of summer SAC area 22% of winter SAC area
Single piling at all 5 offshore windfarm– seasonal average			13.81% of summer SAC area 15.1% of winter SAC area
Concurrent piling at all 5 offshore windfarms– seasonal average			17.8% of summer SAC area 18.6% of winter SAC area

The assessment indicated that approximately 2.5 – 5.1% of the North Sea MU reference population could be affected by the in-combination impacts of single and concurrent piling events.

In addition to the implementation of the MMMPs, the Applicant proposed a SIP for the SAC based on the In-principle SIP [APP-708]. The SIP would set out mitigation measures but would be finalised between the granting of the DCO and the beginning of piling in agreement with the MMO and SNCBs. The mitigation measures would include:

- Noise mitigation systems to reduce piling noise at source;

- Scheduled piling to reduce overlap with other offshore windfarm and hence reduce the area over which disturbance would arise;
- Use of alternative foundation methodologies within the consented project envelope which would, if possible, avoid pile driving; and
- Any other potential measures which may emerge before construction begins.

The Applicant's HRA screening identified other potential noise sources in addition to piling which could disturb harbour porpoise [APP-202]:

- UXO clearance;
- Seismic surveys;
- offshore windfarm construction activities and vessels (excluding piling); and
- offshore windfarm operation and maintenance, including vessels.

As it is not possible to estimate the number of UXO clearance operations which will be required, the assumed worst-case scenario was defined as up to two UXO detonations at any one time. A 26km buffer around UXO clearance was used to assess the area that harbour porpoise could potentially be disturbed. The possible scenarios assessed were both detonations in the summer SAC area; both in the winter SAC area; or one in the summer SAC area and one in the winter SAC area. The assessment predicted that displacement of harbour porpoise would not exceed 20% of the seasonal component of the SAC area during any one time, unless two detonations occurred in the winter SAC area. In that case, 33.5% of the winter SAC area would be affected.

To calculate the seasonal average across the area, the defined worst-case scenario was up to 40 potential UXO detonations at each site with one detonation per day. The seasonal averages were calculated by multiplying the average of the minimum and maximum effect on any one day by the proportion of days within the season on which piling could occur. The estimated seasonal average area subject to disturbance would be less than 10% of the seasonal component of the SAC area, unless two detonations occurred in the winter SAC area. This would lead to 14.7% of the winter SAC area being affected.

To calculate the number of harbour porpoise which could potentially be disturbed, a worst-case scenario of up to four UXO clearance operations was used. This could lead to 1.3% of the North Sea MU population being displaced [APP-201].

A similar approach was used to assess effects from seismic surveys, using a 10km buffer around seismic operations used to assess the area that harbour porpoise could potentially be disturbed. The worst-case scenario was determined to be up to two surveys in the summer SAC area and/or winter SAC area at any one time. The areas disturbed on any one day were assessed to be less than 20% of the seasonal SAC component on any given day and the average area disturbed across the season would be less than 10%. This equated to disturbance of 0.05% of the North Sea MU population.

The Applicant also assessed in-combination effects from construction noise (other than piling) with other offshore windfarms, and noise generated by other offshore windfarms which would be newly operational at the point that Project construction would begin. None of the assessments predicted that more than 20% of the area of the SAC seasonal components would be disturbed at any one time or that the seasonal average area of disturbance would exceed 10%.

The seasonal average areas that would be disturbed by in-combination effects for each seasonal component, with and without UXO clearance and seismic surveys are presented in Table 8.53 in the Applicant's Information to Support Habitats Regulations Assessment Report [APP-201]. If UXO clearance and seismic surveys are excluded, then 24.2% of the summer use SAC area and 20.7% of the winter use area would be subject to underwater noise disturbance. When UXO clearance and seismic surveys are included the extent of the area disturbed rises to 26% for the summer SAC area and 24.5% for the winter SAC area. The maximum areas of disturbance were considered to affect 34.1% of the summer SAC area and 43.4% of the winter SAC area [APP-201].

The Applicant's conclusion of no adverse effects on the integrity of the SAC from in-combination disturbance from underwater noise was based on two points: the first was that the assessments were based on worst-case scenarios which were unlikely to all arise. The second was that the SIP provides a mechanism which would allow development of appropriate measures to reduce underwater noise to an acceptable level.

TWT and WDC, in addition to their comments on the assessment of the effects from the Project alone, agreed that while the SIP could be an appropriate mechanism for delivering mitigation, they did not believe it included sufficient detail to give confidence that mitigation would be effective, or support a conclusion of no adverse effects on the integrity of the SAC [RR-040], [REP2-048], [REP2-057], [REP6-040], [REP9-029] and [REP9-030]. TWT stated that there is no regulatory mechanism to manage in-combination underwater noise impacts [RR-040], [REP2-057], [REP6-040] and [REP9-030]. TWT also thought the SIP should be explicit that it is a requirement to mitigate against impacts from both piling and UXO clearance [RR-040], [AS-031], [REP2-098], and [REP9-030]. The WDC commented that the Applicant's in-combination assessment did not consider the impact of pile driving at two locations within the Project area [REP2-112].

Natural England agreed that implementation of the SIP would be an appropriate way of mitigating in-combination effects. However, it expressed concern that as more offshore windfarms come forward, even with a project-specific SIP in place, the 20% and 10% area disturbance thresholds would be exceeded. A regulatory mechanism would be required to ensure that this does not happen before a conclusion of no adverse effects on the integrity of the SAC could be reached [RR-099]. Natural England maintained this position throughout the Examination.

The Applicant maintained that commitment to the SIP would ensure adequate mitigation would be in place to prevent potential effects. Development of the SIP pre-construction would ensure it would be based on the latest scientific evidence and requirements. The Applicant agreed with Natural England that a regulatory mechanism is required, but in its view the responsibility to manage cumulative effects lies with the Marine Management Organisation as the appropriate regulator. The approach of relying on a SIP was accepted by the Secretary of State for East Anglia THREE offshore windfarm and in the draft Review of Consents for the SAC.

The Marine Management Organisation agreed that realistic information on construction activities would only be available near the time of the proposed activities, so a SIP is an appropriate mechanism [RR-069], [AS-027], [REP1-058], [REP3-016] and [REP16-009]. It was content to rely on a SIP in this case as it allows it to gain a full view of potential in-combination impacts at the post-consent stage once the information on construction programmes would be available [REP13-035].

The Marine Management Organisation explained that it is part of a SNS SAC underwater noise regulator group which is developing a management tool for noise activity within the SAC. Development of the tool had been delayed, but it suggested there is an existing manual mechanism which is managed by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) [REP10-060]. Natural England did not agree that OPRED provided a suitable mechanism as it is not a formal process [REP14-065]. The Marine Management Organisation provided further updates on the progress with the development of the management tool, however, the tool had not been delivered by the end of Examination.

The Marine Management Organisation requested a condition to prevent concurrent piling between the Project and Norfolk Vanguard offshore windfarm [RR-069], [AS-027] and [REP2-051]. The Applicant considered it inappropriate to have a condition in the DCO relating to another project. In its view, the SIP would ensure adequate mitigation and would require piling to be scheduled [AS-024] and [REP2-051]. Following a revision to the wording of the SIP, the Marine Management Organisation agreed that the SIP was the appropriate route for dealing with the potential effects from concurrent piling [REP6-029] and [REP8-021].

The Applicant's own assessment predicted that increased in-combination underwater noise from the Project and other offshore windfarms could lead to a level of disturbance over the relevant thresholds,

which could undermine delivery of the SAC objectives. As such, the ExA stated that the possibility of in-combination adverse effects on the integrity of the SAC could not be excluded based on the evidence provided.

The ExA noted that TWT and WDC felt that the SIP contained insufficient detail on mitigation for a conclusion of no adverse effects on the integrity to be reached. However, the ExA felt that it did not appear possible for an accurate assessment to be undertaken of the likely in-combination effects associated with construction or which mitigation measures would be required until the details of construction are known.

Condition 14(1)(m) of Schedules 9 and 10 and Condition 9(1)(I) of Schedules 11 and 12 of the dDCO [REP18-009] require the Applicant to submit a SIP to the Marine Management Organisation in the event that piled foundations are to be used. The Marine Management Organisation must provide written approval for the SIP before activities licenced under the DMLs can begin, providing an additional point of control where construction can only begin if the Applicant has demonstrated adequate mitigation to avoid adverse effects on site integrity.

Natural England, WDC and TWT expressed concerns about the lack of a mechanism to manage in-combination construction effects in the North Sea. However, the ExA was content to rely on advice from the Marine Management Organisation as the relevant regulator, who did not share these concerns. The ExA concluded that, subject to the implementation of the mitigation discussed, that no adverse effects on the integrity of the Southern North Sea SAC would arise as a result of the Project in-combination with other plans or projects.

5.11.2.2. Increased Vessel Activity

The projects which were considered in the in-combination assessment are listed in Table 8.54 of the Applicant's Information to Support Habitats Regulations Assessment [APP-201].

The number of individuals that could be affected during construction was calculated to be 5% of those present in each offshore windfarm area, based on the Applicant's assumption that 95% of harbour porpoise would be able to avoid collisions. This was calculated to be 0.07% of the North Sea MU population. The increase in vessel movements from operation/maintenance and decommissioning was expected to be lower than the increase during construction. The Applicant concluded that there would be no adverse effects on the integrity of the SAC from in-combination effects [APP-201].

5.11.2.3. Changes to Prey Resource

The Applicant concluded that the in-combination effects on prey availability would be no greater than the effects of in-combination disturbance from underwater noise. This assumed that both harbour porpoise and their prey would be disturbed from a similar area, so they would not be present to be affected by prey decline. The effects on prey were expected to be intermittent, temporary and highly localised with the potential for future recovery. The Applicant concluded that there would be no adverse effects on the integrity of the SAC from in-combination effects on the prey resource [APP-201].

5.11.2.4. Conclusion

Overall, the ExA concluded that subject to implementation of the mitigation secured within Schedules 9, 10, 11 and 12 of the dMLs, no adverse effect on the integrity of the Southern North Sea SAC would arise as a result of the Project alone or in-combination with other plans or projects.

The Secretary of State recognises the disagreements between TWT, WDC and the Applicant on the approach to the assessment of effects from underwater noise alone and in-combination, and the confidence placed on the mitigation measures proposed. He also recognises the concerns shared by Natural England, TWT and WDC regarding the lack of a mechanism to manage in-combination construction effects in the North Sea. The Secretary of State has considered the representations made by the Applicant, Natural England, the Marine Management Organisation, TWT and WDC and the recommendation as made by the ExA.

The Secretary of State is content to agree with the recommendation as made by the ExA and is satisfied that the potential impacts on harbour porpoise from the Project in-combination with other plans or projects, would not represent an adverse effect on the integrity of the Southern North Sea SAC. This is subject to the implementation of the mitigation secured within Schedules 9, 10, 11 and 12 of the dMLs.

5.12. Appropriate Assessment: Paston Great Barn SAC

Paston Great Barn SAC is the only known building in the UK supporting a maternity roost of barbastelle bats. The SAC is situated 3km from the onshore cable route.

The Annex II feature which is the primary reason for the selection of this SAC is barbastelle bat.

The Secretary of State identified a LSE on the barbastelle bat feature of the SAC arising from the onshore cable route construction.

