Norfolk Vanguard Offshore Wind Farm

Habitats Regulations Derogation

Provision of Evidence

Applicant: Norfolk Vanguard Limited
Document Reference: ExA; IROPI; 11.D10.3

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Photo: Kentish Flats Offshore Wind Farm

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Acronyms

AA	Appropriate Assessment
AEoI	Adverse Effect on Integrity
AfL	Agreement for Lease
AOE	Alde-Ore Estuary
AONB	Area of Outstanding Natural Beauty
BEIS	Business Energy and Industrial Strategy
CCC	Committee on Climate Change
CEBR	Centre for Economics and Business Research
CfD	Contract for Difference
CGS	Clean Growth Strategy
CRM	Collision Risk Modelling
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DML	Deemed Marine Licence
EAOW	East Anglia Offshore Wind
EC	European Commission
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ETG	Expert Topic Group
EU	European Union
ExA	Examining Authority
FCS	Favourable Conservation Status
FFC	Flamborough and Filey Coast
GDP	Gross Domestic Product
GW	Gigawatt
HDD	Horizontal Directional Drilling
HHW	Haisborough, Hammond and Winterton
HRA	Habitats Regulations Assessment
HRGN	Habitats Regulations Guidance Note
IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
Km	Kilometres
LEP	Local Enterprise Partnership
LiDAR	Light Detection and Ranging
LSE	Likely Significant Effects
MMO	Marine Management Organisation
MW	Megawatt

NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NV East	Norfolk Vanguard East
NV West	Norfolk Vanguard West
PEXA	Military Practice and Exercise Areas
O&M	Operation and Maintenance
OFTO	Offshore Transmission Owner
OWF	Offshore Wind Farm
RIES	Report on the Implications for European Sites
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SIP	Site Integrity Plan
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
SPR	ScottishPower Renewables
SSSI	Site of Special Scientific Interest
STW	Scottish Territorial Waters
TCE	The Crown Estate
VWPL	Vattenfall Wind Power Ltd
WMO	World Meteorological Organization
ZAP	Zonal Appraisal and Planning

1 INTRODUCTION

1.1 Project Background

1. Norfolk Vanguard Limited ('the Applicant'), an affiliate company of Vattenfall Wind Power Limited (VWPL) has applied for a Development Consent Order (DCO) for Norfolk Vanguard, an offshore wind farm (OWF) in the southern North Sea.

2. The OWF comprises two distinct areas, Norfolk Vanguard (NV) East and NV West ('the OWF sites'), located in the southern North Sea, approximately 70 km and 47 km from the nearest point of the Norfolk coast respectively. The OWF would be connected to the shore by offshore export cables installed within the offshore cable corridor from the OWF sites to a landfall point at Happisburgh South, Norfolk. From there, onshore cables would transport power over approximately 60 km to the onshore project substation and grid connection point near Necton, Norfolk. The project location is shown in Figure 1.1.

3. Once built, Norfolk Vanguard would have an export capacity of up to 1800 MW, with the offshore components comprising:

   - Wind turbines;
   - Offshore electrical platforms;
   - Accommodation platforms;
   - Met masts;
   - Measuring equipment (Light Detection and Ranging (LiDAR) and wave buoys);
   - Array cables;
   - Interconnector cables; and
   - Export cables.

4. The key onshore components of the project comprise:

   - Landfall;
   - Onshore cable route, accesses, trenchless crossing technique (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation areas;
   - Onshore project substation; and
   - Extension to the existing Necton National Grid substation and overhead line modifications.

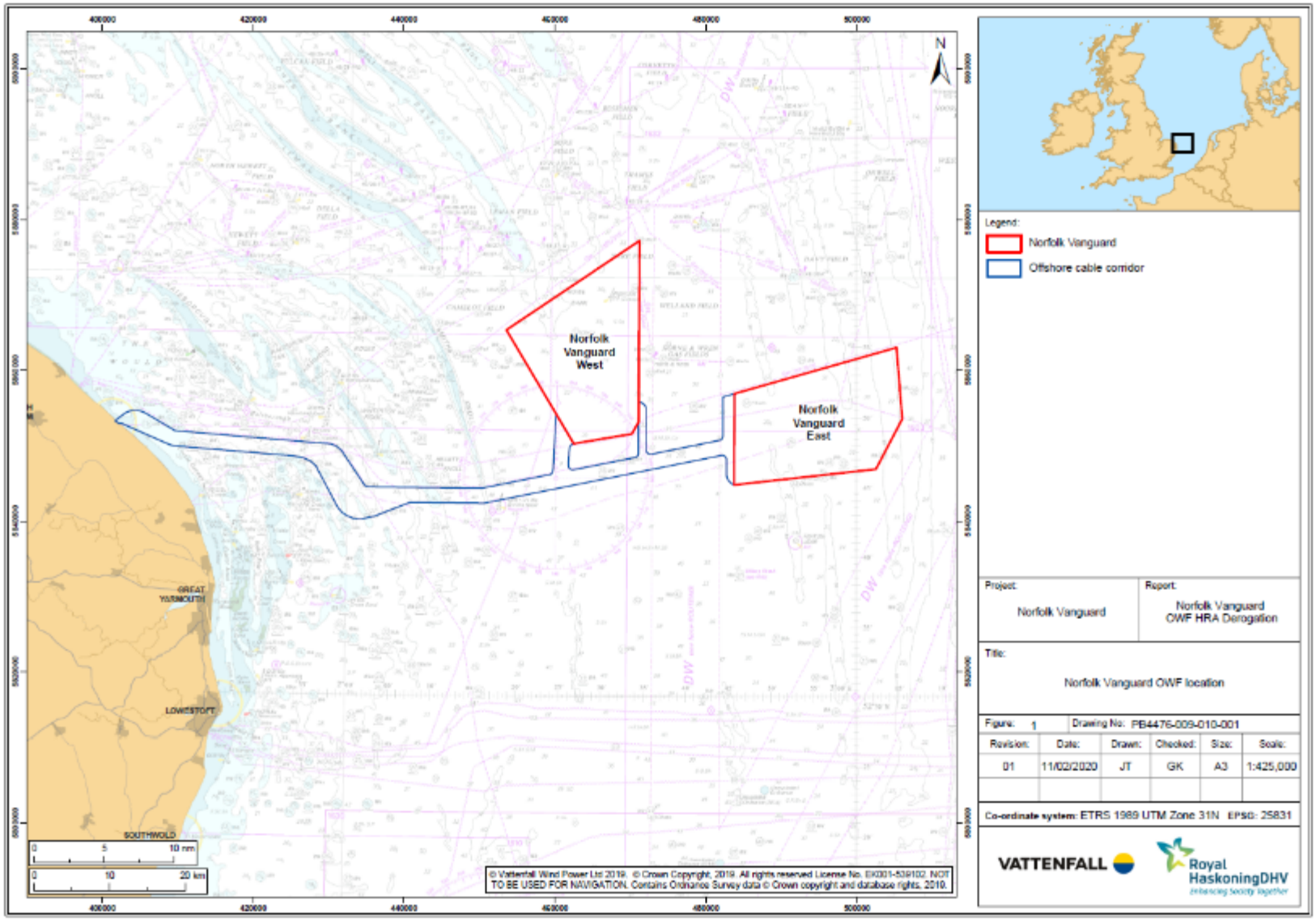

Figure 1.1 Norfolk Vanguard location

1.2 Purpose of this Document

5. Table 1.1 lists the European designated sites ('Natura 2000' sites) for which a Likely Significant Effect (LSE) due to Norfolk Vanguard could not be ruled out (i.e. that were screened in) during the project's Habitats Regulations Assessment (HRA). This list was agreed with the Statutory Nature Conservation Body (SNCB), Natural England.

6. The Applicant submitted Information to Support the HRA (document reference 5.3) with the DCO application, as well as providing additional information in response to HRA issues raised during the Examination. The Planning Inspectorate's Report on the Implications for European Sites (RIES, dated 9 May 2019) provides a summary of the information submitted by all relevant parties up to Deadline 7 of the Examination and outlines the areas of agreement and disagreement at this time. The latest position of the Applicant and SNCB from the Examination, which concluded on 10 June 2019, regarding the potential for Norfolk Vanguard to have an adverse effect on site integrity (AEoI) is discussed in the Summary Overview (document reference ExA; Sum; 11.D10.2) and summarised in Table 1.1.

7. As noted in Table 1.1, the sites for which there is remaining disagreement between the Applicant and SNCB in relation to the potential for AEoI are:

   - Alde-Ore Estuary Special Protection Area (SPA);
   - Flamborough and Filey Coast SPA; and
   - Haisborough, Hammond and Winterton (HHW) Special Area of Conservation (SAC).

Table 1.1 Natura 2000 sites screened in to the assessment and position on AEoI of the Applicant and Natural England

Natura 2000 Site: LSE (Screened in to HRA)	Feature screened in	Conclusions regarding AEoI	
		Applicant's position	Natural England position at the end of the Examination (June 2019)
Alde-Ore Estuary (AOE) Special Protection Area (SPA)	Lesser Black backed gull	AEoI can be ruled out	AEoI can be ruled out for the Project alone. However, **an AEoI cannot be ruled out as a result of collision risk when the Project is considered in-combination with other OWFs.**
Breydon Water SPA	Wintering and passage waterbird assemblage including as named features Bewick's swan, ruff, golden plover, avocet, lapwing	AEoI can be ruled out	
Broadland SPA	Wintering and passage waterbird assemblage including as named features shoveler, wigeon, gadwall, Bewick's swan, whooper swan, ruff	AEoI can be ruled out	
Flamborough & Filey Coast (FFC) SPA	Kittiwake Gannet Guillemot Razorbill Puffin	AEoI can be ruled out	AEoI can be ruled out for the Project alone and in-combination with other OWFs when Hornsea Project Three is excluded. However, **an AEoI cannot be ruled out as a result of collision risk when the Project is considered in-combination with other OWFs including Hornsea Project Three.**
Greater Wash SPA	Red-throated diver Little gull	AEoI can be ruled out. With respect to red-throated diver the Applicant committed to reduce the number of cable laying vessels to one in the months January to March inclusive, to mitigate disturbance.	Agreement that AEoI can be ruled out. Note that for red-throated diver this followed the additional mitigation committed to by the Applicant during Examination.
North Norfolk Coast SPA	Wintering and passage waterbird assemblage, including (as named features) shoveler, wigeon, gadwall, Bewick's swan, whooper swan and ruff	AEoI can be ruled out	

Natura 2000 Site: LSE (Screened in to HRA)	Feature screened in	Conclusions regarding AEoI	
		Applicant's position	Natural England position at the end of the Examination (June 2019)
Outer Thames Estuary SPA	Red-throated diver	AEoI can be ruled out. The Applicant committed to reduce the number of cable laying vessels to one in the months January to March inclusive to mitigate disturbance of red-throated diver.	Agreement that AEoI can be ruled out following the additional mitigation committed to by the Applicant during Examination.
Haisborough, Hammond and Winterton (HHW) Special Area of Conservation (SAC)	Reef Sandbanks which are slightly covered by sea water all the time	AEoI can be ruled out	An AEoI cannot be ruled out
Southern North Sea SAC	Harbour porpoise	AEoI can be ruled out with mitigation delivered by the SNS SAC Site Integrity Plan (SIP) as secured through the Deemed Marine Licences (DMLs).	
Humber Estuary SAC	Grey seal	AEoI can be ruled out	
The Wash and North Norfolk Coast SAC	Harbour seal	AEoI can be ruled out	
River Wensum SAC	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation; and Desmoulin's whorl snail	AEoI can be ruled out	
Paston Great Barn SAC	Barbastelle bats	AEoI can be ruled out	
Norfolk Valley Fens SAC	Various	AEoI can be ruled out	
The Broads SAC	Various	AEoI can be ruled out	

8. A Request for Information was submitted by the Department for Business, Energy and Industrial Strategy (BEIS) on 6 December 2019 which states:

9. In relation to ornithology:

"In relation to in-combination impacts on the qualifying kittiwake feature of the Flamborough and Filey Coast Special Protection Area ("SPA") and the qualifying lesser black-backed gull feature of the Alde-Ore Estuary SPA, the Applicant, in consultation with Natural England as necessary, is invited to provide information on any mitigation, not discussed during the Examination, which could lessen or avoid any adverse effects on the integrity of these sites.