A bat radio-tracking study, bat transect surveys, and a habitat assessment were undertaken. The studies identified five areas of high value bat habitat within the study area, and 17 hedgerows with moderate or high suitability for commuting and/or foraging barbastelle bats [APP-201].

Under Scenario 2 [APP-201], sections of hedgerow would be removed, to facilitate duct installation, from 16 of the 17 hedgerows identified as having moderate or high suitability for bats. This would also result in the temporary isolation of 11ha of habitat, which represents 0.6% of the available habitat within the study area [APP-201]. The Applicant proposed the following measures to minimise the effects of hedgerow removal during construction:

- Reduction in the cable working width from 25m to 13m at these points.
- Removal of the hedgerow in winter, where possible, to give bats time to adjust to the change before the maternity period begins.
- Removal works would not commence after nights of poor weather (the definition of poor weather would be contained in the Outline Code of Construction Practice (OCoCP).
- Removal of hedgerows as close to the beginning of works as possible to minimise the length of time the gap would be open.
- Replanting the sections of hedgerow to provide replacement foraging and commuting habitats for bats the first winter after construction except the 6m gap required for the running track.
- The 6m gap for the running track would be retained for a maximum of two years.
- Replanting to follow guidance within the Norfolk Hedgerow Biodiversity Action Plan. Future hedgerow management to include allowing standard trees to develop, where possible, and ground flora planting designed to encourage insect biomass. Hedgerows would be double-planted with 2m grassland strips to ensure that a leeward side to forage is always available. Replanting would also include hedgerow improvement works such as gapping up and tree management, where necessary.
- With landowner agreement, the hedgerows would be allowed to become overgrown within the onshore cable route width to provide better quality foraging and commuting habitat.
- A Hedgerow Mitigation Plan would be developed in consultation with Natural England prior to the removal of the hedgerows which would provide the details of the reinstatement approach and the subsequent monitoring and maintenance of the planting.
- Pre-construction surveys to confirm which hedgerows are suitable for commuting and foraging.
- Micro-siting of cables to avoid mature trees within hedgerows, where possible.

After three to seven years the replacement hedgerow planting will support commuting and foraging bats, therefore the effects of hedgerow loss are temporary.

Under Scenario 1, hedgerow removal would have been completed for the Norfolk Vanguard offshore windfarm. The effect of this Project would be the retention of a 6m gap in 20% of hedgerows along the route to allow the use of part of the running track installed for Norfolk Vanguard offshore windfarm. The

location of the gaps has yet to be determined so it is assumed that they may be required at all the hedgerows scheduled to be removed by Norfolk Vanguard offshore windfarm. The gaps would be retained for 16 weeks and would then be replanted. Published evidence indicates that all UK bat species can cross gaps of 10m or less[30].

Furthermore, indirect effects on ex-situ habitats for both scenarios would be mitigated by the following measures:

- Excavations will be fully reinstated following the completion of construction (as set out in the OCoCP) to minimise long term effect on local drainage patterns.
- A pre-construction drainage plan will be developed to minimise water in the cable trench and ensure the drainage of surrounding land.
- Construction lighting would not be used at night, except at the trenchless crossing locations, notably Dilham Canal and land east of Dilham Canal. Any lighting would be directional to minimise light spill.

The Applicant stated that there will be no adverse effects in the integrity of the SAC during operation because the hedgerow replanting will provide improved bat commuting and foraging habitats; all earthworks will be reinstated once duct installation is complete; and there will be no lighting during operation [APP-201]. Furthermore, there will be no adverse effects in the integrity of the SAC during decommissioning as the cable ducts will be left in situ.

The effects of the Project were considered in-combination with Norfolk Vanguard offshore windfarm, the Bacton Gas Terminal and the Bacton Coastal Protection Scheme. All in-combination effects from the two Bacton schemes have been excluded as the construction periods would not overlap with those of the Project.

In-combination effects with Norfolk Vanguard offshore windfarm would only arise under Scenario 1 (in Scenario 2 Norfolk Vanguard offshore windfarm would not be constructed). The combined effect of Norfolk Vanguard offshore windfarm and Scenario 1 of the Project would be to extend the length of time that a 6m gap was present in the affected hedgerows; however, as all UK bat species can cross gaps of 6m, this would not lead to an adverse effect on the SAC.

The Applicant concluded that as the indirect effects on hydrology and from lighting from Scenario 1 would be negligible, no in-combination effects would arise that would lead to an adverse effect on the integrity of the SAC.

The Applicant submitted an updated version of the OLEMS at D14 [REP14-020] and [REP14-021] which included the original mitigation measures and additional mitigation for foraging areas and post-construction monitoring. This version of the OLEMS is listed as a certified document in the dDCO submitted at D18 [REP18-009]. Requirement 24 of the dDCO prevents the commencement of any stage of the onshore transmission works before a written ecological management plan has been approved by the planning authority in consultation with the relevant statutory nature conservation body.

The Secretary of State is satisfied that all necessary mitigation has been adequately secured and, based upon the information presented, concludes that an adverse effect on the integrity of Paston Great Barn SAC from the Project alone or in-combination with other plans or projects due to impacts upon barbastelle bats, can be excluded.

[30] Bat Conservation Trust (2012). *Landscape and Urban Design for Bats and Biodiversity*.

5.13. Appropriate Assessment: River Wensum SAC

The River Wensum is a naturally enriched, calcareous lowland river. The upper reaches are fed by springs that rise from the chalk and by run-off from calcareous soils rich in plant nutrients. This gives rise to beds of submerged and emergent vegetation characteristic of a chalk stream. Lower down, the chalk is overlain with boulder clay and river gravels, resulting in aquatic plant communities more typical of a slow-flowing river on mixed substrate.

The site covers an area of approximately 3.82 km^2. It was designated for floating aquatic vegetation that is dominated by water-crowfoot and several species that include white-clawed crayfish, bullhead, brook lamprey and Desmoulin's whorl snail.

The Secretary of State identified LSEs for Annex I and Annex II features of the SAC comprising watercourses of plain to montane levels and Desmoulin's whorl snail, white-clawed crayfish, brook lamprey, and bullhead.

The Applicant's position was that LSEs could only arise from indirect effects on the watercourse of plain to montane levels and Desmoulin's whorl snail features and concluded that adverse effects on these features would be avoided because:

- The features were not found to be present in the onshore project area;
- Ex-situ habitats would be avoided through the use of trenchless techniques;
- Scenario 2 only – changes to local hydrological conditions would not occur because there are no springs or seepages directly connected to the SAC;
- Scenario 2 only – cable ducts would not affect groundwater flows for the SAC;
- Scenario 2 only – the ES demonstrates that the cable trenches would not impede subsurface flows; and
- The mitigation measures in the Outline Code of Construction Practice (OCoCP) would be sufficient to avoid any impacts during cable installation.

Natural England [RR-099] and the Environment Agency [RR-095] raised concerns about the risk of drilling mud breakouts during HDD and the need for site-specific water crossing plans. The Applicant provided additional information on pollution avoidance and mitigation measures which are secured through Requirement 25 of the dDCO [REP18-019, Section 11.1.2]. Subsequently, Natural England and the Environment Agency confirmed that the additional information addressed its concerns in relation to risks to water and substrate quality in the SAC.

Natural England also advised [RR-099] that the HDD compound that would be within the floodplain of the SAC should be restored in accordance with the River Wensum Restoration Strategy and the River Wensum SAC conservation objectives supplementary advice.

The Applicant updated the OCoCP [REP1-018] and [REP1-019] to commit to review the Restoration Strategy and the River Wensum SAC conservation objectives during the development of the final OCoCP. It also stated that "*In addition, where possible the HDD compound within the River Wensum floodplain will be restored to the current soil/ground moisture conditions so that water levels are similar to those pre-disturbance*". Natural England advised that it was content that adverse effects on the integrity of the site are unlikely [REP7-050].

The mitigation required to avoid adverse effects on the integrity of the SAC has been secured through the following:

- Requirement 16 of the dDCO [REP18-009] commits the Applicant to trenchless cable installation techniques under the SAC if Scenario 2 is followed.
- Requirement 20 of the dDCO [REP18-009] prevents any stage of the onshore transmission works commencing until a code of construction practice for that stage has been approved by the relevant

planning authority in consultation with Norfolk County Council, the Environment Agency, and the relevant statutory nature conservation body. It must accord with the OCoCP [REP18-019].
- The OCoCP submitted at D18 includes the revisions listed above and would be a certified document [REP18-019].
- Requirement 25 of the dDCO which commits the Applicant to the production of site-specific water crossing plans before each stage of the onshore transmission works commences, has been retained in the final version of the dDCO [REP18-009] and in the rDCO.

With regards to in-combination effects, Natural England noted that the Onshore Clarification Notes [AS-025] considered the Hornsea Project Three offshore windfarm cable route which could be under construction at the same time as the Proposed Development [REP9-057]. No other evidence was provided by any IP to consider other projects in the assessment of effects on the integrity of the SAC.

The Secretary of State is satisfied that all necessary mitigation has been adequately secured and concludes that an adverse effect on the integrity of the River Wensum SAC from the Project alone or in combination with other plans or projects can be excluded.

5.14. Appropriate Assessment: The Broads SAC

The Broads SAC is approximately 5,865 ha of wetlands and nutrient-rich lakes.

The site is designated for the following Annex I and Annex II features:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; Calcium-rich nutrient-poor lakes, lochs and pools.
- Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition*-type vegetation; Naturally nutrient-rich lakes or lochs which are often dominated by pondweed.
- Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*); Purple moor-grass meadows
- Transition mires and quaking bogs; Very wet mires often identified by an unstable `quaking` surface.
- Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Calcium-rich fen dominated by great fen sedge (saw sedge).
- Alkaline fens; Calcium-rich springwater-fed fens.
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*); Alder woodland on floodplains.
- Vertigo *moulinsiana*; Desmoulin`s whorl snail.
- Otter.
- Fen orchid.
- Little whirlpool ram's-horn snail.

The Secretary of State has identified an LSE on the features listed above.

Under Scenario 2, otter commuting routes would be maintained by using HDD to cross the North Walsham and Dilham Canal. This would avoid the disturbance of bankside habitats. Furthermore, excavations within 100m of the canal will either be covered overnight or left with escape routes for otters. Vehicles/tracks would be checked in the morning for the presence of sleeping otter. The mitigation designed to protect otters during the construction phase is secured through the OLEMS [REP14-020] and the delivery of this version of the OLEMS is secured through Requirement 24 of the dDCO [REP18-009] and in the rDCO.

Good practice pollution prevention measures will be employed to manage accidental spills or leaks. Furthermore, the use of HDD to cross the canal will avoid indirect effects on the qualifying habitats, fen

orchid and Ramshorn snail. The East Ruston stream would be crossed using a trenching methodology. The trenching methodology would be developed post-consent (secured through Requirement 25 of the dDCO [REP18-009] and in the rDCO). This would minimise the effects of any temporary dams or culverts and ensure that the water flow is maintained.

For both scenarios, a Surface Water and Drainage Plan will be developed post-consent which would contain measures to minimise runoff while ensuring drainage of surrounding land continues.

With regards to in-combination effects, NE noted that the Onshore Clarification Notes [AS-025] considered the Hornsea Project Three offshore windfarm cable route which could be under construction at the same time as the Project [REP9-057]. No other evidence was provided by any IP to consider other projects in the assessment of effects on the integrity of the SAC.

The Secretary of State is satisfied that all necessary mitigation has been adequately secured and concludes that an adverse effect on the integrity of the Broads SAC from the Project alone or in combination with other plans or projects can be excluded.

5.15. Appropriate Assessment: Norfolk Valley Fens SAC

The Norfolk Valley Fens SAC is approximately 616 ha of spring-fed fens.

The site is designated for the following Annex I and Annex II features:

- Northern Atlantic wet heaths with *Erica tetralix*; wet heathland with cross-leaved heath.
- European dry heaths.
- Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*); dry grasslands and scrublands on chalk or limestone.
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*); purple moor-grass meadows.
- Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; calcium-rich fen dominated by great fen sedge (saw sedge).
- Alkaline fens; calcium-rich springwater-fed fens.
- Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*).
- Alder woodland on floodplains.
- *Vertigo angustior*; narrow-mouthed whorl snail.
- *Vertigo moulinsiana*; desmoulin`s whorl snail.

The Secretary of State has identified an LSE on the features listed above.

LSE were identified on Booton Common SSSI which is a component SSSI of the SAC. The habitats which are the qualifying features of the SAC are dependent on groundwater and surface water levels and quality. The installation of the onshore cable would cross two of the SAC tributaries and could affect the water supply to the SAC.

Measures to avoid impacts on water quality during construction for both scenarios would be secured and delivered through site-specific water crossing plans (secured through Requirement 25 of the rDCO) and Surface Water Drainage Plans (secured through Requirement 20 of the rDCO).

An investigation of the groundwater supply to the site identified the most likely source as being artesian water from the chalk aquifer which is then discharged into the Blackwater Drain. There is relatively little discharge from the drift deposits which lie above the chalk aquifer. The cable works would take place around 7m above the known depth of the chalk aquifer and would not extend beyond the boulder clay

layer. There is only weak connectivity between the chalk aquifer and the superficial deposits above it [APP-201].

As there would be no excavation in the chalk aquifer and there is only weak connectivity between the aquifer and the superficial deposits, the Applicant concluded that there would be no effect on the groundwater supply to Booton Common SSSI and hence to the SAC. This conclusion was not disputed by any IP.

Natural England confirmed that given the distance between the HDD operations and the SAC, it was unlikely that adverse effect on the integrity of the SAC would arise from a drilling mud breakout [REP2-080].

With regards to in-combination effects, Natural England noted that the Onshore Clarification Notes [AS-025] considered the Hornsea Project Three offshore windfarm cable route which could be under construction at the same time as the Project [REP9-057]. No other evidence was provided by any IP to consider other projects in the assessment of effects on the integrity of the SAC.

The Secretary of State is satisfied that necessary mitigation has been adequately secured and concludes that an adverse effect on the integrity of the Norfolk Valley Fens SAC from the Project alone or in combination with other plans or projects can be excluded.

6. Habitats Regulations Assessment Overall Conclusions

The Secretary of State has carefully considered the information presented, including the RIES, the ES, representations made by Interested Parties, and the ExA's report itself. He considers that the Project had the potential to have an LSE on 19 Protected sites when considered alone or in-combination with other projects. These sites are listed below:

- Alde-Ore Estuary SPA
- Alde-Ore Estuary Ramsar site
- Breydon Water SPA
- Breydon Water Ramsar site
- Broadland SPA
- Broadland Ramsar site
- Flamborough and Filey Coast SPA
- Greater Wash SPA
- Haisborough Hammond and Winterton SAC
- Humber Estuary SAC
- North Norfolk Coast SPA
- North Norfolk Coast Ramsar site
- Norfolk Valley Fens SAC
- Outer Thames Estuary SPA
- Paston Great Barn SAC
- River Wensum SAC
- Southern North Sea SAC
- The Broads SAC
- The Wash and North Norfolk Coast SAC

The Secretary of State has undertaken an Appropriate Assessment in respect of the conservation objectives of the sites to determine whether the Project, either alone or in-combination with other projects, will result in an adverse effect on their integrity.

The Secretary of State has considered the available information, including the mitigation measures secured through the DCO and dMLs, and has concluded that the Project will not have an adverse effect on integrity on the following sites:

- Breydon Water SPA
- Breydon Water Ramsar site
- Broadland SPA
- Broadland Ramsar site
- Greater Wash SPA
- Humber Estuary SAC
- North Norfolk Coast SPA
- North Norfolk Coast Ramsar site
- Norfolk Valley Fens SAC
- Outer Thames Estuary SPA
- Paston Great Barn SAC
- River Wensum SAC
- Southern North Sea SAC
- The Broads SAC
- The Wash and North Norfolk Coast SAC

However, the Secretary of State cannot rule out an adverse effect on integrity beyond reasonable scientific doubt in relation to:

- Impacts on the lesser black-backed gull feature of the Alde-Ore Estuary SPA/ Ramsar, from the Project in-combination with other projects.
- Impacts on the kittiwake feature of the Flamborough and Filey Coast SPA, from the Project in-combination with other projects.
- Impacts on the Annex 1 sandbank and reef features of the Haisborough, Hammond and Winterton SAC from the Project alone and in combination with other projects.

The Secretary of State concludes that the Project does not meet the integrity test and that the further tests set out in the Habitats Regulations must be applied. These include an assessment of alternative solutions; Imperative Reasons of Overriding Public Interest (IROPI); and environmental compensation.

Further consideration on whether sufficient information on the further tests set out in the Habitats Regulations to allow a decision to be made are presented in Sections 9 to 11.

7. Transboundary Assessment

Given the potential for this Project to affect mobile features across a wide geographical area, the Secretary of State believes it important to consider the potential impacts on protected sites in European Economic Area ("EEA") states, known as transboundary sites. 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 Secretary of State's own views on this matter are presented below.

Under Regulation 24 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009, the ExA (on behalf of the Secretary of State) undertook two screenings. The first screening was undertaken on 21 July 2017 [OD-002]. It concluded that the Project was likely to have significant effects on the environment of European Economic Area States. A notice was placed in the London Gazette on 26 July 2017 [OD-003] and the following States were notified:

- Belgium;
- Denmark;
- France;
- The Netherlands; and
- Germany.

Belgium, France, Germany and the Netherlands responded requesting to be involved in further consultation in relation to the Project. Denmark responded stating that it declined to participate.

Following the acceptance of the application, the second screening was undertaken under Regulation 32 of the EIA Regulations 2017 on 21 August 2019. Consultation letters were sent to the states which had previously requested further involvement, offering the opportunity for them to register as Interested Parties.

Netherlands and Germany responded to acknowledge the consultation letters but did not respond again with any detail. Belgium responded to confirm it has no comments to make. There was no response from France. The Secretary of State therefore decided that it is not necessary to invite these states to participate in the Examination as Other Persons.

A Relevant Representation was received from Rijkswaterstaat [RR-015] stating its relationship with the Netherlands Government and its areas of special interest, which include cumulative environmental effects of offshore windfarms with foreign offshore windfarms and safety for shipping. No further communication was received from it during the Examination.

No other comments or representations were received from any State during the Examination.

The Secretary of State notes the ExA's commitment to pass on any further correspondence received in relation to transboundary issues to the Secretary of State who must have regard to transboundary considerations and to any responses made by any EEA State. No such correspondence has been received.

The Secretary of State has considered all of the information available, particularly noting the lack of objections from any of the EEA states potentially affected by the development.

The Secretary of State notes that the Applicant considered non-UK sites in its application and it concluded that there would be no likely significant effect from the Project alone or in-combination for all non-UK sites.

No evidence was submitted to the examination of any specific effects on the integrity of these sites, either from the EEA States where the European sites are located or interested parties.

The Secretary of State is satisfied that the Project, either alone or in-combination with other plans or projects, will not have a likely significant effect the integrity of any of the transboundary protected sites.

8. Consideration of the Case for Derogation

Based on the AA the Secretary of State cannot conclude within reasonable scientific doubt, the absence of an adverse effect from the Project, in-combination with other projects, on the integrity of the Flamborough and Filey Coast SPA with respect to the kittiwake feature; the lesser black-backed gull feature of Alde-Ore Estuary SPA; and for the Project alone and in-combination with other projects the sandbank and reef features, of the Haisborough Hammond and Winterton SAC.

The Secretary of State has therefore reviewed the Project in the context of Regulations 64 and 68 of the Habitats Regulations and Regulations 29 and 36 of the Offshore Habitats Regulations to determine whether the Project can be consented. References to Regulations 29 and 36 below should be read as references to Regulations 64 and 68 if applicable.

Regulation 29 allows for the consenting of a project that is required for imperative reasons of overriding public interest ("IROPI"), even though it would cause a negative adverse effect on the integrity of a protected site ("AEOI").

Consent may only be given under Regulation 29 where no alternative solutions to the project are available which are less damaging to the affected protected site and where Regulation 36 is satisfied.

Regulation 36 requires the appropriate authority to secure any necessary compensatory measures to ensure that the overall coherence of the UK's national site network is protected.

In accordance with guidance on the application of HRA published by the Planning Inspectorate (Advice Note 10)[31] and Defra (2021)[32], this part of the Project review has followed a sequential process whereby:

- alternative solutions to the Project have been considered;
- consideration has been given to whether there are IROPI for the Project to proceed; and
- compensation measures proposed by the Applicant for ensuring that the overall coherence of the UK's national site network is protected have been assessed.

[31] The Planning Inspectorate (2017): *Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects.*

[32] https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site

9. Alternative Solutions

The Secretary of State has given regard to the objectives of the Project as described by the Applicant and has considered how these objectives could be met by alternative means.

9.1. Project Objectives

The Applicant outlines a series of objectives for the Project, which include those that define the strategic function of the project within the UK energy strategy and others that have been adopted to influence certain aspects of the design of the development or reflect the geographical constraints available to the Applicant.

The objectives for the Project are summarised as:

a) To contribute to enhancing the security of the UK's energy supply by providing UK-produced renewable energy as required by National Policy Statement (NPS) EN-1.
b) To provide low-cost energy to the UK consumer. The Project site is stated to have been selected because its ground conditions and high wind resource would make delivery efficient. Offshore wind is also stated to be one of the most cost-effective and easy-to-deploy sources of energy within the UK.
c) To contribute to the UK's drive to meet carbon reduction commitments.
d) To contribute to the Offshore Wind Sector Deal and the Government's targets to reach 40GW respectively of installed offshore wind capacity by 2030.
e) To contribute to the UK's industrial strategy and global leadership in the development of offshore wind projects resulting in socio-economic benefits at a UK and East Anglia/Norfolk level.
f) To help to create a positive legacy for Norfolk and East Anglia facilitating socio-economic development.

Having regard to the suite of objectives identified by the Applicant in the context of National Policy Statements on energy (EN-1)[33], renewable energy infrastructure (EN-3)[34] and electricity networks infrastructure (EN-5)[35], the Secretary of State considers the primary objectives of the Project to be:

- To generate low carbon electricity from an offshore wind farm in support of the decarbonisation of the UK electricity supply.
- To export electricity to the UK National Grid to support UK commitments for offshore wind generation and security of supply.

Beyond this, many of the Applicant's objectives for the Project are necessarily set within the UK Government's mechanisms for promoting the development of offshore wind, notably the granting of leases by The Crown Estate for areas of the seabed to be developed, and the purchase of low carbon electricity through Contracts for Difference[36].