In addition, or alternatively, the Applicant, in consultation with Natural England as necessary, is invited to provide evidence as to:

- *whether there are any feasible alternative solutions to the Norfolk Vanguard project which could avoid or lessen any adverse effects on the integrity of these sites;*
- *any imperative reasons of overriding public interest for the Norfolk Vanguard project to proceed; and*
- *any in-principle compensatory measures proposed to ensure that the overall coherence of the network of Natura 2000 sites is protected.*

Compensatory measures should, if possible, be agreed by Natural England as at least sufficient, to offset the potential residual harm to the features of the Natura 2000 sites. In order that the Secretary of State can consider fully the application, the Applicant is requested to provide as much information as possible to explain the compensatory measures proposed and the feasibility of those measures. Details of the steps required to implement the compensation and proposed timescales to establish the compensatory measures should also be provided. Where disagreement remains between the parties on the assessment and quantification of an impact, compensation proposals should be provided for a range of scenarios."

10. In relation to the HHW SAC:

"The Applicant, in consultation with the Marine Management Organisation and Natural England as necessary, is invited to provide information on the specific mitigation solutions that would address the potential effects of cable protection on the SAC features. In the absence of any identifiable mitigation measures, the Applicant, in consultation with Natural England, may wish to consider the provision of evidence as to:

- *whether there are any feasible alternative solutions to the Norfolk Vanguard project which could avoid or lessen any adverse effects on the integrity of these sites;*
- *any imperative reasons of overriding public interest for the Norfolk Vanguard project to proceed; and*
- *any in-principle compensatory measures proposed to ensure that the overall coherence of the network of Natura 2000 sites is protected."*

11. In response to this request for information, this document provides the Applicant's submission in relation to alternative solutions (Section 4), Imperative Reasons of Overriding Public Interest (IROPI) (Section 5) and in-principle compensatory measures in respect of the FFC SPA, AOE SPA and the HHW SAC (Section 6). Sections 2 and 3 provide the legislative context and information on the designated interest features.

12. The Applicant nevertheless firmly maintains the position presented during the Examination that, in respect of the FFC SPA, AOE SPA and the HHW SAC, an AEoI can be ruled out beyond reasonable scientific doubt (this is discussed further in the Summary Overview, document reference ExA; Sum; 11.D10.2). This submission is, therefore, with regard to the FFC and AOE SPAs, entirely without prejudice to the Applicant's position that there would be no AEoI in respect of in-combination impacts on the qualifying kittiwake feature of the FFC SPA nor in respect of the qualifying lesser black-backed gull feature of the AOE SPA. With regard to the HHW SAC, it is entirely without prejudice to the Applicant's position that there would be no AEoI in respect of cable installation and cable protection on the SAC features.

13. This document relates to Norfolk Vanguard alone, however, its sister project (Norfolk Boreas) has been considered strategically during the site selection and assessment of alternatives stage of the Project and would be considered in the development of detailed compensatory measures, if required, post consent.

2 LEGISLATIVE CONTEXT

2.1 The Habitats Directive

14. The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (the Habitats Directive) provides a framework for the conservation and management of natural habitats, wild fauna (except birds) and flora in Europe. Its aim is to maintain or restore natural habitats and wild species at a favourable conservation status. The relevant provisions of the Directive are the procedures for the protection of SACs and SPAs (Article 6). SACs are identified based on the presence of natural habitat types listed in Annex I and populations of the species listed in Annex II.

15. The EU Directive on the Conservation of Wild Birds (2009/147/EC) (the Birds Directive) provides a framework for the conservation and management of wild birds in Europe.

16. Articles 6(3) and 6(4) of the Habitats Directive (see Table 2.1) set out the consenting procedure associated with a plan or project, for which there is a LSE on a Natura 2000 site, either individually or in-combination with other plans or projects. Such plans or projects are subject to an Appropriate Assessment (see Section 2.2).

17. In England and Wales, the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019[1] ('the Habitats Regulations') transpose the Habitats Directive and elements of the Birds Directive into UK law.

Table 2.1 Relevant Articles and Regulations

Article	Requirement
Habitats Directive Article 6(3)	*"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."*
Habitats Directive Article 6(4)	*"If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.* *Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public*

[1] The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 amend the Conservation of Habitats and Species Regulations 2017 and the Conservation of Offshore Marine Habitats and Species Regulations 2017 ('the Offshore Marine Regulations') which covers UK offshore waters (i.e. 12nm from the coast out to 200nm or to the limit of the UK Continental Shelf Designated Area) so that the regulations remain operable, ensure protection continues, to meet the UK's international commitments following withdrawal from the European Union.

Article	Requirement
	safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest."
Habitats Regulations Regulation 64	*"(1) If the competent authority is satisfied that, there being no alternative solutions, the plan or project must be carried out for imperative reasons of overriding public interest (which, subject to paragraph (2), may be of a social or economic nature), it may agree to the plan or project notwithstanding a negative assessment of the implications for the European site or the European offshore marine site (as the case may be).* *(2) Where the site concerned hosts a priority natural habitat type or a priority species, the reasons referred to in paragraph (1) must be either—* *(a) reasons relating to human health, public safety or beneficial consequences of primary importance to the environment; or* *(b) any other reasons which the competent authority, having due regard to the opinion of the European Commission, considers to be imperative reasons of overriding public interest.* *(3) Where a competent authority other than the Secretary of State or the Welsh Ministers desires to obtain the opinion of the European Commission as to whether reasons are to be considered imperative reasons of overriding public interest, it may submit a written request to the appropriate authority—* *(a) identifying the matter on which an opinion is sought; and* *(b) accompanied by any documents or information which may be required.* *(4) The appropriate authority—* *(a) may seek the opinion of the European Commission concerning the plan or project; and* *(b) where such an opinion is received, must send it to the competent authority.* *(5) Where a competent authority other than the Secretary of State or the Welsh Ministers proposes to agree to a plan or project under this regulation notwithstanding a negative assessment of the implications for the site concerned—* *(a) it must notify the appropriate authority; and* *(b) it must not agree to the plan or project before the end of the period of 21 days beginning with the day notified by the appropriate authority as that on which its notification was received, unless the appropriate authority notifies it that it may do so.* *(6) Without prejudice to any other power, the appropriate authority may give directions to the competent authority in any such case prohibiting it from agreeing to the plan or project, either indefinitely or during such period as may be specified in the direction."*
Habitats Regulations Regulation 68	*"Where in accordance with regulation 64—* *(a) a plan or project is agreed to, notwithstanding a negative assessment of the implications for a European site or a European offshore marine site, or* *(b) a decision, or a consent, permission or other authorisation, is affirmed on review, notwithstanding such an assessment,* *the appropriate authority must secure that any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 is protected."*

2.2 Habitats Regulations Assessment

18. Under the Habitats Regulations, the relevant Competent Authority must consider whether a plan or project has the potential to have an AEoI on a Natura 2000 site. Article 6(4) can only apply after the Appropriate Assessment (AA) has concluded that an AEoI cannot be ruled out.

19. The following UK and European Commission (EC) Guidance addresses Article 6(4):

- Habitats Directive – Guidance on the application of Article 6(4), published by DEFRA in August 2012 (the DEFRA Guidance);
- Managing Natura 2000 sites – the provisions of Article 6(3) of the 'Habitats' directive 92/42/EEC (2000) ("MN 2000") first published by the EC in 2000 but updated in November 2018 (the EC Guidance).

20. Figure 2.1 provides an outline of the sequential HRA process. This document provides information relating to Stages 3 to 4 (shown in Figure 2.1), i.e. where it has been concluded that AEoI cannot be discounted .

21. **However, as stated in Section 1, the Applicant's primary case is that Article 6(4) is not engaged in relation to the FFC SPA, the AOE SPA or the HHW SAC as a result of Norfolk Vanguard (either alone or in-combination) and, therefore, Stages 3 and 4 should not be required.**

22. Having regard to the manner in which it is proposed to carry out Norfolk Vanguard and to the requirements and conditions subject to which it is proposed that development consent should be granted, the Applicant's position is that the evidence clearly demonstrates that there would be no AEoI of any European sites. The reasoning and evidence for this conclusion is principally set out in the Applicant's Information to Support HRA report (document 5.3), as supplemented by the following clarification notes and further submissions by the Applicant on ornithology and benthic ecology matters:

- Norfolk Vanguard Written Questions Appendix 3.1 Red-Throated Diver Displacement (document reference ExA; WQApp 03.01;10.D1.3);
- Norfolk Vanguard Offshore Ornithology Deterministic Collision Risk Modelling (document reference ExA; AS; 10.D6.15);
- Lesser Black-backed Gull Alde Ore Estuary Population Viability Analysis (document reference ExA; AS; 10.D6.16);
- Norfolk Vanguard Migrant non-seabird Collision Risk Modelling (CRM) Revision of REP3-038 (document reference ExA; AS; 10.D6.18);
- CRM for revised layout (document reference ExA; CRM; 10.D6.5.1);
- Offshore Ornithology Cumulative and In-combination Collision Risk Assessment Update (document reference ExA; AS; 10.D7.21);
- Deterministic CRM revised layout and draught height (document reference ExA;AS;10.D7.5.2);
- Updated Auk Displacement Assessment for Deadline 8 (document reference ExA; AS; 10.D8.10); and
- Haisborough Hammond and Winterton SAC Site Integrity Plan (document 8.20).