In his assessment of alternatives, the Secretary of State has not constrained himself solely to those alternatives that could be delivered by the Applicant. Nevertheless, the Secretary of State acknowledges

[33] Department of Energy & Climate Change. *Overarching National Policy Statement for Energy (EN-1).* TSO, 2011.
[34] Department of Energy & Climate Change. *National Policy Statement for Renewable Energy Infrastructure (EN-3).* TSO, 2011.
[35] Department of Energy & Climate Change. *National Policy Statement for Electricity Networks Infrastructure (EN-5).* TSO, 2011.
[36] *https://www.gov.uk/government/collections/electricity-market-reform-contracts-for-difference.*

that any alternative must be economically feasible for a developer and allow a developer to fulfil the terms of its lease with The Crown Estate. This is captured by the Applicant's Objective C:

- Contribute to the UK's drive to meeting carbon reduction commitments.

In conclusion it is considered that the benefits from the Project to the UK society and / or to the developer could alternatively be provided by any project with the following objectives:

- To generate low carbon electricity from an offshore wind farm in support of the decarbonisation of the UK electricity supply.
- To export electricity to the UK National Grid to support UK commitments for offshore wind generation and security of supply.
- To optimise generation and export capacity within the constraints of available sites and onshore transmission infrastructure.
- Contribute to the UK's drive to meet carbon reduction commitments.

9.2. Identification of Alternatives

In accordance with guidance published by Defra, the Secretary of State does not consider that alternative forms of energy generation meet the objectives for the Project. Alternatives to the Project considered by the Secretary of State are consequently limited either to Do Nothing or to alternative wind farm projects.

Alternative types of wind farm projects considered are:

- Offshore wind farms not in UK Exclusive Economic Zone (EEZ);

- Offshore wind farms within UK EEZ, including:
  - Within Scottish Territorial Waters;
  - At other locations available to the Applicant;
  - Within other Zones leased from The Crown Estate by other developers;
  - Within Zones to be leased by The Crown Estate under the Licensing Round 4.

9.3. Consideration of Alternatives

9.3.1. Do Nothing

Not proceeding with the Project would remove the risk of direct impacts to ornithology and benthic features but would not meet the Project objectives and would hinder the wider need to deploy offshore wind generation at scale before 2030, to help the UK to meet its commitments under the Climate Change Act 2008 (as amended) to mitigate the effects of climate change.

The benefits from the Project are established by the Applicant in its Provision of Evidence [REP11-011]. In summary, the key drivers underpinning the urgent need for renewable energy, within the UK are:

- The need for energy security, including:
  - The need to secure safe, affordable, reliable energy, preferably generated in the UK for the UK market;
  - The need to replace existing ageing energy generation infrastructure;
  - The need to meet expected electricity demand whilst meeting climate change commitments; and
  - The need to reduce greenhouse gas emissions by increasing energy generation from low carbon source, replacing high carbon energy sources such as coal and gas.

Once constructed, Norfolk Boreas would be one of the largest offshore wind projects in the world and would make a significant contribution to the achievement of both the national renewable energy targets and to the UK's contribution to global efforts to reduce the effects of climate change.

The Do Nothing alternative would erode the ability to meet the 2030 target, putting additional reliance on as-yet unidentified projects to meet the Government's ambitions.

9.3.2. Offshore Wind Farms Not in UK EEZ

The Secretary of State considers offshore wind farm projects that are located outside UK territorial waters are not an alternative to the Project since this would not meet the objective to support the decarbonisation of the UK electricity supply and UK commitments on offshore wind generation.

Although the UK is party to international treaties and conventions in relation to climate change and renewable energy, according to the principle of subsidiarity and its legally binding commitments under those treaties and conventions, the UK has its own specific legal obligations and targets in relation to carbon emission reductions and renewable energy generation. Other countries similarly have their own (different) binding targets. Sites outside the UK are required to achieve their own respective targets in respect of climate change and renewable energy.

9.3.3. Alternative Designs

9.3.3.1. Feasibility of Fewer Turbines

The Applicant has reduced the number of turbines from 257, as proposed in the Scoping Report based on a 7MW turbine, to a maximum of 158 11.55MW turbines. The option to further reduce the number of turbines by using larger capacity turbines is included in the design envelope (11.55MW to 20MW turbines) to enable new technologies to be adopted if available prior to construction.

9.3.3.2. Feasibility to Increase Draught Height

The Applicant has committed to raising draught heights to mitigate ornithology collision risk. It is understood that installation vessels are currently available to install turbines with a hub height up to 145 to 150m. The installation capacity of vessels currently available is, therefore, a key limiting factor in relation to the maximum draught height increase that can be secured, together with other factors including rotor diameter, turbine weight, water depths and potential impacts on radar line of sight. In response to ongoing consultation with Natural England, the Applicant has now committed to raising draught heights to:

- 35m (above MHWS) for turbine models of up to 14.6MW capacity; and
- 30m above MHWS for turbine models of 14.7MW and above.

As a result of this mitigation, the Applicant is progressing a design which is at the limit of current commercial availability both in relation to installation vessel capacity and turbine capacity.

9.3.3.3. Feasibility of Seasonal Restrictions for Turbine Operation

For seasonal restrictions of turbine operation to have any material effect on the number of predicted collisions of kittiwake from the Flamborough and Filey Coast SPA, shutdown of all the turbines would be required for several months of the year. Given that the contribution of Norfolk Boreas to the in-combination collision risk total is already small, this measure would provide a very limited benefit.

For lesser black-backed gulls, collisions did not exceed one bird from Alde-Ore Estuary SPA in any month. Therefore, even a complete shutdown for a month would be of limited benefit and would be accompanied by a significant reduction in electricity output, that would significantly reduce the overall capacity of Norfolk Boreas; affecting the ability of the Project to meet the objective of contributing to the 2030 renewable energy target. It would also reduce its cost efficiency (associated with economies of

scale), affecting its ability provide low-cost energy to the UK consumer in line with the requirements of the CfD process.

9.3.3.4. Conclusions on Alternative Designs

A range of alternative solutions are assessed by the Applicant [REP11-011]. The Applicant concluded that there were no feasible alternative solutions and so there were no potential alternative solutions which would lead to less harm on the affected designated sites.

Natural England suggested [REP9-057] that the Applicant should consider use of surface laid cables and the use of marker buoys instead of cable protection within the Haisborough, Hammond and Winterton SAC. The Applicant advised why it did not consider this to be a feasible alternative to cable protection [REP10-042] and [REP11-011]. Natural England considered that the Applicant had taken all reasonable steps to avoid, reduce and mitigate the impacts on the kittiwake feature of the Flamborough and Filey Coast SPA and lesser black-backed gull features of the Alde-Ore Estuary SPA.

TWT [REP16-031] argued that the Applicant had not exhausted all alternative solutions in relation to effects on the Haisborough, Hammond and Winterton SAC. TWT argued that the use of rock armour in the SAC should be avoided and instead advocated the use of cable management measures which involve using exposed cables.

The Secretary of State has reviewed the case presented by the Applicant, as well representations of other interested parties and concludes that there are no alternative design solutions to the delivery of the Project.

9.4. Conclusion on Alternatives

The ExA considered information on alternatives submitted by the Applicant and other interested parties. It considered it to be reasonable to focus on other potential sites for offshore wind energy and was satisfied that alternatives had been properly considered. Being mindful that information provided by the Applicant was preliminary in nature the ExA recommended that further information should be sought from the Applicant and relevant SNCBs. This was requested by the Secretary of State in his letter of 22nd September 2021[3].

Following a review of the information submitted by the Applicant in response to this letter the Secretary of State remains in agreement with the conclusions of the ExA.

Having identified the objectives of the Project and considered all alternative means of fulfilling these objectives, the Secretary of State is satisfied that no alternative solutions are available.

10. Imperative Reasons of Overriding Public Interest (IROPI)

The HRA Derogation Provisions provide that a project having an adverse effect on integrity on a protected site may proceed (subject to a positive conclusion on alternatives and provision of any necessary compensation) if there are IROPI.

This section of the HRA determines whether there are IROPI for the Project to proceed subject to adequate compensatory measures being implemented.

The HRA Derogation Provisions identify certain in-principle grounds of IROPI that may be advanced in favour of such a project. Where the site concerned hosts a priority natural habitat or a priority species, grounds for IROPI should include human health, public safety or beneficial consequences of primary importance to the environment but otherwise may be of a social or economic nature.

The parameters of IROPI are explored in guidance provided by Defra[37] and the European Commission[38], which identify the following principles:

- Imperative – Urgency and importance: There would usually be urgency to the objective(s) and it must be considered "indispensable" or "essential" (i.e. imperative). In practical terms, this can be evidenced where the objective falls within a framework for one or more of the following;
  (i) actions or policies aiming to protect fundamental values for citizens' life (health, safety, environment);
  (ii) fundamental policies for the State and the Society; or
  (iii) activities of an economic or social nature, fulfilling specific obligations of public service.
- Public interest: The interest must be a public rather than a solely private interest (although a private interest can coincide with delivery of a public objective).
- Long-term: The interest would generally be long-term; short-term interests are unlikely to be regarded as overriding because the conservation objectives of protected sites are long term interests.
- Overriding: The public interest of development must be greater than the public interest of conservation of the relevant protected site(s).

The Secretary of State is satisfied that there are imperative reasons of overriding public interest for the Project to proceed subject to adequate compensatory measures being implemented. In arriving at his decision, the Secretary of State has reviewed how the Project provides a public benefit which is essential and urgent despite the harm to the integrity of the kittiwake feature of the Flamborough and Filey Coast SPA; the sandbank and reef features of Haisborough Hammond and Winterton SAC; and the lesser black-backed gull feature of Alde-Ore Estuary SPA.

The decision is predicated by the principal and essential benefit of the Project as a significant contribution to limiting the extent of climate change in accordance with the objectives of the Paris Agreement. The consequences of not achieving those objectives would be severely detrimental to societies across the globe, including the UK, to human health, to social and economic interests and to the environment.

The need to address climate change is the principal tenet behind the Climate Change Act 2008 (“2008 Act”), and subsequently published National Policy Statements for energy (EN-1)[39], renewable energy

[37]https://consult.defra.gov.uk/marine-planning-licensing-team/mpa-compensation-guidance-consultation/supporting _documents/mpacompensatorymeasuresbestpracticeguidance.pdf

[38] https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/EN_art_6_guide_jun_2019.pdf

[39] Department of Energy & Climate Change. *Overarching National Policy Statement for Energy (EN-1).* TSO, 2011.

infrastructure (EN-3)[40] and electricity networks (EN-5)[41] provide a framework for delivering the UK's international commitments on climate change.

Measures set out in the NPSs have been given further impetus to reflect evolving understanding of the urgency of actions to combat climate change, including a commitment to reduce greenhouse gas emissions to net zero by 2050, which is now reflected in domestic law through amendments to the 2008 Act.

The Government's strategy for decarbonisation to achieve this commitment relies on contributions from all sectors delivered through multiple individual projects implemented by the private sector. The Government has also set up schemes to facilitate the deployment of such projects and to provide the public with value for money, such as via the Contracts for Difference scheme.

The Government anticipates that decarbonisation will lead to a substantially increased demand for electricity as other power sources are at least partially phased out or transformed and other sectors, such as heat and transport, electrify. Government has committed to no longer use coal to generate electricity from 1 October 2024[42].