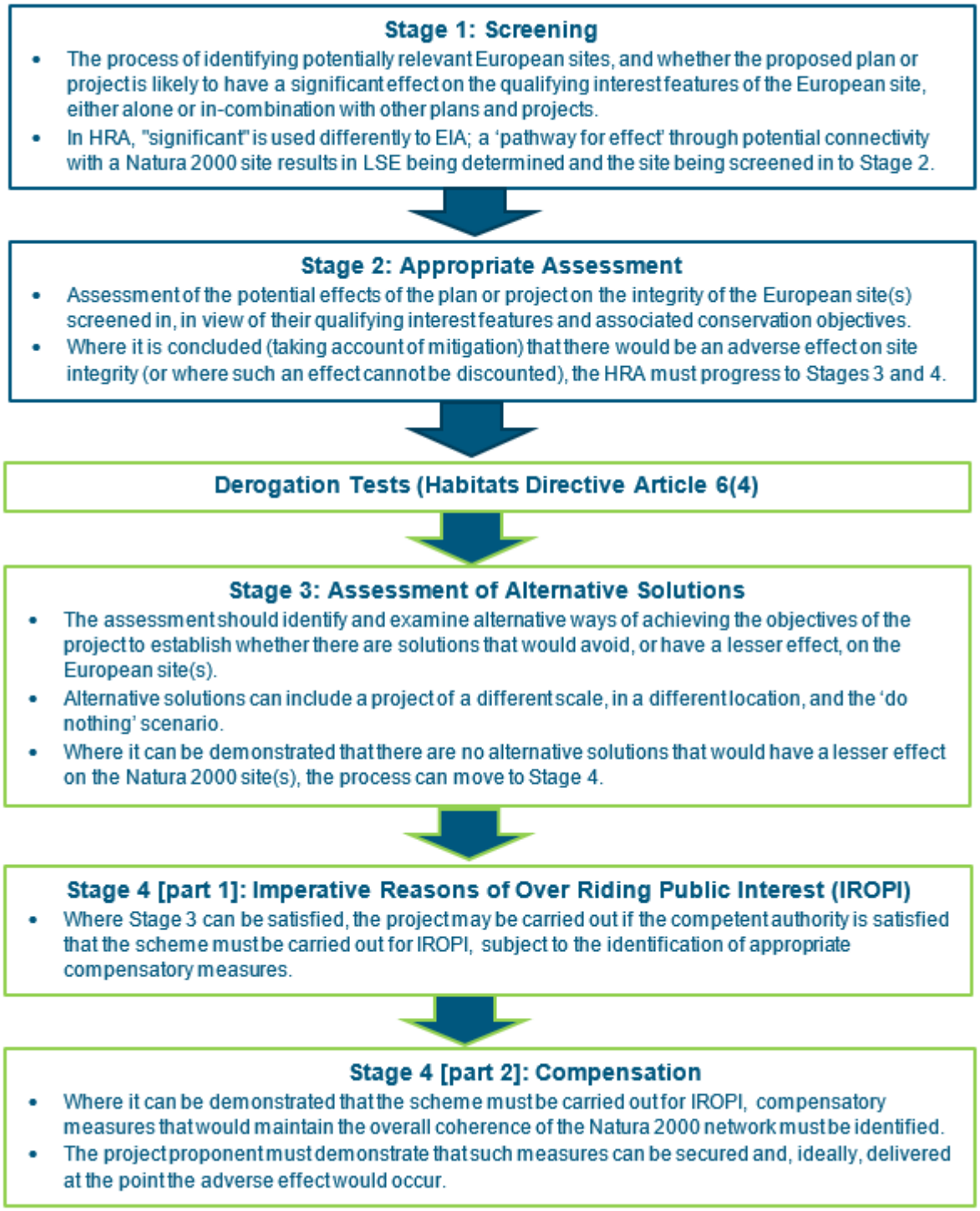

Figure 2.1 HRA process

3 RELEVANT DESIGNATED SITES

3.1 Flamborough and Filey Coast SPA

3.1.1 Overview

23. Flamborough and Filey Coast SPA covers an area of 7,858ha and is located on the Yorkshire coast between Bridlington and Scarborough. The SPA is in two sections: the southern section extends north from South Landing around Flamborough Head to Speeton; the northern section covers the peninsula of Filey Brigg before extending north west to Cunstone Nab. The seaward boundary extends 2km throughout the two sections of the site into the marine environment, running parallel to the landward boundaries to include the adjacent coastal waters. The SPA includes the RSPB reserve at Bempton Cliffs, the Yorkshire Wildlife Trust Flamborough Cliffs Nature Reserve and the East Riding of Yorkshire Council Flamborough Head Local Nature Reserve.

24. The site description indicates that the Flamborough and Filey Coast SPA qualifies under Article 4.2 of the Bird Directive (2009/147/EC) by supporting over 1% of the biogeographical populations of four regularly occurring migratory species and a breeding seabird assemblage of European importance: kittiwake 44,520 pairs (89,040 breeding adults, 4 year average 2008-2011); gannet 8,469 pairs (16,938 breeding adults, 2008-2012); guillemot 41,607 pairs (83,214 breeding adults, 2008-2011) and razorbill 10,570 pairs (21,140 breeding adults, 2008-2011). In addition, the SPA supports a breeding seabird assemblage of 216,730 individuals (average 2008-2012).

25. The Flamborough and Filey Coast SPA supersedes the Flamborough Head and Bempton Cliffs SPA. It is worth noting that the trend in the kittiwake population for this site has been subject to discussion and disagreement between seabird experts (e.g. John Coulson) and the SNCBs. At the time of citation, the Flamborough Head and Bempton Cliffs SPA was thought to support 83,370 breeding pairs of kittiwakes (2.6% of the breeding Eastern Atlantic population) (count as of 1987). However, there were 37,617 kittiwake pairs or 75,234 breeding adults recorded in 2008 (JNCC Seabird Colony Register). The citation (JNCC 2011b) notes that the SPA designations were reviewed in 2000, at which point kittiwakes were the only notified feature of the site. There is some uncertainty as to whether there were ever as many as 83,370 pairs of kittiwakes at this site; this number has been challenged repeatedly by the world's leading expert on kittiwake biology (Coulson, 2011), most recently by noting that this colony should have been increasing in numbers based on monitoring data on its productivity. The apparent decline from 83,370 pairs in 1987 to 37,617 pairs in 2008 does not correspond with population trajectories elsewhere based on the influence of productivity on population change (Coulson 2017). Recent counts by RSPB indeed

show a small increase in kittiwake breeding numbers in the years since 2008 (RSPB data), as predicted by Coulson (2017).

26. This site does not support any priority habitats or species.

27. Only the kittiwake feature of this SPA is of potential relevance to the Norfolk Vanguard derogation case.

3.1.2 Conservation Objectives

28. The Conservation Objectives for the site are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- the extent and distribution of the habitats of the qualifying features;
- the structure and function of the habitats of the qualifying features;
- the supporting processes on which the habitats of the qualifying features rely;
- the populations of each of the qualifying features; and
- the distribution of the qualifying features within the site.

3.1.3 Kittiwake Conservation Status

29. The kittiwake is a small cliff-nesting gull. It breeds in a large number of colonies around the coast of the British Isles, though there are very few colonies along the coast of south east England owing to the lack of suitable nesting habitat (Coulson 2011). Kittiwake numbers increased dramatically between 1900 and 1985, however started to decline during the 1980s in Shetland when the local sandeel stock suffered recruitment failure (Mitchell *et al.* 2004). Numbers have declined considerably since the 1980s, although this decline has been less severe in England than in Scotland, and also less in the west of Great Britain than in North Sea colonies (Mitchell *et al.* 2004). Within regions, declines have been greatest in SPA populations (of which there are many) (Furness 2015) because they are the largest colonies and furthermore, food shortage affects breeding success and recruitment at large colonies more than at small ones (Coulson 2011). In contrast to the declining trend in much of the UK, breeding numbers of kittiwakes have increased slightly at Flamborough and Filey Coast SPA between 2008 and 2017 (RSPB data).

3.2 Alde-Ore Estuary SPA

3.2.1 Overview

30. The Alde-Ore Estuary SPA covers 2,417ha and is located on and around the Suffolk coast, 92 km from the proposed Norfolk Vanguard offshore wind farm at its closest

point. The SPA comprises an estuarine complex of the rivers Alde, Butley and Ore. The Alde-Ore Estuary was also listed as a Ramsar site in October 1996 for its internationally important wetland assemblage. The SPA citation was published in January 1996 and the site was classified by the UK Government as an SPA under the provisions of the Birds Directive in August 1998. The site is coincident with the Alde-Ore Estuary Site of Special Scientific Interest (SSSI), which was notified in 1952, with the SSSI boundary being identical to that of the SPA and Ramsar sites. The SPA/Ramsar site also forms part of the Alde-Ore and Butley European Marine Site.

31. There are several important habitats within the Alde-Ore Estuary site, including intertidal mudflats, saltmarsh, vegetated shingle (including the second-largest and best-preserved area in Britain at Orfordness), saline lagoons and semi-intensified grazing marsh. The diversity of wetland habitat types present is of particular significance to the birds occurring on the site, as these provide a range of opportunities for feeding, roosting and nesting within the site complex. At different times of the year, the site supports notable assemblages of wetland birds including seabirds, wildfowl and waders. As well as being an important wintering area for waterbirds, the Alde-Ore Estuary provides important breeding habitat for several species of seabird, wader and birds of prey. During the breeding season, gulls and terns feed substantially outside the SPA (JNCC 2011a). The Suffolk Wildlife Trust, the National Trust and the RSPB have nature reserves within the SPA.

32. The Joint Nature Conservation Committee's (JNCC's) SPA site description (as published in 2001) indicates that the Alde-Ore Estuary qualifies as an SPA under Article 4.1 of the Birds Directive (79/409/EEC) by regularly supporting populations of Annex I species of European importance: breeding populations of little tern, marsh harrier and Sandwich tern, and avocet (both breeding and wintering). The site also qualifies under Article 4.2 of the Birds Directive by supporting two Annex II species - a wintering population of redshanks, and a breeding population of lesser black-backed gulls, the designation of the lesser black-backed gulls being based on 14,074 breeding pairs (4 year mean peak, 1994-1997). At designation, the site regularly supported 59,118 individual seabirds during the breeding season, including: herring gull, black-headed gull, lesser black-backed gull, little tern and Sandwich tern.

33. Following the UK SPA review (Stroud *et al.* 2001) additional Article 4.2 qualifying features were identified as needing protection: a breeding seabird assemblage of international importance (at least 20,000 seabirds) and a wintering waterbird assemblage of international importance (at least 20,000 waterbirds).

34. This site does not support any priority habitats or species.

35. Only the lesser black back gull feature of this SPA is of potential relevance to the Norfolk Vanguard derogation case.

3.2.2 Conservation Objectives

36. The Conservation Objectives for the site are to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:

- the extent and distribution of the habitats of the qualifying features;
- the structure and function of the habitats of the qualifying features;
- the supporting processes on which the habitats of the qualifying features rely;
- the populations of the qualifying features; and
- the distribution of the qualifying features within the site.

3.2.3 Lesser Black Backed Gull Conservation Status

37. The lesser black-backed gull breeds in large numbers in England, mostly in coastal areas but also in urban sites (Mitchell *et al.* 2004). It is primarily a summer visitor, with most birds migrating to southern Europe or north Africa for the winter (Wernham *et al.* 2002). However, increasing numbers have taken to overwintering in the southern North Sea in recent decades (Wernham *et al.* 2002). Breeding numbers increased considerably during the 20th century, probably in part due to provision of fishery discards (Camphuysen 2013). Male lesser black-backed gulls forage mostly at sea, whereas females forage more in terrestrial habitats (Camphuysen *et al.* 2015). Habitat use is also seasonal, with greater use of inland foraging early and late in the breeding season, and peak marine foraging activity during chick-rearing (Thaxter *et al.* 2015).

38. The changing fortunes of gulls at the Alde-Ore Estuary SPA and reasons for the current unfavourable declining status have been documented in the Appropriate Assessment for Galloper Offshore Wind Farm (Department of Energy and Climate Change 2013a) and elsewhere, for example, Mason (2010). The colony was first formed in the early 1960s, when a few pairs nested (Stroud *et al.* 2001). Numbers then increased rapidly, apparently due to immigration of birds from elsewhere (Stroud *et al.* 2001). Although most of the colony was at Orfordness, numbers there have declined since 2000. As numbers declined at Orfordness, numbers increased at Havergate Island (RSPB reserve and also part of the Alde-Ore Estuary SPA), suggesting that colony relocation was in part related to impacts of predators or disturbance. Flooding of breeding areas has also contributed to breeding failures at Orfordness in some years, for example together with predator impacts causing total breeding failures in 2010 and 2012 (Thaxter *et al.* 2015).

3.3 Haisborough, Hammond and Winterton SAC

3.3.1 Overview

39. The HHW SAC is located to the west of Norfolk Vanguard, and the proposed offshore cable corridor for the Project will pass through the SAC to make landfall. The SAC is designated for Annex I Sandbanks which are slightly covered by seawater all the time and Annex I Reefs (*Sabellaria spinulosa*).

40. The sandbank ridges consist of sinusoidal banks which have evolved over the last 5,000 years and comprise of Haisborough Sand, Haisborough Tail, Hammond Knoll, Winterton Ridge and Hearty Knoll. Older sandbanks, Hewett Ridge and Smiths Knoll, that have formed over the last 7,000 years are present along the outer site boundary. The more geologically recent sandbanks of Newarp Banks and North and Middle Cross Sands are located in the south west corner of the SAC.

41. The JNCC HHW Site Details[2] state that, at the time of designation, *S. spinulosa* reef had been recorded on Haisborough Tail, Haisborough Gat and between Winterton Ridge and Hewett Ridge.

42. This site does not support any priority habitats or species.

3.3.2 Conservation Objectives

43. Conservation objectives are set to ensure that, subject to natural change, the integrity of a site is maintained or restored, as appropriate, and that the site contributes to achieving the Favourable Conservation Status of its qualifying features, by maintaining or restoring:

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

[2] http://jncc.defra.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030369

3.3.3 Conservation Status

44. In August 2019 Natural England published the results of the latest conservation status assessment for the site[3]. This assessment finds that 100% of the Annex 1 Reef and Sandbank features are in unfavourable condition and both features need to be restored to favourable condition.

[3] https://designatedsites.naturalengland.org.uk/MarineCondition/PublicSubFeature.aspx?featureGuid=c8c43fb1-2919-e611-9771-000d3a2004ef&SiteCode=UK0030369

4 ASSESSMENT OF ALTERNATIVE SOLUTIONS

4.1 Introduction

45. Norfolk Vanguard is a Round 3 OWF, located in the former East Anglia Zone (Zone 5). The former East Anglia Zone was originally identified by The Crown Estate (TCE) as a suitable area offering 'potential for offshore wind' as part of the Round 3 Offshore Wind Zone development process in 2008. The Round 3 selection process involved an approach based on development zones, which ultimately included the former East Anglia Zone.

46. TCE led the Round 3 process to identify suitable zones using MaRS (its Marine Resource System GIS tool). Initial areas of opportunity identified were:

- excluded if there were conflicting uses in place or planned;
- weighted for restriction if there were constraints such as nature conservation; and
- reviewed for local factors which included "sensitive bird areas".

47. Eleven initial zones were subject to consultation. In the course of this exercise the 11 zones were then adapted to nine zones. Finally, slight boundary adjustments were made to the nine "Round 3" zones. The former East Anglia Zone was, therefore, progressed following consultation with stakeholders, initiated by TCE, before a tender round was issued to potential developers.

48. In December 2009 East Anglia Offshore Wind (EAOW, a consortium of Vattenfall Wind Power Limited (VWPL) and Scottish Power Renewables (SPR)) was awarded the rights to develop Zone 5 (the former East Anglia Zone) with a Zone Development Agreement (ZDA).

49. As noted in National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3), the award of ZDAs amounted to a plan within the meaning of the Offshore Habitats Regulations and, therefore, an Appropriate Assessment was carried out by TCE, as competent authority, before the ZDAs were awarded.

50. In parallel, DECC undertook a Strategic Environmental Assessment (SEA) in accordance with the Environmental Assessment of Plans and Programmes Regulations 2004 (the SEA Regulations). As set out in NPS EN-3, through this Offshore Energy SEA (OESEA) (DECC, 2009), the UK Government assessed "*the environmental implications and spatial interactions of a plan/programme for some 25GW new offshore wind, on top of existing plans for 8GW of offshore wind*". The OESEA included consideration of alternatives to the draft plan/programme for all elements covered by the SEA, including future offshore wind leasing. The UK Government concluded there were no

overriding environmental considerations to prevent the achievement of the plan/programme.

51. The identification of OWF locations within the former East Anglia Zone was undertaken through a robust Zonal Appraisal and Planning (ZAP) process conducted by EAOW, which commenced in 2010 utilising available environmental and technical data. This resulted in a Zonal Development Plan (ZDP) in 2012, which identified areas with the least environmental and technical constraints. Following the commercial split of the former East Anglia Zone, VWPL took control of all development activities for projects in the northern half of the zone and SPR for development activities in the southern half of the zone.

52. During 2015, VWPL revisited the ZDP for the northern half of the zone and the locations of Norfolk Vanguard (and the sister project, Norfolk Boreas) were identified; taking account of key environmental and stakeholder constraints, technical aspects and the lowest cost of energy, as described in paragraphs 26-29 of Chapter 4 of the Environmental Statement (ES).

53. The southern North Sea provides an optimum location for OWFs due to the availability of suitable wind resource, water depths and ground conditions. Assessment of Alternatives Methodology

54. The DEFRA Guidance establishes that the consideration of alternative solutions to OWFs need not go beyond the consideration of options for OWFs, in order to deliver the objectives of renewable energy production:

"Alternative solutions are limited to those which would deliver the same overall objective as the original proposal. For example, in considering alternative solutions to an offshore wind renewable energy development the competent authority need only consider alternative offshore wind renewable energy developments. Alternative forms of energy generation are not alternative solutions to this project as they are beyond the scope of its objective. Similarly, alternative solutions to a port development will be limited to other ways of delivering port capacity, and not other options for importing freight. Likewise, the assessment of alternative solutions for a proposed motorway would not need to include the assessment of alternative modes of transport. This approach was followed in the Nuclear Energy National Policy Statement where the consideration of alternative solutions was limited to alternative sites for nuclear development.

National Policy Statements and other documents setting out Government policy (e.g. the UK Renewable Energy Roadmap) provide a context for competent authorities considering the scope of alternative solutions they will assess."

55. In accordance with this guidance, only OWFs (and not other forms of energy provision) are considered in this assessment of alternative solutions.

56. The methodology adopted to assess alternative solutions has been developed based on guidance from a range of sources, including:

- DEFRA (2012). Habitats and Wild Birds Directives: guidance on the application of Article 6(4) Alternative solutions, IROPI and compensatory measures.
- EC (2001). Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.
- EC (2011). Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones; with particular attention to port development and dredging.
- EC (2012). Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC. Clarification of the concepts of: Alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission.
- EC (2018). Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC.
- The Planning Inspectorate (2012). Advice Note Ten: Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects.

57. In accordance with the EC (2001) Guidance, the methodology adopted herein follows the following steps:

- Step 1 – summarise the need for the Project and Project objectives.
- Step 2 – identify the risk of harm to the integrity of the relevant Natura 2000 sites.
- Step 3 – produce a long list of potential alternative solutions to address the potential harm and screen these in terms of whether they meet the need for and objectives of the Project - to produce a short list of alternative solutions (that meet the Project need and objectives).
- Step 4 – consider whether any short-listed potential alternative solutions are ‘feasible’ (legally, technically and financially).
- Step 5 – consider whether any feasible alternative solutions would have a lesser effect on the integrity of the Natura 2000 network.

58. Further details on these five steps are provided below.

Table 4.1 Assessment of Alternative Solutions Methodology

Step	Methodology
Step 1 – summarise the need for the Project and the Project objectives	European Union and Defra guidance explains that it is important to define the Project's need and objectives in order to determine what constitute relevant alternatives (this enables a short list of relevant potential alternative solutions to be identified at step 3). The 'need' for the Project will be derived from Task 3 (IROPI) (i.e. a summary of part of the IROPI case). The core objectives for the Project will reflect the content of the Planning Statement.
Step 2 - identify the risk of harm to the integrity of the relevant designated sites	Step 2 comprises the following: • Description of the envisaged potential for harm. That is, those activities where the project may cause an AEoI of the SPA or SAC (or an adverse effect on integrity cannot be ruled out, beyond reasonable scientific doubt). • Defining the particular aspects of the Project works that relate to the envisaged potential for harm (why the works are needed, how the works would be constructed, when the works would occur and where the works would be located). • Presenting the proposed mitigation for the potential harm. • Identifying the residual potential for harm which requires assessment to determine if there are alternative solutions available. In part, the reporting for Step 2 will draw from the findings of the Shadow HRA, but also requires investigation into the detail of the construction work and the assessment studies undertaken for the Environmental Impact Assessment (EIA).
Step 3 – production of a long list of potential alternative solutions and screen to produce a short list	Step 3 comprises of: • Identifying a long list of potential alternative solutions for the potential residual harm. • Screening the long list of potential alternative solutions against the Project need and objectives to produce a short list. To develop a long list of potential alternative solutions, the following categories of potential alternative solutions will be considered (with a series of alternative solutions for each category): a) Do nothing. b) Alternative locations. c) Alternative scale or design. For each of the alternative solutions, a high-level judgement on the effect of the alternative solution on residual harm to the Natura 2000 site will be made (e.g. removes the effect, changes the characteristics of the effect, etc.). The long list will then be screened to assess whether the potential alternative solutions could meet or deliver the need for, and objectives of, the Project (as defined in Step 1). The output of this is a short list of potential alternative solutions.
Step 4 – consider whether any short-listed potential alternative solutions are 'feasible'	This step will assess the feasibility of each of the short listed potential alternative solutions. Only alternative solutions that meet or deliver the Project need and objectives are considered in Step 4. Each short-listed potential alternative solution will be assessed to determine whether it is legally, technically and financially feasible (in line with Defra guidance).

Step	Methodology
Step 5 – consider whether any feasible alternative solutions would have a lesser effect on the integrity of the Natura 2000 network.	Step 5 will assess the effects of any feasible alternative on the integrity of the Natura 2000 site (i.e. whether the alternative would have a lesser effect on the site).

4.2 Step 1: Define the Project Need and Objectives

4.2.1 The Need for the Project

59. The need for the Project is underpinned by the IROPI case outlined in Section 5.

60. In summary, the key drivers underpinning the urgent need for renewable energy within the UK (discussed further in Sections 4.2.1.1 and 4.2.1.2) 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.

61. Once constructed, Norfolk Vanguard 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.

62. The NPSs set out the UK Government's objectives for the development of Nationally Significant Infrastructure Projects (NSIP), including for the mitigation of, and adaptation to, climate change. The following NPS are relevant to Norfolk Vanguard:

- Overarching NPS for Energy (EN-1); and
- NPS for Renewable Energy Infrastructure (EN-3).

63. In addition, the National Planning Policy Framework (NPPF) makes clear that the planning process plays a pivotal role in securing radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate

change, and supporting the delivery of renewable and low carbon energy and associated infrastructure.