The UK has also committed to decarbonise the electricity system by 2035, subject to security of supply, focusing on 'home-grown technologies'[43]. This will require the establishment of a reliable and secure mix of low-carbon electricity sources, including large-scale development of offshore wind generation. The scale of the contribution of offshore wind to the electricity supply mix is reflected in the targets set by the Government for 40 GW of offshore wind by 2030.

Offshore wind generation schemes can only be developed through the mechanism put in place by The Crown Estate for leasing areas of the seabed in a structured and timely way. Projects which make a significant contribution to meeting the target capacity in the timeframe required are therefore both necessary and urgent.

These considerations are expanded on in the following section.

Additional, subsidiary beneficial consequences of primary importance to the environment, to human health, and social and economic benefits from the Project are noted but are not deemed essential.

10.1. The National Policy Statements (NPSs)

10.1.1. Establishing the Basis Provided by the 2011 NPSs

The NPSs were established against obligations made as part of the Climate Change Act 2008 ('CCA2008'). The overarching National Policy Statement for Energy (NPS EN-1) sets out national policy for energy infrastructure in Great Britain (GB). It has effect, in combination with NPS EN-3 (for renewable energy infrastructure) and NPS EN-5 (for electricity networks), on recommendations made by the Planning Inspectorate ('PINS') to the Secretary of State for BEIS on applications for energy developments that fall within the scope of the NPSs[44]. These NPSs, when combined with the relevant technology-specific energy NPS, provide the primary basis for decisions by the Secretary of State.

[40] Department of Energy & Climate Change. *National Policy Statement for Renewable Energy Infrastructure (EN-3).* TSO, 2011.

[41] Department of Energy & Climate Change. *National Policy Statement for Electricity Networks Infrastructure (EN-5).* TSO, 2011.

[42] www.gov.uk/government/news/end-to-coal-power-brought-forward-to-october-2024

[43] https://www.gov.uk/government/news/plans-unveiled-to-decarbonise-uk-power-system-by-2035

[44] NPS EN-1 Para 1.1.1

The NPSs set out a case for the need and urgency for new energy infrastructure to be consented and built with the objective of supporting the Government's policies on sustainable development, in particular by:

- Mitigating and adapting to climate change, and
- Contributing to a secure, diverse and affordable energy supply[45].

The NPS for renewable energy infrastructure covers those technologies which, at the time of publication in 2011, were technically viable at generation capacities of over 50 MW onshore and 100 MW offshore. This includes offshore wind, and as such the need for this technology is fully covered by the NPS.

The Energy White Paper, Powering Our Net Zero Future, was published on 14 December 2020. It announced a review of the suite of energy National Policy Statements but confirmed that the current National Policy Statements were not being suspended in the meantime. The 2011 energy National Policy Statements therefore remain the basis of the Secretary of State's consideration of the Application.

The arguments which support a national need for low-carbon infrastructure made today are consistent with those arguments contained in the NPSs, and indeed the Secretary of State is of the view that the NPSs clearly set out the specific planning policies which the Government believes both respect the principles of sustainable development and are capable of facilitating the consenting of energy infrastructure on the scale and of the kinds necessary to help us maintain, safe, secure, affordable and increasingly low carbon supplies of energy.

The NPSs set out the national case and establish the need for certain types of infrastructure, as well as identifying potential key issues that should be considered by the decision maker. S104 of the Planning Act (2008)[46] makes clear that where an NPS exists relating to the development type applied for, the Secretary of State must have regard to it. The NPSs provide specific policy in relation to offshore wind development, and the policies set out in NPS EN-1, EN-3 and EN-5 therefore apply.

This national need relates both to the decarbonisation of the electricity supply within the required timeframe and to the risk the decarbonisation programme could pose to the security of electricity supply as more traditional generating stations are decommissioned.

With regard to the latter, the Secretary of State notes the ruling in case C-411/17 by the European Court of Justice[47] that the objective of ensuring the security of the electricity supply constitutes an IROPI.

10.1.2. A Synthesis of the 2011 National Policy Statements EN-1 and EN-3

At the time the NPSs were published, scientific opinion was that, to avoid the most dangerous impacts of climate change, the increase in average global temperatures must be kept to no more than 2°C. Global emissions must therefore start falling as a matter of urgency[48].

The energy NPSs were intended to speed up the transition to a low carbon economy and help the UK to realise its climate change commitments sooner than would a continuation under the current planning system[49]. They recognise that moving to a secure, low carbon energy system to enable the UK to meet its legally binding target to cut greenhouse gas emissions by at least 80% by 2050, compared to 1990 levels, is challenging, but achievable. This would require major investment in new technologies to electrify heating, industry and transport, and cleaner power generation[50]. Under some 2050 pathways, electricity generation would need to be virtually emission-free, because emissions from other sectors were expected

[45] NPS EN-3 Para 1.3.1

[46] *http://www.legislation.gov.uk/ukpga/2008/29/contents.*

[47] Judgment of 29. 7. 2019 – *Case C-411/17 Inter-Environnement Wallonie and Bond Beter Leefmilieu Vlaanderen.* ECLI:EU:2019;622.

[48] NPS EN-1 Para 2.2.8

[49] NPS EN-1 Para 11.7.2

[50] NPS EN-1 Para 2.2.1

still to persist[51]. Consequentially, the need to electrify large parts of the industrial and domestic heat and transport sectors could double electricity demand by 2050[52].

The NPSs conclude that the UK needs sufficient electricity capacity from a diverse mix of technologies and fuels[53], and therefore the UK also needs all the types of energy infrastructure covered by the NPSs to achieve energy security at the same time as dramatically reducing greenhouse gas emissions[54]. Thus, all applications for development consent for the types of infrastructure covered by the energy NPSs should be assessed on the basis that the Government has demonstrated that there is a need for those types of infrastructure and that the scale and urgency of that need is as described within EN-1 Part 3. Substantial weight should therefore be given to the contribution which projects would make towards satisfying this need for a secure, low carbon, electricity supply when considering applications for development consent under the Planning Act 2008[55,56]. The economic feasibility of harvesting sufficient available natural resource will be an important driver for proposed locations of renewable energy projects[57].

To hit the target of UK commitments to largely decarbonise the power sector by 2030, the NPSs conclude that it is necessary to bring forward new renewable electricity generating projects as soon as possible. The need for new renewable electricity generation projects is therefore urgent.

The NPS expected offshore wind farms to make up a significant proportion of the UK's renewable energy generating capacity up to 2020 and towards 2050[58].

10.2. The United Kingdom has a Legal Commitment to Decarbonise

This section sets out the obligations of the 2008 Act, against which the NPSs (2011) were established. It then outlines the UK's 2019 legally binding commitment to achieving 'Net-Zero' carbon emissions by 2050, against which the need for future electricity generation developments should be assessed.

10.2.1. Climate Change Act 2008

The Government, through the 2008 Act, set legally binding carbon targets for the UK[59], aiming to cut emissions (versus 1990 baselines) by 34% by 2020 and at least 80% by 2050, 'through investment in energy efficiency and clean energy technologies such as renewables, nuclear and carbon capture and storage'[60].

The 2008 Act is underpinned by further legislation and policy measures. Many of these have been consolidated in the UK Low Carbon Transition Plan ('LCTP')[61], and UK Clean Growth Strategy[62]. A statutory body, the Committee on Climate Change ('CCC'), was also created by the 2008 Act, to advise the UK and devolved Governments and Parliaments on tackling and preparing for climate change, and

[51] NPS EN-1 Para 2.2.6
[52] NPS EN-1 Para 2.2.22
[53] NPS EN-1 Para 2.2.20
[54] NPS EN-1 Para 3.1.1
[55] NPS EN-1 Para 3.1.3
[56] NPS EN-1 Para 3.1.4
[57] NPS EN-3, Para 2.6.57
[58] NPS EN-3 Para 2.6.1
[59] The commitment to decarbonise extends across the United Kingdom of Great Britain and Northern Ireland. Northern Ireland is interconnected with the mainland power system through interconnectors but is operated under a different electricity market framework. Therefore, hereinafter we refer to Great Britain ('GB') in relation to electricity generation and transmission, and the UK, to refer to the nation which has legally committed itself to Net-Zero carbon emissions by 2050

[60] HM Government. *The UK Low Carbon Transition Plan*. HMSO, 2009. Five Point Plan.
[61] HM Government. *The UK Low Carbon Transition Plan*. HMSO, 2009. Five Point Plan.

[62] BEIS. *The Clean Growth Strategy*. HMG, 2017 (Corrected 2018).

to advise on setting carbon budgets. The CCC report regularly to the Parliaments and Assemblies on the progress made in reducing greenhouse gas emissions. The UK government has set five-yearly carbon budgets which currently run until 2032.

10.2.2. Enhancements of Existing UK Government Policy on Climate Change: Net-Zero

The UK context for the need for greater capacities of low-carbon UK generation to come forward with pace, has continued to develop. In October 2018, following the adoption by the UN Framework Convention on Climate Change of the Paris Agreement, the Intergovernmental Panel on Climate Change ('IPCC') published a 'Special Report on the impacts of global warming of 1.5°C above pre-industrial levels'. This report concludes that human-induced warming had already reached approximately 1ºC above preindustrial levels, and that without a significant and rapid decline in emissions across all sectors, global warming would not be likely to be contained, and therefore more urgent international action is required.

In response, in May 2019, the CCC published their report called: 'Net-Zero: The UK's contribution to stopping global warming.' This report recommended that government extend the ambition of the 2008 Act past the delivery of net UK greenhouse gas savings of 80% from 1990 levels, by 2050. The CCC recommend that '*The UK should set and vigorously pursue an ambitious target to reduce greenhouse gas emissions (GHGs) to 'Net-Zero' by 2050, ending the UK's contribution to global warming within 30 years.' The CCC believe that this recommendation is 'necessary [against the context of international scientific studies], feasible [in that the technology to deliver the recommendation already exists] and cost-effective', reporting that 'falling costs for key technologies mean that . . . renewable power (e.g., solar, wind) is now as cheap as or cheaper than fossil fuels*.' Importantly, the CCC recommendation identifies a need for low-carbon infrastructure development which is consistent with the need case set out in NPS EN-1, but points to an increased urgency for action.

Since the implementation of the Climate Change Act 2008, government has set five-yearly carbon budgets. The latest of which is the sixth carbon budget (CB6) which was laid in legislation in April 2021 and commits to cutting greenhouse gas emissions by 78% by 2035, compared to 1990 level, in line with the CCC recommendation. The sixth carbon budget spans from 2033-2037.

In October 2021, government published The Net Zero Strategy: Build back Greener. It is a cross-economy strategy which sets out the measures to keep us on our path to net zero, including the action we will take to keep us on track for meeting carbon budgets and our 2030 Nationally Determined Contribution. We set in the Net Zero Strategy that to meet the level of decarbonisation that CB6 requires and simultaneously cater to a 40-60% increase in electricity demand. This presents a substantial challenge and could require having to build out all currently known low carbon technologies in the power sector at or close to their maximum technical limits by 2035.

In March 2019 the Government announced its ambition to deliver at least 30 GW of offshore wind by 2030, as part of the Offshore Wind Sector Deal (the 'Sector Deal')[63]. The Sector Deal reinforces the aims of the UK's Industrial Strategy and Clean Growth Strategy, which seeks to maximise the advantages for UK industry from the global shift to clean growth, and in particular: 'The deal will drive the transformation of offshore wind generation, making it an integral part of a low-cost, low-carbon, flexible grid system.' Within supplementary documents to the Queens Speech, December 2019[64], Government committed to increase their ambition on offshore wind to 40 GW by 2030.