4.2.1.1 The Need for Energy Security

64. EN-1 is clear that "*The UK needs all the types of energy infrastructure covered by this NPS in order to achieve energy security at the same time as dramatically reducing greenhouse gas emissions."* (paragraph 3.1.1)

65. EN-1 also states that the Secretary of State should "*give substantial weight to the contribution which projects would make towards satisfying this need"* (paragraph 3.2.3) and that the amount of weight given "*should be proportionate to the anticipated extent of a project's actual contribution to satisfying the need for a particular type of infrastructure"* (paragraph 3.1.4). EN-1 projected total need for new generation capacity by 2025 to be 59GW, including an assumed contribution to this total of 33GW from renewable sources. The recent Sector Deal and net zero analysis by the Committee on Climate Change (CCC) seeks around 30GW of offshore wind to be deployed by 2030. In addition, the Conservative party 2019 manifesto set an even more ambitious target for offshore wind deployment in the UK, namely 40GW by 2030. Norfolk Vanguard would contribute a substantial 1.8GW towards these totals.

66. The need for new and additional generation capacity is urgent and significant for the following reasons.

- Risk to security of supply has increased:
    - Total generating capacity of the UK has dropped 4GW, from 85GW to 81GW, since 2011. Fossil fuel capacity has reduced (with traditional power stations closing) while renewable capacity has nearly tripled.
    - Closure of fossil fuel generators, most notably coal and nuclear, is expected to intensify, with further predicted losses of 19 to 22GW (by 2025), over and above the 22GW anticipated by the NPS; meaning a total loss from these sources of 41 to 44GW (BEIS, 2018)
- Overall electricity demand is increasing:
    - Electricity demand in the UK is likely to rise during the 2020s as a greater proportion of the heat and transportation systems electrify.
    - NPS EN-1 envisages a doubling or tripling in demand.

67. In addition, the EU Exit also raises a number of challenges in relation to the UK's Energy security (House of Lords, 2018). In response to this challenge, the UK Government has committed to broadening Great Britain's power generation base, through new offshore wind to ensure long term security, delivering dependable, secure and low-carbon energy (BEIS, 2018).

4.2.1.2 The Need to Reduce Greenhouse Gas Emissions

68. In EN-1, predictions are made that a continuation of global emission trends, including emissions of greenhouse gases such as carbon dioxide, could lead average global temperatures to rise by up to 6°C by the end of this century (paragraph 2.2.7). The potential impacts associated with such a global temperature rise include (DECC, 2014):

- increased frequency of extreme weather events such as floods and drought;
- reduced food supplies;
- impacts on human health;
- increased poverty; and
- ecosystem impacts, including species extinction.

69. In 2019, the UK saw the highest temperature on record in Cambridge at 38.7°C and 2019 was the second hottest year globally since records began in 1880 (Copernicus Climate Change service, 2020), with 2016 being the hottest year on record.

70. A commitment by the UK was made during the 21st Conference of the Parties (COP) in Paris in 2015 to pursue efforts to limit the global temperature increase to within 2°C of the pre-industrial average temperature, with an aspiration for an improved limit of 1.5°C. Section 5.2 provides further information on the policy and legislative requirements and targets for offshore wind in this context.

71. The Climate Change Act 2008 (2050 Target Amendment) Order 2019 sets the minimum percentage by which the net UK carbon account[4] for the year 2050 must be lower than the 1990 baseline, down to "net zero greenhouse gases emissions". This is likely to result in new policies to promote renewable and low carbon energy at the expense of fossil fuels, without carbon capture and storage.

72. In response to low carbon commitments, power sector emissions fell 17% in 2015 to 50% below 1990 levels. This followed an average annual decrease of 5% in the years between 2009 and 2014; largely due to an increase in renewable and nuclear generation, equating to almost half of the UK's electricity demand in 2015 (CCC, 2016a). In order to achieve necessary ongoing reductions in emissions, the CCC recommended that the UK Government should set out an intention to support 1-2GW of offshore wind per year, provided costs continue to fall, with a view to phasing out subsidies in the 2020s (CCC, 2015a).

[4] The amount of net UK emissions adjusted by the amount of carbon units credited or debited.

73. Norfolk Vanguard has the potential to deliver 1.8GW of clean, renewable energy and to prevent more than 2,000,000 t of CO_2 from entering the atmosphere (based on current levels of UK carbon emissions from the power sector)[5].

74. Due to the long operating horizons for large-scale energy infrastructure, paragraph 3.3.16 of EN-1 notes that "*a failure to decarbonise and diversify our energy sources now could result in the UK becoming locked into a system of high carbon generation, which would make it very difficult and expensive to meet our 2050 carbon reduction target*" (paragraph 3.3.16).

4.2.2 In Summary

75. Only alternatives that have the potential to meet or deliver the Project Need and Objectives are considered in this assessment of alternative solutions. That is, the alternative would have to deliver against: *"the urgent need for offshore wind energy generation in order to help meet the requirement for 59GW of new electricity capacity by 2025 and the aspiration to achieve 33GW from renewable sources"*.

4.2.3 Project Objectives

76. The Norfolk Vanguard project objectives are shown in Table 4.2.

Table 4.2 Norfolk Vanguard Project Objectives

Ref	Objective	Basis for the objective
1	Contribute effectively to enhancing the security of the UK's energy supply, by providing "home-grown", renewable energy	NPS EN–1, issued by the Secretary of State for Energy and Climate Change in 2011, sets out the Government's policy for the delivery of major energy infrastructure. Part 2 of NPS EN–1 notes that *"it is critical that the UK continues to have secure and reliable supplies of electricity as we make the transition to a low carbon economy"* and acknowledges the need for a diverse mix of technologies to ensure security of supply. Part 3 of NPS EN–1 describes the vital role of energy to economic prosperity and social well-being and the importance of ensuring the UK has secure and affordable energy. It discusses the scale and urgency of the need for nationally significant energy projects. In section 3.4.3, the Government sets out the expectation that offshore wind will provide the largest single contribution towards the 2020 renewable energy generation targets. Norfolk Vanguard aims to contribute 1.8GW of export capacity, which represents the electricity needs of approximately 1.95M UK homes or 2% of total UK electricity needs[6]

[5] https://www.renewableuk.com/page/UKWEDExplained

[6] Based on a load factor of 47.3% which is advocated by BEIS for new offshore wind farm projects (BEIS, 2018) and RenewableUK www.renewableuk.com/page/UKWEDExplained

Ref	Objective	Basis for the objective
2	Provide low cost energy to the UK consumer	The commitment by the UK Government to support offshore wind through the Sector Deal is based on the principles of competitive allocation of support, continued cost reductions and value for consumers. The Sector Deal states "*Over the period to 2030, the sector will continue to focus on reducing both the levelised cost of offshore wind and system costs, as low-carbon technologies move towards a subsidy free world.*" This requirement to reduce energy cost is driven by the competitive Contracts for Difference (CfD) scheme. The continuing innovation driving the offshore wind sector towards greater cost efficiencies and improved conversion of wind power to the electricity network has resulted in the cost of offshore wind coming down relative to all other scale-able sources. The last CfD round (2019) saw offshore wind projects coming in at £49.50 / MW (c.f. £150 /MW in 2011) and considerably lower than other energy sources. The rate of deliverability of offshore wind projects is also favourable compared to other low carbon means of electricity generation, making offshore wind one of the most cost-effective and deployable sources of energy to address the urgent need for new energy projects, set out in EN–1. The Norfolk Vanguard site was originally selected to provide low cost energy to the consumer, owing to its ground conditions and high wind resource. Of the new generation of OWFs (Round 3), the site is also relatively close to shore. Additionally, the Project is being developed in a coordinated way with Norfolk Boreas which, as well as minimising environmental impacts, would allow 3.6GW of installed capacity to be delivered with economic efficiencies.
3	Contribute to the UK's drive to meeting Carbon reduction commitments	The UK Government has committed to reducing its greenhouse gas emissions by at least 100% of 1990 levels (net zero) by 2050. This commitment is made through the Climate Change Act 2008 (2050 Target Amendment) Order 2019 which was brought into force in June 2019 in response to recommendations by the CCC (CCC, 2019), To meet this target electricity generation based on offshore wind is needed, as reflected in the Sector Deal (see below). It is estimated that Norfolk Vanguard alone would prevent more than 2 million tonnes of carbon dioxide entering the atmosphere. By developing both Norfolk Vanguard and Norfolk Boreas together, the time normally required to install the equivalent capacity would be reduced, thereby initiating these

Ref	Objective	Basis for the objective
		extensive carbon savings much sooner than if the projects were being developed separately.
4	Contribute to the Offshore Wind Sector Deal and Conservative Government's targets to reach 30GW and 40GW respectively of installed offshore wind capacity by 2030	Since the NPSs were published in 2011, new legislation has committed the UK to achieving Net Zero emissions by 2050. Furthermore, in March 2019, the UK Government and the Offshore Wind Sector published the Offshore Wind Sector Deal, with an agreed target to increase offshore wind capacity to 30GW by 2030. The Conservative party 2019 manifesto set an even more ambitious target for offshore wind deployment in the UK, namely 40GW by 2030. Norfolk Vanguard and Norfolk Boreas would provide more than a third of the additional capacity required to meet Sector Deal targets.
5	Contribute to the UK's industrial strategy and global leadership in the development of offshore wind projects, resulting in socio-economic benefits to the UK as a whole, as well as East Anglia and Norfolk specifically	The need to maximise social and economic opportunities for the UK from energy infrastructure investment, is noted in the Clean Growth Strategy (BEIS, 2017). The UK Offshore Wind Sector Deal (BEIS, 2019) aims to create 27,000 skilled jobs across the UK (up from 11,000), mainly in coastal areas, by 2030. The Centre for Economics and Business Research (CEBR, 2012) estimates that by 2030, offshore wind could increase the Gross Domestic Product (GDP) value by 0.6% and support 173,000 jobs. The Industrial Strategy: Offshore Wind Sector Deal was agreed and published in 2019 and commits the UK to almost quadruple offshore wind capacity from 7.9 gigawatts, to at least 30GW by 2030, generating one-third of the UK's electricity. The Sector Deal sets the strategy to generate thousands of high-quality jobs, create opportunities and a strong UK supply chain. Vattenfall continues to work proactively with national, regional and local stakeholders to optimise socio-economic opportunities in line with the five pillars of the Government's Industrial Strategy and Clean Growth Challenge. Vattenfall's approach to business development will contribute to the maintenance of the UK's global leadership in offshore wind.
6	Help to create a positive legacy for Norfolk and East Anglia, facilitating socio-economic enhancement, including encouraging businesses and residents to consider the opportunities associated with	Offshore clean energy is supported by the New Anglia Local Enterprise Partnership for Norfolk and Suffolk (New Anglia LEP, 2015) due to the economic benefits the sector brings to Norfolk and Suffolk. The aim of the New Anglia LEP is to lead economic growth and job creation in these areas by 2026.

Ref	Objective	Basis for the objective
	the multi-billion pound investments required to build Norfolk Vanguard	In delivery of the Project, Vattenfall would build on local strengths and contribute effectively to addressing local skills needs, through collaboration with local stakeholders and further developing Vattenfall's own skills and employment initiatives to encourage greater participation in the sector of local residents and workers.

4.3 Step 2: Define the Potential for Harm

77. The Summary Overview submitted by the Applicant on 28 February 2020 (document reference ExA; Sum; 11.D10.2) provides the Applicant's firm position that there would not be an AEoI. However, in order to undertake an assessment of alternative solutions 'potential harm' needs to be defined. The following sections are provided without prejudice to this position.

4.3.1 Kittiwake of the FFC SPA

78. Kittiwakes are at risk of collision with the wind turbines in the Norfolk Vanguard wind farm. Collison risk modelling (CRM) was used to estimate the total number of each species predicted to be at risk of collision mortality in each month of the year. A proportion of these have been assigned to the FFC SPA kittiwake population using both Natural England's preferred modelling methods and the Applicant's (the latter derived from the Applicant's own review of evidence). Following the Applicant's commitment to further design mitigation (increases in draught height and a reduced number of turbines, see Additional Mitigation (document reference ExA; Mit; 11.D10.2) for details), the Applicant's estimate of the annual mortality of FFC SPA kittiwakes is 4.6 (95% confidence interval 0.6-11.5), while using Natural England's methods the estimate is 21 (95% confidence interval 1.2-60.2). Precautionary population modelling (MacArthur Green 2018) indicates that, even at the higher mortality level, over the wind farm's 30 year lease this would result in the population growth rate being reduced by less than 0.1%.

4.3.2 Lesser black backed gull of the AOE SPA

79. Lesser black-backed gulls are at risk of collision with the wind turbines in the Norfolk Vanguard wind farm. Collison risk modelling (CRM) was used to estimate the total number of each species predicted to be at risk of collision mortality in each month of the year. A proportion of these have been assigned to the AOE SPA lesser black-backed gull population using both Natural England's preferred modelling methods and the Applicant's (the latter derived from the Applicant's own review of evidence). Following the Applicant's commitment to further design mitigation (increases in draught height

and a reduced number of turbines, see Additional Mitigation (document reference ExA; Mit; 11.D10.2) for details), the Applicant's estimate of the annual mortality of FFC SPA kittiwakes is 1.6 (95% confidence interval 0.1-4.2), while using Natural England's methods the estimate is 2.6 (95% confidence interval 0.1-7.1). Precautionary population modelling (MacArthur Green 2019) indicates that, even at the higher mortality level, over the wind farm's 30 year lease this would result in the population growth rate being reduced by less than 0.1%.

4.3.3 Habitat loss in the HHW SAC

80. The total footprint of infrastructure (cable protection) for the Project within the HHW SAC could be up to 32,000m^2 (0.03km^2) based on the following:

- 12,000m^2 as a result of up to six crossings for each of the export cable pairs (12 crossings in total) within the HHW SAC.
    - This is based on each crossing requiring up to 100m length and 10m width of protection.
    - Every effort is being made by the Applicant to reduce the number of crossings required by removing disused cables where agreement can be reached with the cable owners. An Out of Service Cable Recovery Agreement has been discussed with BT Subsea and a Letter of Comfort from BT Subsea is provided as Appendix 4 of the Additional Mitigation report (document reference ExA; Mit; 11.D10.2.App4), demonstrating the advanced stages of these discussions, with a formal agreement expected to be in place imminently.
- 20,000m^2 as a result of up to 5% of the cable length in the SAC potentially requiring cable protection, in the unlikely event that unsuitable ground conditions are encountered. This is based on:
    - 2km of cable protection per cable pair, 4km in total.
    - A 5m width of cable protection could be required.

81. In accordance with Natural England advice that *S. spinulosa* reef growing on artificial substrate is not Annex I reef and their Norfolk Boreas Pre 22 January 2020 Issue Specific Hearing Updated Benthic Ecology Advice, which states that *"Natural England is less concerned about cable crossing points compared to un-impacted areas, as it is unlikely for reef to be present"*, where cable protection is required due to pipeline / cable crossings, this is not taken to represent a loss of Annex I habitat.

4.4 Step 3: Long List of Alternative Solutions

4.4.1 Do Nothing

82. While the DEFRA Guidance (paragraph 17) advises that the "do nothing" option should be considered, it acknowledges this would rarely be a true alternative:

"Normally this would not be an acceptable alternative solution because it would not deliver the objective of the proposal. However it can help form a baseline from which to gauge other alternatives. It can also help in understanding the need for the proposal to proceed, which will be relevant to any later consideration of the IROPI test…".[7]

83. On the basis that UK renewable energy targets are unconstrained, logically, renewable energy projects cannot be ruled out (in principle) on the basis that an alternative could be progressed. That is, all available solutions / all relevant projects are required. Recent announcements by TCE regarding further offshore wind licensing rounds (project extensions and "Round 4"), as well as updates to policy and legislation requirements, are further evidence that more offshore wind is considered necessary to meet UK renewable energy targets (see Section 5.2). Furthermore, the public good that Norfolk Vanguard (as a substantial offshore wind project) would serve (set out in Section 5) encompasses considerations relating to human health and public safety, and the Project provides beneficial consequences of primary importance to the environment. Given the weight of this argument, doing nothing is not a realistic option.

4.4.2 Alternative OWF Locations

4.4.2.1 Introduction

84. This section considers potential alternative locations for the OWF.

85. TCE holds the exclusive right to grant licences for offshore wind farms under the Energy Act 2004. Following the development of Round 1 and Round 2 Offshore Wind Farm sites, TCE in conjunction with DECC (now part of the Department for BEIS), embarked on a programme of site selection for offshore wind. As noted in NPS EN-3, TCE identifies potential development areas in accordance with the Crown Estate Act 1961, Government policy, plans and associated SEA works.

86. As discussed above, the Norfolk Vanguard DCO application was founded on an extensive and rigorous UK wide zone selection process undertaken over many years, originally by the Government and TCE, and subsequently by an equally extensive and rigorous project specific assessment of alternative locations within the former East

[8] https://www.renewableuk.com/page/UKWEDhome/Wind-Energy-Statistics.htm

Anglia Zone. The aim of which was to select sites which offered the least environmental and technical constraints and the lowest cost of energy to the consumer.

87. The process and factors which influence and constrain site selection and design are described in NPS EN-3 (paragraphs 2.6.15 - 2.6.35) and are also discussed in ES Chapter 4 "Site Selection and Assessment of Alternatives" Section 4.4 and illustrated in plate 4.1 (Site selection process for Norfolk Vanguard and Norfolk Boreas).

4.4.2.2 International sites

88. Projects in other EU countries would not meet the Project Need or Objectives and, therefore, are not deemed to be alternative solutions for the following reasons:

- they do not meet the UK specific legal obligations, targets and policy in relation to carbon emission reductions or renewable energy generation; and
- they do not provide the socio-economic benefits that underpin the Project Objectives discussed in Section 4.2.3.

4.4.2.3 UK Alternatives outside existing Leasing Round Areas

89. Due to the long lead in times for the site selection, EIA, consenting, detailed design, procurement, consent compliance, and construction of an OWF, any location which has not yet commenced a site selection exercise would not meet Project Objective 4. That is, it would not contribute to the 2030 Sector Deal in response to the urgent need for renewable energy.

90. Table 4.3 outlines the timescale for Round 3 OWF development since the announcement of the Round 3 process in 2008. This highlights the long lead-in time for offshore wind farms of typically over 10 years from the start of the process, through to lease award, consenting, construction and commissioning.

Table 4.3 Round 3 Development timescale

Round 3 OWF	Zone awarded	Consent Decision	Construction start year	Commissioning start year
Zone 1				
Moray East	2010	2014	2019	Expected 2022
Moray West	2010	2019	2022	Expected 2024
Zone 2				
Seagreen Alpha	2010	2014	2022	Expected 2024
Seagreen Bravo	2010	2014	2022	Expected 2024
Zone 3				
Dogger Bank Creyke Beck A	2010	2015	2020	Expected 2023
Dogger Bank Creyke Beck B	2010	2015	2020	Expected 2025
Dogger Bank Teesside A	2010	2015	Expected 2024	2025
Dogger Bank Teesside B (now 'Sophia')	2010	2015	2023	2024
Zone 4				
Hornsea Project One	2010	2014	2016	2019

Round 3 OWF	Zone awarded	Consent Decision	Construction start year	Commissioning start year
Hornsea Project Two	2010	2016	2020	Expected 2022
Hornsea Project Three	2010	Expected June 2020	Expected 2024	2023
Hornsea Project Four	2010	TBC	2023	2027
Zone 5				
East Anglia ONE	2010	2014	2018	Expected 2020
East Anglia THREE	2010	2017	2022	2023
East Anglia TWO	2010	TBC	2024	2026
East Anglia ONE North	2010	TBC	2024	2026
Norfolk Vanguard	2010	Expected June 2020	Expected 2024	2024
Norfolk Boreas	2010	Expected November 2020	Expected 2025	2024
Zone 6				
Rampion	2010	2014	2015	2018

4.4.2.4 UK Alternatives within Existing Lease Areas

4.4.2.4.1 Repowering existing wind farms

91. Wind farms normally have a life span of 20 to 25 years before decommissioning is planned and most operational offshore wind farms will not reach their decommissioning stage for another decade. The timeframes involved for the decisions on repowering therefore do not meet Project Objective 4 in contributing to the 2030 Sector Deal target.

92. Round 1 and 2 sites are also significantly smaller in capacity (less than 0.7GW) than Norfolk Vanguard and, therefore, a much greater number of OWFs would have to be repowered to address the urgent need for large scale projects required to meet the Government's climate change targets (see Section 4.2).

4.4.2.4.2 Scottish Territorial Waters OWFs

93. TCE offered exclusivity agreements to the following OWFs in Scottish Territorial Waters (STW) in 2009:

- Bell Rock - cancelled due to issues with radar.
- Argyll Array, Forth Array, Islay and Kintyre Offshore Wind Farms were not progressed by developers due to financial and technical reasons.
- Wigtown Bay was stopped by the Scottish Government due to potential landscape and visual impacts.
- Three offshore wind farms in STW have been consented:
    - Beatrice (588MW);

- Inch Cape (905MW); and
- Neart na Gaoithe (450MW).

94. The STW sites which are being developed have their own project objectives and form a critical component of satisfying the urgent need for renewable energy. These are not, therefore, considered to be alternative solutions.

95. Of the STW OWFs that have not been taken forward, the reasons they were discounted are likely to largely still apply. In addition, any data collected during their development would now be out of date and the consenting process would need to be restarted. Therefore, these sites would be unlikely to meet Project Objective 4 in contributing to the 2030 Sector Deal in response to the urgent need for renewable energy.

96. These sites are also significantly smaller in capacity than Norfolk Vanguard and, therefore, a greater number would be required to address the urgent need for offshore wind projects required to meet the Government climate change (see Section 4.2).

97. For the reasons outlined above, the development of sites from the previous STW leasing round is not an alternative solution.

4.4.2.4.3 Round 2

98. The following sites were not taken forward:

- Docking Shoal - refused consent due to ornithological impacts; and
- London Array II - the applicant requested the lease to be terminated (again on ornithological grounds).

99. The reasons for which these sites were discounted are likely to largely still apply. In addition, any data collected during their development would now be out of date and the consenting process would need to be restarted. Therefore, as for the STW OWFs, these sites would be unlikely to meet Project Objective 4 in contributing to the 2030 Sector Deal in response to the urgent need for renewable energy.

4.4.2.4.4 Round 1 and 2 Extensions

100. In 2010, TCE allowed extensions to Round 1 and 2 offshore wind farms by up to 2GW. Galloper Wind Farm (an extension to Greater Gabbard), Kentish Flats Extension, Burbo Bank Extension and the Walney Extension, ranging from 51MW to 750MW capacity, were progressed and all consented. Of these sites, Galloper has applied for further extension through the TCE extension process in 2017 (described in Section 4.4.2.5). However, as discussed above, existing OWFs are not alternatives to Norfolk Vanguard.