In June 2019 the Government amended the 2008 Act to implement the CCC's recommendation. This made the UK the first major economy to pass laws requiring it to end its contribution to global warming by 2050.

[63] BEIS. *Offshore wind Sector Deal*. BEIS Policy Paper, 2019.

[64] HM Government, The Queen's Speech 2019 – background briefing notes. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/ attachment data/file/853886/Queen_s_Speech_December_2019_-_background_briefing_notes.pdf, 2019 p116

At the end of 2020 GB had 10,415MW of operational offshore wind[65] with 9,823MW in construction or soon to start construction. There is around a further 30GW of projects in earlier stages of development.

The inclusion of a project on a 'future project pipeline' does not indicate that the project will go ahead, or if it does, at a particular generation capacity. It is therefore not the case that the ambitions of the Sector Deal, nor the newly adopted government policy, will certainly be met by those projects currently under consideration by developers. Within this context, the importance of all offshore wind projects currently under development, to the achievement of Government policy and pledges, is clear. Without the Project, it is very possible that delivery of the Sector Deal and the UK government's 2030 ambition will fall short.

In conclusion, offshore wind is recognised as being an important technology for low-carbon generation and the urgent need for large capacities of low-carbon generation is clear to avoid compromising security of electricity supply. Specifically, the Project will be a necessary part of the future generation mix, and as such will make a valuable contribution to meeting the UK Government's achievement of decarbonisation commitments as part of the legally binding target for Net Zero by 2050. On this basis the Secretary of State concludes that there are imperative reasons of overriding public interest which justify the Project going ahead.

[65] Offshore Wind Operational Report 2020, The Crown Estate, p7, https://www.thecrownestate.co.uk/media/3792/offshore-wind-operational-report-1.pdf

11. Proposed Compensatory Measures

The Applicant developed in-principle plans for compensatory measures, the delivery of which would be secured through Article 45 and Schedule 19 of the dDCO [REP18-009] and in the rDCO. The dDCO would require the Applicant to develop strategies for the delivery of the relevant measures, and the monitoring and reporting of their effectiveness no less than 12 months before the commencement of any offshore works. The strategies would be submitted to the Secretary of State for approval in consultation with the relevant statutory nature conservation body. The final versions of the in-principle compensatory measures plans were listed as certified documents in the final version of the dDCO [REP18-009] and in the rDCO.

11.1. Alde-ore Estuary SPA

The final version of the Applicant's in-principle compensatory measures plan for lesser black-backed gull, submitted during the Examination [REP11-013], contained the following measures:

- Provision of predator-proof fencing and habitat management to provide a nesting area where mammal predators are excluded; and
- Funding a coordinator to facilitate the organisation of a stakeholder working group which would review the factors affecting the status of the lesser black-backed gull population and proposals for conservation measures.

The Applicant would undertake research to confirm that the current poor breeding success at the colony is linked to mammalian predation and not to other factors and ensure that other measures which could be effective at improving breeding success are not overlooked. If necessary, trials of compensation measures would be undertaken to establish effectiveness.

The Applicant has identified sites at Orford Ness which could be made suitable for nesting lesser black-backed gulls through predator-control. The Applicant suggested that enclosing an area of over 4ha would enhance breeding success at the SPA to an extent that would greatly exceed the loss of 2.1 birds per year attributed to the Project (based on Natural England's calculation of collision-related mortality).

The Applicant proposed a phased approach with the delivery co-ordinator being appointed first and setting up a working group which would be likely to involve the Applicant, Natural England, the Local Planning Authority, the RSPB and the National Trust (as landowners and managers). A scoping study of potential measures would be undertaken; the working group would then consider which measures would be appropriate and these would be implemented. The costs would be met by the Applicant. It advised that it might not be possible to have all the measures in place before the operation of the Project but considered that the proposal was likely to over-compensate for any losses and that this would outweigh a short-term delay in delivery.

The strategy would include monitoring proposals, the results of which would be provided to the Secretary of State, along with any proposals to improve effectiveness. Proposals to improve effectiveness of measures would be implemented as approved by the Secretary of State.

The following compensation measures were also considered by the Applicant, but not taken forward:

- Closure of sandeel fisheries to provide improved prey availability. These measures were scoped out because sandeels are not considered to be a major component of the lesser black-backed gull diet and the primary North Sea sandeel fishery areas are not within foraging range of the SPA population.

- Cessation of culling of lesser black-backed gulls at the SPA. This was scoped out because culling is not currently undertaken at the site.

Natural England confirmed that it was content with the proposed measures detailed in Schedule 19 Part 2 of the dDCO.

The RSPB was concerned that Part 2 of Schedule 19 of the dDCO [REP18-009] was too narrowly focussed on predator control and did not adequately address other factors affecting breeding success [REP17-012]. Other concerns included the difficulty of distinguishing between measures necessary to restore the favourable conservation status of the SPA; the timing of delivery of the measures before harm occurs; the location of measures within the SPA; and the duration of the compensatory measures. In its view, the measures should be delivered outside the SPA boundaries. The RSPB stated that the wording of Part 2 should be expanded to include clauses which address its concerns. The Applicant considered that the final wording in the dDCO was sufficient to allow the implementation of the type of measures advocated by the RSPB. The RSPB [REP18-038] advised that these revisions did not address their concerns.

The Secretary of State considered that the wording of the dDCO secured a possible mechanism for delivering compensation measures, but there was insufficient detail in the evidence presented to provide confidence that a package of measures could be delivered which would protect the coherence of national site network as required by Regulations 29 and 36 of the Habitats Regulations.

11.2. Flamborough and Filey Coast SPA

The final version of the Applicant's in-principle compensatory measures plan submitted during the Examination [REP11-012] proposed the construction of artificial nest sites to increase the productivity of the kittiwake population. The Applicant calculated that an area of wall measuring 30m by 8m could accommodate 200 pairs of kittiwake, which in turn would produce around seven times the 14 birds per year that would be lost from the SPA colony (based on Natural England's preferred calculation method).

The Applicant also considered the option of purchasing sandeel fishing quotas, but noted that the quota is currently held entirely by Danish fisheries interests. It concluded that reduction in fishing pressures on sandeel would not be practical.

Predator control was also considered, but research by the JNCC on the national seabird population did not identify predation as a major cause of kittiwake decline [REP11-012]. The Applicant concluded that predator control at the colony was unlikely to deliver any significant benefits.

While Natural England agreed that artificial nests could in principle contribute to the coherence of the national site network if the measures delivered a net increase in the overall population, it remained concerned about confining the measures only to the provision of artificial nesting and advised that measures should be identified which would increase productivity at the colony, such as controls on fisheries [REP9-045]. It acknowledged that it was not possible for the Project alone to deliver fishery controls or closures, but advised that alternative draft conditions should be added to the dDCO to allow for a range of compensatory measures for the Secretary of State to consider.

The RSPB also raised concerns about the likely success of the artificial nesting sites and the limited details available about the proposals including the location of any structures; the timescale for delivery; and the time that the measures would be kept in place [REP15-013] and [REP17-012].

The Applicant provided additional information, including evidence that Associated British Port would in principle be willing to deliver artificial nesting sites at the Port of Lowestoft [REP16-003] and [REP16-004].

The Secretary of State considered that the wording of the dDCO secured a possible mechanism for delivering compensation measures, but there was insufficient detail in the evidence presented to provide confidence that a package of measures could be delivered which would protect the coherence of national site network as required by Regulations 29 and 36 of the Offshore Habitats Regulations.

11.3. Haisborough, Hammond and Winterton SAC

The final version of the Applicant's in-principle compensatory measures [REP11-014] proposed an extension of the Haisborough, Hammond and Winterton SAC, or the designation of other suitable habitat to compensate for adverse impacts on the Annex 1 sandbank and reef features. The Applicant stated that there is clear evidence of potential for an extension where areas of sandbank and reef features stretch beyond the boundaries of the SAC [REP7-027] and [REP10-034]. The proposals included providing support to the statutory bodies to progress the designation.

The Applicant noted that there was some degree of uncertainty about securing the SAC extension, but stated that the Possible Special Area of Conservation (pSAC) designation would provide short-term compensation.

The Applicant considered several other potential compensation measures but discounted them [REP11-014], these included:

- The establishment of a new reef feature within the SAC: which was discounted because of the difficulty of directly establishing *S. spinulosa* reef, and the lack of evidence that other forms of biogenic reef can be established apart from native oyster beds. Native oyster beds are not classed as an Annex I habitat and so would not contribute to the coherence of the national site network.
- Fisheries management to reduce intrusive fishing methods: which was discounted because no authority has the jurisdiction to deliver fisheries management areas as compensation.
- Removal of disused anthropogenic infrastructure and litter such as cables, pipelines and fishing gear from the SAC seabed: which was discounted because where infrastructure is approaching the end of its life, it will be the owner's responsibility to decommission it, so it would not provide additional compensation. Furthermore, the EIFCA was unable to identify any areas of lost fishing gear that could be removed.

Natural England agreed with the proposal to extend the SAC, but requested more details [REP9-045], [REP9-048] and [REP9-057]. It agreed with the Applicant's decision to discount other measures, apart from the removal of disused anthropogenic structures, but acknowledged the practical difficulties of delivering this measure. It agreed that native oyster reefs would not be compensation for lasting changes to reefs.

The EIFCA raised concerns about the proposals to extend the SAC. It was concerned about the potential requirements for further fisheries management. It considered that insufficient information had been provided to allow the Secretary of State to make a judgement about the impacts of SAC extension on marine ecology and sea users. It stated that it would be supportive, in principle, of measures to remove disused infrastructure.

TWT [REP16-031] was concerned about the feasibility of extending the SAC because of the timescales and resources required. It also considered that this approach could undermine the status of other designated sites and create problems for future offshore windfarms. It considered that fisheries management measures should be delivered at a strategic level to allow headroom for individual offshore windfarms. It did not consider that the removal of marine litter and infrastructure met the EU and Defra guidance on compensatory measures, and such measures should be undertaken by the asset owners.

The Secretary of State considered that the wording in the rDCO offered a useful mechanism for securing compensatory measures. However, the Secretary of State was concerned that there was considerable uncertainty about the feasibility of delivering the extension of the SAC before the Project became operational. Having assessed the information presented to him the Secretary of State was therefore unable to conclude that a package of compensatory measures was in place which would protect the coherence of national site network as required by Regulations 64 and 68.

11.4. Additional Environmental Information

11.4.1. Alde-Ore Estuary SPA

With regards to the lesser black-backed gull feature of the Alde-Ore Estuary SPA, Natural England agreed that New Zealand-style predator exclusion fencing would create safe nesting conditions for lesser black-backed gull, and that this would probably result in increased nesting success to the direct benefit of the impacted SPA. However, Natural England expressed concern that a specific location for the compensation measures had not been identified and this reduced their confidence that the compensation could be secured[75].

In relation to compensation measures for the lesser black-backed gull feature of Alde-Ore Estuary SPA, the RSPB was concerned that there was a reliance on predator fencing to achieve a more successful breeding colony of lesser black-backed gulls, and that other fundamental ecological requirements of the species, such as suitable nest sites and associated habitat structure, food availability, disturbance were not addressed[70].

On 28th April 2021, the Secretary of State wrote to the Applicant for additional environmental information on the in-principle compensation measures[66]. For Alde-Ore Estuary SPA, further information was sought to confirm whether any strategic compensation measures had been considered; to provide evidence of how the compensation site(s) would be acquired/ leased; and to confirm the timetable for implementing the compensation measures and delivering their objectives.

On the 25th June 2021, in response to the request for additional environmental information, the Applicant provided the following:

- The Applicant confirmed that they were working collaboratively with Scottish Power Renewables to deliver strategic compensation measures for several offshore windfarms.
- The Applicant confirmed that they were working with landowners to secure land to deliver the compensation measures.
- Annual monitoring was proposed to estimate breeding success. Furthermore, regular checks of the fence were proposed to identify any damage requiring repairs. Both monitoring measures would continue for the lifetime of the Project. The habitats within the enclosure would also be managed outside the breeding season to ensure it continued to provide suitable habitat for nesting gulls.
- A detailed implementation strategy was provided proposing the following programme:
  - Appointment of relevant stakeholders to a stakeholder working group (Q3 2021);
  - The necessary land ownership and access agreements to be obtained (Q4 2021 – Q2 2022);
  - If necessary, planning permission (and any other consents) for fencing (Q1-2 2022);
  - Detailed designs to be finalised, and a specialist contractor to be appointed (Q2-3 2022);
  - Habitat management within the enclosure to be undertaken and trapping out of mammals. (Q3-4 2022); and

[66] BEIS (2021). *BEIS Letter Reference EN010087*

- Annual monitoring to estimate breeding success. Regular checks of the fence to identify any problems (to continue for the lifetime of the project). The habitat within the enclosure would also be managed outside the breeding season to provide suitable habitat for gull breeding.

On 22nd September 2021, the Secretary of State wrote to the Applicant for additional environmental information[67]. The Applicant was asked to provide an update on the selection of the compensation sites, along with details of how and when the sites are expected to be secured. The Applicant was also asked to provide details of alternative compensation measures to be adopted, should the preferred compensation sites not be secured.

On the 21st October 2021, in response to the request for additional environmental information, the Applicant provided the following details:

- The Applicant confirmed that a land parcel within the Alde-Ore Estuary SPA had been identified for the mammal predator control area. Furthermore, the Applicant confirmed that they were negotiating Heads of Terms with the landowner to secure the lease of the site[68] [69].

11.4.2. Flamborough and Filey Coast SPA

With regards to the kittiwake feature of Flamborough and Filey Coast SPA, Natural England agreed that the proposed compensation measures would provide additional adult kittiwake into the wider biogeographic population from which the SPA draws its recruits[75]. However, due to the uncertainty regarding the extent to which the proposal will directly benefit the SPA, Natural England suggest that the benefits come from increasing the robustness of the wider UK kittiwake population, therefore it would be appropriate for the measure to deliver benefits at a scale greater than the impacts felt at SPA.

Natural England also expressed concerns around the following issues:

- The details of the location and design of the compensation measures should be provided prior to determination.
- The Project's DCO/dML only requires them to submit a compensation plan to the Secretary of State prior to the operation of any wind turbine and there is no requirement for the compensation to be in place or functional prior to impact.
- The use of a single structure reduces the chances of success and the use of more than one structure would spread the risk if one structure failed to attract birds.

In their letter dated 20th August 2021[70], the RSPB presented comments on the proposed compensation measures for the kittiwake feature of the Flamborough and Filey Coast SPA. The RSPB noted that birds recruited to the artificial nesting structures located in Lowestoft/ Suffolk could be vulnerable to collision risk, and this had not been addressed. Furthermore, any artificial nesting structure located in the Port of Lowestoft is unlikely to function as compensation during the redevelopment of the port and there is a lack of evidence that a 50m buffer around all construction activity would be sufficient to mitigate disturbance to nesting structures.

[67] *BEIS (2021). BEIS Letter Reference EN010087*

[68] Royal HaskoningDHV (October 2021): *Norfolk Boreas Offshore Wind Farm. The Applicant' Response to the Request for Further Information. Version 1*. ExA.PDR.D22.v1.

[69] MacArthur Green (October 2021): *Norfolk Boreas Offshore Wind farm. In Principle Habitats Regulations Derogation Provision of Evidence. Appendix 2 Alde-Ore Estuary SPA In Principle Compensation. Version 3.*

[70] RSPB (August 2021). *RSPB Letter*. Ref: 2002291.

On 28th April 2021 the Secretary of State wrote to the Applicant for additional environmental information on the in-principle compensation measures[71]. Further details were sought to provide evidence of how compensation site(s) for kittiwakes would be acquired/ leased; and to confirm the proposed timetable for implementing the kittiwake compensation measures and delivering the compensation objectives.

On the 25th June 2021, in response to the request for additional environmental information, the Applicant provided the following:

- The Applicant confirmed that they were in discussions with Associated British Ports and other landowners to secure kittiwake compensation sites.
- A detailed implementation strategy was provided proposing the following programme:
  - Concept designs for two possible structures to be completed by end of June 2021;
  - Study of breeding success to be completed by August 2021;
  - Screening and early consultation with the Local Planning Authority;
  - Detailed designs for the structures to be completed after the breeding success survey;
  - Results of survey and detailed designs to be shared with stakeholders in August 2021;
  - Detailed designs updated following stakeholder input;
  - Identification of the structure location and engagement on location suitability;
  - Planning Application submitted end of October 2021;
  - Procurement of structure(s) to be completed end of November 2021;
  - Planning approved mid-January 2022;
  - Manufacturing of structures complete by the end of January 2022;
  - Installation complete by the middle of February 2022;
  - Ready for colonisation by the end of February 2022;
  - Monitoring success of the colonies and adaptive management throughout the project lifetime;
  - First cohort from the colony reaches breeding age and is available to recruit to the breeding population (e.g. to FFC SPA) in spring 2026;
  - Start of offshore construction for the Project April 2026;
  - Second cohort from the colony reaches breeding age and is available to recruit to the breeding population (e.g. to FFC SPA) in spring 2027; and
  - First generation Q2 2027.

On 22nd September 2021, the Secretary of State wrote to the Applicant[72] and requested that they provide an update on the selection of the compensation sites, along with details of how and when the sites are expected to be secured. The Applicant was also asked to provide details of alternative compensation measures to be adopted, should the preferred compensation sites not be secured.

On the 21st October 2021, in response to the request for additional environmental information, the Applicant provided the following:

- The Applicant confirmed that several sites within the Port of Lowestoft had been identified for the artificial nest sites and Heads of Terms with the port to secure the lease of the sites were under negotiation. Furthermore, other locations were being considered and discussions were progressing with landowners within Great Yarmouth Borough Council, and Peel Ports Great Yarmouth Port Landholding[73].

[71] BEIS (2021). *BEIS Letter Reference EN010087*

[72] *BEIS (2021). BEIS Letter Reference EN010087*

[73] MacArthur Green (October 2021): *Norfolk Boreas Offshore Wind farm. In Principle Habitats Regulations Derogation Provision of Evidence. Appendix 1 Flamborough and Filey Coast SPA In Principle Compensation.* Version 3.

11.4.3. Haisborough, Hammond and Winterton SAC

In their letter dated February 2021[74], Defra expressed concerns around the Applicant's proposed strategy to compensate for impacts on the sandbank and reef features of Haisborough, Hammond and Winterton SAC. In summary, Defra's position was that SACs could only be designated based on relevant scientific evidence, and that extending designated sites or creating new site designations as compensatory measures for a development, would not comply with the legislation.

Defra also confirmed that the process of extending SACs is complex, and that there was no certainty that the proposed research would result in a recommendation for designation. Therefore, the compensation measures could not be secured before construction, unless the Project was delayed for several years.

Natural England stated that extending the SAC, along with removal of redundant surface laid infrastructure that wouldn't otherwise be removed, were the compensatory measures most likely to achieve the required environmental outcomes. However, Natural England did not consider that the removal of marine debris and an awareness campaign would provide compensatory measures for the predicted impacts of the Project on Haisborough Hammond and Winterton SAC, because the presence of marine debris is not impeding the conservation objectives of the site from being met. Furthermore, there is concern that debris removal activities could be detrimental to the conservation objectives of the site.

Natural England's letter dated 20th August 2021[75], considered the additional information on the recovery of Annex 1 sandbanks and concluded that current assessments suggest that sandbank recovery is possible; however, further data is required to remove all reasonable scientific doubt.

In their final letter dated 21st October 2021[76], Natural England advised that to address the need for evidence to improve our understanding of the timescales for recovery, monitoring similar in scope to the Larsen et al. (2019) surveys should be undertaken of all areas where sandwave sweeping/levelling occurs within the SAC and the surveys should be repeated until the sandbanks are considered by the regulator (in consultation with Natural England) to have recovered.

In their letter dated 20th August 2021[77], TWT presented comments on the proposed compensation for impacts on the sandbank and reef features of Haisborough Hammond and Winterton SAC. TWT's preferred compensation measures were the implementation of fisheries management measures and to exploit early opportunities as part of the Offshore Transmission Network. TWT also supported the Applicants proposal for the removal of redundant oil and gas infrastructure.

TWT did not consider that marine debris removal and the associated awareness campaign would provide compensation for the loss of habitats from cable protection. In TWT's view further site decline would be expected if these measures were implemented as compensation, and the coherence of the national site network would not be achieved, contravening the requirements of the Habitats Regulations.

TWT were not supportive of the proposal to extend the SAC, because of the uncertainty that this could be achieved. Furthermore, TWT note that extending the SAC could create problems for future for offshore wind farm development, complicating the consenting process and putting the ecological integrity of the UK MPA network at risk.

[74] Defra (2021). *Defra Letter Ref: 210225.*

[75] Natural England (August 2021). *Natural England Letter Case ref 10570/Consultation ref 351731*.

[76] Natural England (October 2021). *Natural England Letter* Case ref 10570/Consultation ref 369229.

[77] The Wildlife Trust (August 2021). *TWT Letter. Ref:* 20022896.

On 28th April 2021 the Secretary of State wrote to the Applicant[78] for details of alternative compensation strategies for the reef and sandbank features.

On the 25th June 2021, in response to the request for additional environmental information, the Applicant provided the following:

- The Applicant confirmed that the removal of disused infrastructure and extension of the SAC were the preferred compensation options, should an adverse effect on the integrity on the sandbank and reef features of the SAC be identified.

On 22nd September 2021, the Secretary of State wrote to the Applicant[79] to confirm the number of marine debris retrieval campaigns being proposed; and to identify the existing oil and gas infrastructure proposed for removal, and details of the engagement with the current owners of such infrastructure. Furthermore, details of modifications to this Project, which would avoid the need for all cable rock protection within the SAC and information to demonstrate that all reefs can be avoided during cable installation was sought.

On the 21st October 2021, in response to the request for additional environmental information, the Applicant provided the following:

- The Applicant confirmed that the proposal was to undertake a single marine litter removal campaign; however, further campaigns could be undertaken during the operation of the windfarm, if during the development of the strategy it was concluded that this would be beneficial[80].