4.4.2.4.5 Round 3

101. Out of the nine zones identified during the TCE Round 3 process, only six of the zones have progressed.

102. Within the former East Anglia Zone, East Anglia ONE North, East Anglia TWO and Norfolk Boreas are in the planning phase. Other Round 3 OWFs currently in the planning phase include Hornsea Project Three and Hornsea Project Four. However, the consenting of other Round 3 OWFs does not lessen the scale or urgency of the need for further large scale offshore wind projects, either in general terms or within the former East Anglia Zone. In order to meet the 2030 Sector Deal, the majority, if not all of the 8.7GW in planning, 6.2GW in pre-construction and construction, 7GW in Round 4 and 2.85GW of Extensions are likely to be required, on top of the 8.5GW in operation.[8] These are not, therefore, considered to be alternative solutions.

103. Round 3 sites which have not been taken forward include:

- Atlantic Array (Bristol Channel Zone);
- Rhiannon (Irish Sea Zone); and
- Navitus Bay (West of Isle of Wight Zone).

104. These sites could be considered to represent potential alternatives, albeit Project Objective 6 (socio-economic enhancement in Norfolk and East Anglia) would not be met, and so the potential feasibility of each these is discussed in Section 0.

4.4.2.5 ScotWind, Round 4 and 2017 Extension OWFs

105. The Scottish Government's Sectoral Marine Plan for offshore wind energy identifies areas of search for OWFs for between 3GW to 10GW of future deployment. It is anticipated that Crown Estate Scotland will start the next offshore wind leasing round (ScotWind) in 2020. However, the closing date for applications to ScotWind Leasing will be made after the Sectoral Marine Plan has been finalised and adopted. There has also been a series of delays and uncertainty as to when the Sectoral Plan will be finalised, further increasing the timeframes within which operational wind farms will be achieved. Therefore, Scotwind will not deliver the urgent need for renewable energy to which Norfolk Vanguard can contribute (see Section 4.2).

106. Round 4 and 2017 Extension OWFs were announced by TCE in 2019 and are, therefore, approximately ten years behind the Round 3 process (with the exception of the Thanet Extension, discussed further below).

107. As discussed above, in order to meet the 2030 Sector Deal, the majority, if not all of the 8.7GW in planning, 6.2GW in pre-construction and construction, 7GW in Round 4,

[8] https://www.renewableuk.com/page/UKWEDhome/Wind-Energy-Statistics.htm

3GW of ScotWind and 2.85GW of Extensions are likely to be required, on top of the 8.5GW in operation.[9] Therefore, the identification of Round 4 and extension projects does not lessen the scale or urgency of the need for further large scale offshore wind projects to meet the Government's targets. Consequently, Round 4 and 2017 Extension sites are not considered to be alternatives.

108. Thanet Extension OWF submitted a DCO application in 2018 and is currently awaiting the Secretary of State's decision. The Agreement for Lease (AfL) with TCE is for a maximum generating installed capacity of only 300MW. While an important contribution to UK targets, this is far smaller in scale than Norfolk Vanguard. Therefore, this is not an alternative solution.

4.4.3 Alternative Offshore Cable Corridors

109. The site selection for the Norfolk Vanguard offshore cable corridor was undertaken in consultation with TCE. Possible landfall locations were reviewed within a large search area from The Wash to Harwich. The majority of the coastline in this area is protected by designations, including:

- North Norfolk Coast Area of Outstanding Natural Beauty (AONB) - from Hunstanton to Mundesley, just north of Bacton;
- The Wash and North Norfolk Coast SAC;
- North Norfolk Coast Ramsar site;
- North Norfolk Coast SPA;
- North Norfolk Coast Site of SSSI;
- Broads National Park - from Sea Palling to Lowestoft; and
- Suffolk Coast and Heaths AONB - from Kessingland, south of Lowestoft to Felixstowe.

110. In order to avoid these designations, potential landfall areas were identified as follows:

- Mundesley to Sea Palling (including Happisburgh South, the selected option);
- Gorleston-on-Sea; or
- Lowestoft to Kessingland (Lowestoft area).

111. In parallel with the identification of landfall options, the Applicant's in-house mapping team identified options for provisional offshore cable corridors from NV East and NV West to each of the three landfall options listed above (see Figure 4.1). Offshore constraints taken into account in this exercise were:

- other offshore wind farms;

[9] https://www.renewableuk.com/page/UKWEDhome/Wind-Energy-Statistics.htm

- shipping and navigation routes;
- existing offshore cables;
- oil and gas infrastructure including platforms and pipelines;
- Military Practice and Exercise Areas (PEXAs);
- aggregate dredging grounds;
- nature conservation designations;
- commercial fishing; and
- sensitive seabed features.

112. Consequently, the offshore cable corridor alternatives could not take direct routes from NV East and NV West to the potential landfall areas; and the routes were lengthened due to the need to avoid constraints.

113. The feasibility of adopting an alternative cable route is discussed further in Section 4.5.4.

4.4.4 Alternative Design Solutions

4.4.4.1 Fewer turbines

114. A reduction in the number of turbines for the Project would reduce seabird collision risk (including for kittiwake from the FFC SPA and lesser black backed gull from the AOE SPA). The feasibility of this alternative is, therefore, considered in Section 4.5.5.1.

4.4.4.2 Draught height

115. An increase in the draught height of turbines would reduce seabird collision risk (including for kittiwake from the FFC SPA and lesser black backed gull from the AOE SPA). The feasibility of this alternative is, therefore, considered in Section 4.5.5.2.

4.4.4.3 Seasonal restrictions on turbine operation

116. Shutdown of turbines during certain key weeks has been considered as an alternative in order to reduce collision risk. The feasibility of this alternative is, therefore, considered in Section 4.5.5.3.

4.4.4.4 Cable protection

117. The use of no cable protection in the HHW SAC and/or marker buoys as alternatives to cable protection have been considered and their feasibility is discussed in Section 4.5.5.3.

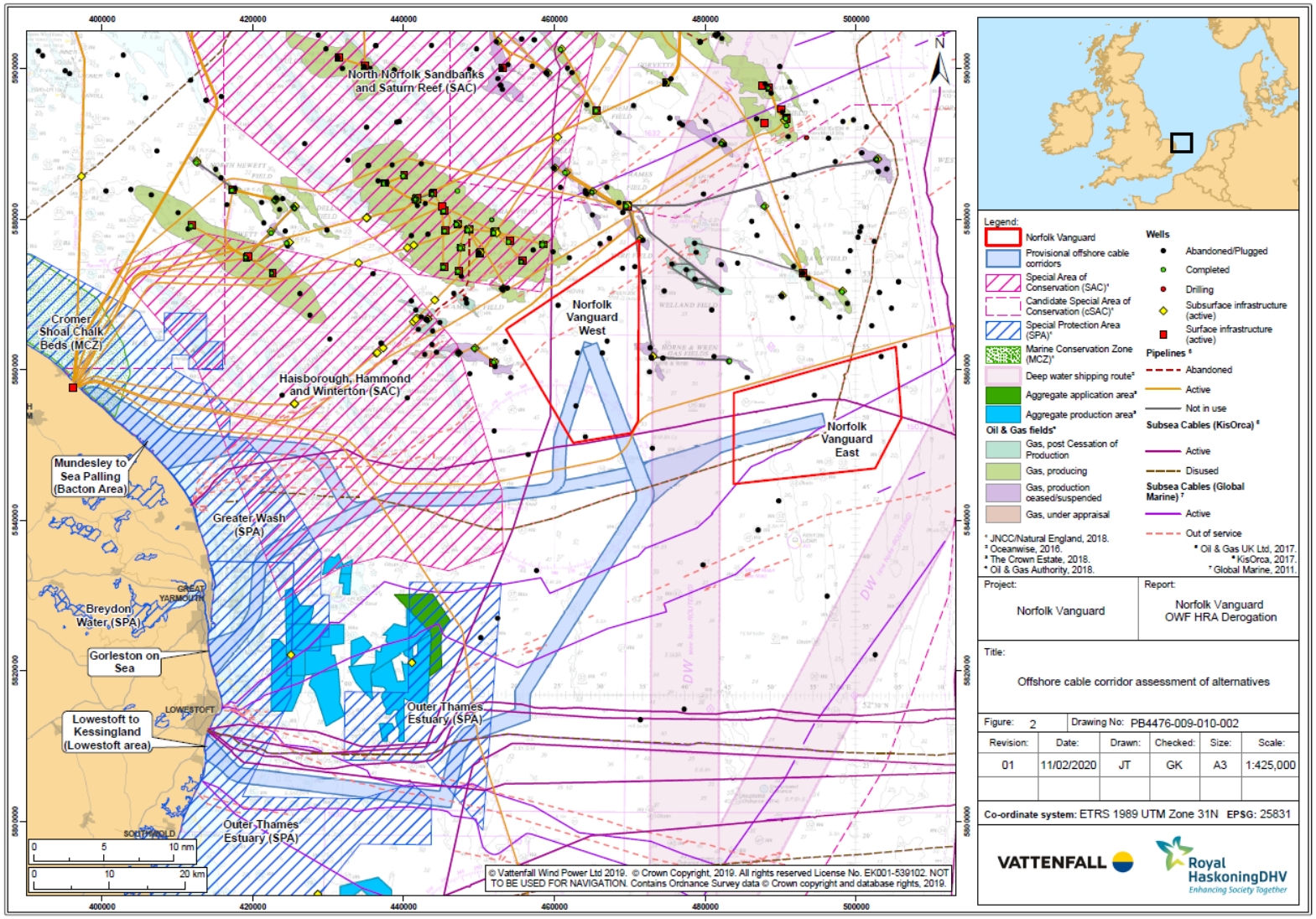

Figure 4.1 Offshore cable corridor assessment of alternatives

4.4.5 Summary of Alternative Solutions

Table 4.4 Long list of potential alternative solutions

Type	Alternatives considered	Ability to meet the Project Need and Objectives (the feasibility of those with a ✓ is considered in Section 0)
Do Nothing Scenario	Do Nothing Scenario	x
Alternative OWF location	Location in another country	x
Alternative OWF location	Location outside UK offshore leasing round areas to date	x
Alternative OWF location	Repowering an existing wind farm	x
Alternative OWF location	Scottish Territorial Waters	x
Alternative OWF location	Round 2	x
Alternative OWF location	Rounds 1 and 2 Extensions	x
Alternative OWF location	Round 3 - Atlantic Array	✓
Alternative OWF location	Round 3 - Celtic Array	✓
Alternative OWF location	Round 3 - Navitus Bay	✓
Alternative OWF location	Other Round 3 sites	x
Alternative OWF location	ScotWind, Round 4 and 2017 Extensions	x
Alternative offshore cable corridor	Cable corridor to Gorleston-on-Sea landfall	✓
Alternative offshore cable corridor	Cable corridor to Lowestoft area landfall	✓
Alternative design	Fewer turbines	✓
Alternative design	Raising of draught height	✓
Alternative design	Use of marker buoys as cable protection	✓
Alternative design	No cable protection in the HHW SAC	✓

4.5 Step 4: Feasibility of Alternative Solutions

4.5.1 Atlantic Array Feasibility

118. A DCO application for the Atlantic Array was submitted in June 2013, however, the Applicant announced the cancellation of the project on 25 November 2013, citing

technical and financial reasons. The number of turbines had already been significantly reduced due to environmental concerns.

119. Any data which was collected for this site would now be too old to base an assessment on and, therefore, the consenting process would need to be restarted and the urgent need for renewable energy would not be satisfied. In addition, this area has not been put forward as a Bidding Area by TCE for Round 4. The cited reasons for exclusion were proximity to shore and numerous landscape designations, in addition to aggregate extraction areas and significant navigation traffic (The Crown Estate, 2019b).