[78] BEIS (2021). *BEIS Letter Reference EN010087*

[79] *BEIS (2021). BEIS Letter Reference EN010087*

[80] Royal HaskoningDHV (October 2021): *Norfolk Boreas Offshore Wind farm. In Principle Habitats Regulations Derogation Provision of Evidence. Appendix 3 Haisborough, Hammond and Winterton SAC In Principle Compensation. Version 3.*

12. Conclusions

The Secretary of State concludes that an adverse effect on the integrity of the Flamborough and Filey Coast SPA because of the impacts on the kittiwake population from the Project, in combination with other projects, cannot be excluded.

The Secretary of State also concludes that an adverse effect on the integrity of the Alde-Ore Estuary SPA because of the impacts on the lesser black-back gull population from the Project, in combination with other projects, cannot be excluded.

Finally, the Secretary of State concludes that an adverse effect on the integrity of the Haisborough, Hammond and Winterton SAC because of the impacts on sandbank and reef features from the Project, alone or in combination with other projects, cannot be excluded.

The Secretary of State is satisfied that there are no alternatives to fulfilling the objectives of the Project and that the Project provides a benefit that is imperative to the public interest. The Secretary of State is also satisfied that the public benefits of the Project would outweigh the impacts to the Flamborough and Filey Coast SPA, Alde-Ore Estuary SPA, and the Haisborough, Hammond and Winterton SAC, and that necessary compensatory measures to ensure that the overall coherence of the national site network can be secured. The final specifications of these packages that the Applicant must deliver are set out below.

12.1. Lesser Black-Backed Gull Compensation

The Secretary of State concludes that sufficient information has been provided to give confidence that necessary compensatory measures can be secured that will ensure the overall coherence of the national site network for lesser black-backed gull. The Secretary of State agrees that the objective of the compensation as the recruitment of 2.1 adult lesser black-backed gulls into the Alde-Ore Estuary SPA population per year is appropriate, and that the following measures can be addressed as conditions of the DCO:

- A Lesser Black-Backed Gull Steering Group (LBBGSG) must be established, and the following details must be approved by the Secretary of State prior to the commencement of the authorised project:

    i. The Terms of Reference of the LBBGSG.
    ii. The membership of the LBBGSG.
    iii. The schedule for meetings; the reporting and review periods; and the timetable for production of the Lesser Black-Backed Gull Implementation and Management Plan (LBBGIMP).
    iv. The dispute resolution mechanism.

- A LBBGIMP must be developed by the Applicant in consultation with LBBGSG to deliver the strategy set out in the in-principle compensation measures. The LBBGIMP must be submitted to the Secretary of State for approval (in consultation with the LBBGSG and the Local Planning Authority) within sufficient time to provide the agreed compensation measures four full breeding seasons before the operation of the first wind farm generator (see ii below). The LBBGIMP must include the following details:

    i. Details of the locations where compensation measures will be deployed and details of landowner agreements, demonstrating how the land will be bought/ leased, and assurances that the land management will deliver the ecology objectives of the LBBGIMP.

ii. An implementation timetable for the delivery of the fencing and habitat management measures that ensures all compensation measures are in place in time to allow four full breeding seasons prior to the operation of any turbine.
iii. Details of the design of the predator control fencing including the type of fencing, the area and location of enclosure, and details of any other habitat management measures.
iv. Details of the proposed ongoing monitoring and reporting on the effectiveness of the measures, including: survey methods; success criteria; adaptive management measures; timescales for the monitoring and monitoring reports to be delivered; and details of the factors used to trigger alternative compensation measures and/or adaptive management measures.
v. Details of the fence maintenance schedules.
vi. Minutes from all consultations with the LBBGSG.

- Results from the monitoring scheme must be submitted annually to the Secretary of State, and Natural England. This must include details of any finding that the measures have been ineffective in securing an increase in the number of adult lesser black-backed gulls available to recruit to the SAC and, in such cases, proposals to address this. Any proposals to address effectiveness must thereafter be implemented by the undertaker as approved in writing by the Secretary of State in consultation with Natural England.

- The fencing must not be decommissioned without written approval by the Secretary of State, in consultation with the relevant statutory nature conservation body, given its role in maintaining the coherence of the national site network. Furthermore, it should be maintained beyond the operational lifetime of the wind farm if the site is colonised. The routine and adaptive management measures, and monitoring should continue whilst the fencing is in place.

12.2. Kittiwake Compensation

The Secretary of State considers that sufficient information has been provided to give confidence that necessary compensatory measures can be secured that will ensure the overall coherence of the national site network for kittiwake. The Secretary of State agrees that the objective of the compensation is to provide 14 adult kittiwakes per year which could be recruited into the Flamborough and Filey Coast SPA population and that the following measures can be addressed as conditions of the DCO:

- A Kittiwake Steering Group (KSG) must be established, and the following details must be approved by the Secretary of State prior to the commencement of the authorised project:

v. The Terms of Reference of the KSG.
vi. The membership of the KSG.
vii. The schedule for meetings; the reporting and review periods; and the timetable for production of the Kittiwake Implementation and Monitoring Plan (KIMP).
viii. The dispute resolution mechanism.

- A Kittiwake Implementation and Monitoring Plan (KIMP) must be developed by the Applicant in consultation with the KSG. The KIMP must deliver the strategy set out in the in-principal compensation strategy and be submitted to the Secretary of State for approval (in consultation with the KSG and the Local Planning Authority) within sufficient time to provide the agreed compensation measures four full breeding seasons before the operation of the first wind farm generator (see iii below). The KIMP must include the following details:

i. Details of the locations where compensation measures will be deployed and details of landowner agreements, demonstrating how the land will be bought/ leased, and assurances that the land management will deliver the ecology objectives of the KIMP.
ii. Details of the design(s) of artificial nest structures including the number of nesting structures; and how risks from avian or mammalian predation, and unauthorised human access have been designed out.
iii. An implementation timetable for the delivery of the artificial nest structures that ensures all compensation measures are in place in time to allow four full kittiwake breeding seasons prior to the operation of any turbine.
iv. Details of the proposed ongoing monitoring and reporting on the effectiveness of the measures, including: survey methods; success criteria; adaptive management measures; timescales for the monitoring and monitoring reports to be delivered; and details of the factors used to trigger alternative compensation measures and/or adaptive management measures.
v. Monitoring should include annual monitoring of the number of birds colonising the site including: birds prospecting; nesting attempts; egg laying; hatching; and fledging, to identify barriers to breeding success and target alternative or adaptive compensation measures. Evidence of natal dispersal and colony interchange with the Flamborough and Filey Coast SPA kittiwake colony should be investigated, potentially using the colour-ringing of chicks.
vi. Details of the artificial nesting site maintenance schedule.
vii. Minutes from all consultations with KSG;

- Results from the monitoring scheme must be submitted annually to the Secretary of State and Natural England. This must include details of any finding that the measures have been ineffective in securing an increase in the number of adult kittiwakes available to recruit to the SPA and, in such case, proposals to address this. Any proposals to address effectiveness must thereafter be implemented by the undertaker as approved in writing by the Secretary of State in consultation with Natural England.

- The artificial nest structures must not be decommissioned without written approval by the Secretary of State, in consultation with the relevant statutory nature conservation body, given their role in maintaining the coherence of the national site network. Furthermore, they should be maintained beyond the operational lifetime of the wind farm if they are colonised. The routine and adaptive compensation measures, and monitoring should continue whilst the artificial nesting structures are in place.

12.3. Benthic Habitats Compensation

With regards to benthic habitats within Haisborough, Hammond and Winterton SAC, the Secretary of State notes the range of compensatory measures proposed by the Applicant and has concluded that due to the difficulties associated with securing an extension to the SAC, and the legislation around removing disused oil and gas infrastructure, the removal of marine debris from benthic habitats within SAC and a marine debris awareness campaign prior to the start of the construction works represents the most feasible and appropriate compensation measure available.

It is estimated that under the worst-case scenario 5.9 ha of reefs within the SAC could be disturbed by cable installation and a further 2.4 ha of SAC habitats could be lost to cable protection. The compensation measures must therefore compensate for the impacts on a total of 8.3 ha of benthic habitats. The removal of marine debris will improve the condition of the habitats for the endemic epifaunal communities by exposing the underlying substrates that constitute the benthic ecosystem. This will contribute to the conservation objectives of the SAC by removing artificial materials from the seabed and reducing adverse pressures on the biological assemblages.

The following measures are considered appropriate compensation for the potential impacts on the SAC and will be secured by conditions in the DCO:

- The Applicant must establish a Benthic Steering Group (BSG) to inform the preparation of the Benthic Implementation and Monitoring Plan (BIMP). The BSG must be consulted on the final BIMP prior to submission to the Secretary of State and during the approval process. The Applicant must consult with and report to the BSG annually in the establishment and implementation phases of the Project and document the conclusions of the meetings. The following details of the BSG must be submitted to and approved by the Secretary of State prior to the commencement of the offshore cable installation works:

  i. Terms of Reference of the BSG.
  ii. The membership of the BSG.
  iii. The schedule of meetings, reporting and review periods; and the timetable for the preparation of the BIMP.
  iv. The dispute resolution mechanism.

No offshore cable installation works in the Haisborough Hammond and Winterton SAC to commence until a final BIMP has been approved in writing by the Secretary of State (in consultation with the Marine Management Organisation and Natural England).

- The BIMP must accord with the principles set out in the in-principal compensation strategy relating to the protected features, and must include the following details:

  i. Details of how impacts to Annex 1 reef habitats within designated sites will be avoided.
  ii. Details of the locations for the disposal of dredged material, and evidence that the disposal mechanism will allow sediment to be retained within the sandbank system and avoid impacts to other features, particularly reef habitats.
  iii. Details of any further survey work required to confirm the presence and condition of marine debris.
  iv. Details of the areas which will be subject to marine debris removal. The total area of debris removed should equate to at least 8.3 ha to compensate for the predicted effects of cable installation and protection. Should the total area of debris identified be less that the 8.3 ha required to compensate for the impacts of the Project, then in accordance with Defra's guidance[26] on compensation measures, further debris removal will be undertaken at alternative protected sites to benefit other reef and sandbank features within the national site network.
  v. A method statement for its removal, to include the vessel type, tools used and mitigation for how impacts on habitats will be minimised.
  vi. A programme of delivery for education, awareness and provision of facilities to reduce further marine debris from affecting the SAC.
  vii. An environmental monitoring plan to include: appropriate surveys to assess the effects of cable installation on sandbank recovery, sediment movement and epifauna assemblages during the operation of the Project; and appropriate surveys to monitor the recovery of benthic habitats in areas impacted by cable protection, post-decommissioning.
  viii. Details of the timetable for the implementation measures to ensure that no cable installation works in the SAC may be commenced until at least 8.3ha of marine litter has been removed, in accordance with the programme referred to in paragraph 29(d) of Part 3 of Schedule 19 of the DCO.

- Results from the monitoring surveys must be submitted annually to the Secretary of State, the Marine Management Organisation and Natural England. This must include details of any findings that the measures have been ineffective in securing an improvement in the condition of the SAC and, in such case, proposals to address this. Any proposals to address effectiveness

must thereafter be implemented by the undertaker as approved in writing by the Secretary of State in consultation with the Marine Management Organisation and Natural England.

- A report which demonstrates completion of the activities required by the approved strategy must be submitted within 12 months of completion for approval by the Secretary of State, in consultation with the Marine Management Organisation and Natural England.

The compensation measures for the Project referred to in this HRA will be secured and delivered through the DCO as set out in Schedule 19.

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