120. Therefore, the Atlantic Array is not considered to represent a feasible alternative.

4.5.2 Rhiannon Feasibility

121. In July 2014 plans for Rhiannon OWF were terminated due to challenging ground conditions and the foundation requirements being beyond what was financially viable. The majority of the site is over 40m deep, with challenging geology and seabed conditions. Therefore, the project was deemed economically unviable. There have since been new environmental designations in the area, such as the North Anglesey Marine SAC and the Irish Sea Front SPA, which would pose further challenges to development in this area.

122. In addition, any data which was collected for this site would now be too old to base an assessment on, therefore, the data collection process would largely need to be re-starting; as reflected by the inclusion of this area in the Round 4 Leasing (North Wales Region). As discussed in Section 4.4.2.5, Round 4 sites are not considered to represent alternative solutions.

123. Therefore, Rhiannon is not considered to represent a feasible alternative.

4.5.3 Navitus Bay Feasibility

124. In September 2015 development consent for Navitus Bay was refused by the Secretary of State, due to the visual impact the development would have had on the region in general and the Dorset Jurassic Coast in particular. This region was excluded from the TCE Round 4 bidding areas due to its close proximity to the coast, numerous landscape designations and Ministry of Defence sensitivities, with significant commercial shipping and recreational sailing routes (The Crown Estate, 2019b).

125. Therefore, Navitus Bay is not considered to represent a feasible alternative.

4.5.4 Feasibility of Alternative Offshore Cable Corridors

126. Due to the complex nature of the offshore area, both from a technical perspective and given the large number of existing activities and designations in the search area, a comprehensive assessment was undertaken during the site selection process to understand the risks associated with each landfall / offshore cable corridor option. Two external studies were also commissioned by Norfolk Vanguard Limited as follows:

- A Horizontal Direct Drilling (HDD) feasibility report (Riggall and Associates Ltd, 2016), provided in ES Appendix 4.1.
    - This report provides a subjective ranking of indicative landfall sites from Bacton to Lowestoft.
    - Ranking, expressed as a series of 4 tiers of site suitability for HDD, was undertaken on the basis of both offshore and onshore risks, including access, distance from residences, environmental constraints, geology and coastal erosion.
- A cable constructability assessment (Global Marine Systems Ltd (GMSL), 2016), provided in ES Appendix 4.2.
    - This study assessed geology and seabed topography along offshore cable corridor options to the Bacton area and Gorleston-on-Sea.
    - Cable installation risk and design considerations were assessed, and proposed refinements made to reduce the risks identified. The route to Lowestoft was not included in this study as, at the point of commissioning the study, this option had been discounted (see Section 4.5.4.2).

127. One key constraint when considering alternative cable routes is that the final grid connection offer for a project is made at the discretion of National Grid. This, in turn, constrains the potential options in terms of landfall location, which in turn constrains the feasible offshore export cable routes between the array area (which must fall within the boundaries set by TCE) and the landfall location.

4.5.4.1 Corridor to Lowestoft landfall area feasibility

128. The constraints mapping exercise showed that the offshore cable route to a potential landfall in the Lowestoft area would be considerably longer than the other routes, as well as being more complex, requiring approximately 18 cable/pipeline crossing agreements (instead of up to six for the proposed offshore cable corridor to Happisburgh South). The length and complexity of this route makes it unfeasible for the following reasons:

- The additional cost would be in the order of tens of millions of pounds which is not in accordance with Project Objective 2 to provide low energy cost to the UK consumer.
- The ability to achieve crossings agreements with a large number of owners is uncertain.
- The route would result in a significantly higher volume of cable protection entering the marine environment, resulting in increased loss of seabed habitat and potential snagging hazard for trawlers.

4.5.4.2 Corridor to Gorleston-on Sea landfall area feasibility

129. The conclusion of GMSL (2016) was that the corridor to Gorleston-on-Sea was unfeasible for the following reasons:

- The approaches to the Gorleston-on-Sea landfall option are within an area of highly mobile sandwaves, increasing the potential for cables to become exposed, which would result in an increased likelihood of damage to these cables and an increased snagging risk for fishing vessels.
- The cable corridor for the Gorleston-on-Sea landfall option is close to both existing and potential aggregate dredging areas, which increases the potential for interaction.
- Although the cable corridor to Gorleston-on-Sea landfall would be outside the Broads National Park, all onshore routes from the Gorleston-on-Sea landfall location to the gird connection near Necton would have to be routed through the Broads National Park. The onshore ground conditions in this area have a high water content and are unsuitable for cable installation.

4.5.4.3 Corridor to Happisburgh South landfall area feasibility

130. This route and landfall were selected as the feasible preferred option.

4.5.5 Alternative Design Solutions

4.5.5.1 Feasibility of fewer turbines

131. The Applicant has significantly reduced the number of turbines included within the application for Norfolk Vanguard. Originally, 257 turbines were proposed in the Preliminary Environmental Information Report (PEIR) based on a 7MW turbine. As a result of further mitigation, a maximum of 158 turbines is now proposed, based on a minimum turbine capacity of 11.55MW. This represents a 39% decrease in the number of proposed turbines.

132. 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. However, the lower end

of the turbine capacity envelope (i.e. 11.55MW turbines) reflects the capacity of those turbines which are currently proven in the market. As a result, the Applicant is progressing a design which is at the limit of current commercial availability in relation to turbine capacity and any further refinement is not feasible at this time if the output of 1.8GW is to be maintained.

133. In order to have any material effect on the number of predicted collisions, the reduction would need to be substantial, because each turbine contributes equally to the total mortality. Thus, for the estimated kittiwake and lesser black-backed gull collision predictions of 21 and 5 (from the relevant SPA populations, respectively) the mortality for each turbine is 0.17 kittiwakes and 0.04 lesser black-backed gulls. Therefore, to reduce kittiwake collisions below 10 (for example) the wind farm would need to be reduced in size by more than 50%, which is not commercially viable.

134. In addition, this scale of reduction in turbine numbers would significantly reduce the overall capacity of Norfolk Vanguard, affecting the ability of the Project to meet the Project Need and Project Objective 4 (relating to the generation of 30 to 40GW of renewable energy). It would also reduce its cost efficiency (associated with economies of scale), affecting its ability to meet Project Objective 2, providing low cost energy to the UK consumer in line with the requirements of the CfD process.

4.5.5.2 Feasibility to further increase draught height

135. The Applicant committed to raising draught heights by 5m (to 27m from Mean High Water Springs (MHWS)) during the Norfolk Vanguard Examination in order to mitigate ornithology collision risk.

136. Following engagement between the Applicant and the supply chain, it is understood that installation vessels currently available on the market can install turbines with a hub height up to 145 to 150m. The installation capacity of vessels currently available is, therefore, the limiting factor in relation to the maximum draught height increase that can be secured; a hub height of 145m allows a minimum draught height of 35m for turbines with a capacity of 11.55 – 14.6MW and a hub height of 150m allows a minimum draught height of 30m for turbines with a capacity of 14.7 – 20MW, based on the individual turbine parameters.

137. In response to ongoing consultation with Natural England, the Applicant has now committed to further mitigation by raising draught heights to:

- 35m (above MHWS) for turbine models of 11.55MW to 14.6MW capacity; and
- 30m above MHWS for turbine models between 14.7MW and 20MW.

138. As a result of this further 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. The Applicant must also maintain some flexibility as the availability of these largest vessels at the time of construction of the Project cannot be guaranteed, given the number of other offshore wind farms currently in development. Any further raising of draught height would not be feasible.

4.5.5.3 Feasibility of seasonal restrictions for turbine operation

139. In order for seasonal restrictions for turbine operation to have any material effect on the number of predicted collisions of kittiwake from the FFC SPA, shutdown of all the turbines for the Project would need to occur for several months of the year. Furthermore, since the contribution of Norfolk Vanguard to the in-combination collision risk total is already small (5.6%), it follows that the degree of reduction to the in-combination total that would be achieved through turbine shutdown in the month with the largest collision risk (March) would be even smaller (<1%). A shutdown in any other month of the year would make an even smaller contribution to reducing the SPA mortalities. Hence this measure would provide a very limited benefit.

140. For lesser black-backed gulls, the only month when collisions exceeded 1 was August (1.2 collisions). Therefore, even a complete shutdown in that month would only reduce the collision risk for the SPA population from 2.6 to 1.4. In the next two highest months the reduction would be 0.5 (June) and 0.7 (July) and in all other months would be less than 0.05.

141. The limited benefit that would be provided through this measure would be accompanied by a significant reduction in electricity output, that would significantly reduce the overall capacity of Norfolk Vanguard; affecting the ability of the Project to meet the Project Need and Project Objective 4 (relating to the generation of 30 to 40GW of renewable energy). It would also reduce its cost efficiency (associated with economies of scale), affecting its ability to meet Project Objective 2 (providing low cost energy to the UK consumer in line with the requirements of the CfD process).

4.5.5.4 Cable protection

4.5.5.4.1 Feasibility of the use of marker buoys

142. The use of marker buoys as an alternative to surface protection, at locations where it is not possible to achieve the target depth of cable burial, is not feasible for the following reasons:

- The assessment of risk to the cables (as carried out by insurers and offshore transmission owner (OFTO) technical advisers) is based on the degree of physical protection afforded by the completed installation design and unprotected cables are likely to present an unacceptable level of risk.

- Whilst marker buoys may be effective in reducing the threat of physical damage to cables associated with bottom-trawling activities, they cannot be considered as an equivalent alternative to physical protection measures.
- Marker buoys do not mitigate other types of threat to the cable e.g. anchor dragging in poor weather.
- Exposed cables also present a potential health and safety risk (e.g. as a snagging hazard) and the deployment of additional marker buoys would require careful consideration with regards to navigation safety once the location(s) of marker buoys are known.

4.5.5.4.2 Feasibility of using no cable protection within the HHW SAC

143. The Applicant commissioned an Interim Cable Burial Study (provided in Appendix 2 of the HHW SAC control documents, document reference 8.20). This study considered the level of risk of not being able to bury cables and its conclusions enabled the Applicant to reduce the quantity of cable protection within the SAC from 10% to 5% of the cable length.

144. The Applicant has committed to agreeing the cable installation methodology with the Marine Management Organisation (MMO) and Natural England prior to commencement (secured through the HHW SAC control document 8.20). They are continuing to work with cable installation specialists to understand the specific challenges associated with cable burial in the types of substrates that are likely to be encountered in the HHW SAC, and to identify the types of burial methods and tools which are most likely to result in successful burial in these substrates, in order to ensure that impacts are minimised.

145. With any burial tool, there is always the risk of encountering situations which prevent burial to a sufficient depth to provide adequate protection from risk of damage. To achieve the required degree of protection for the cables, it is vital that the Applicant retains the option of using surface protection up to the values in the draft DCO. A commitment to the use of no cable protection in the HHW SAC, therefore, is not feasible.

146. The Applicant notes that the advice from Natural England and the MMO during the pre-application Evidence Plan Process was for them to ensure that conservative assumptions were made with regard to cable protection during the EIA, HRA and within the DCO, to avoid requiring further licences for cable protection during construction. In light of the interim cable burial study, a reduction of cable protection to 5% of the cable length is the lowest feasible option based on available evidence.

4.5.6 Summary of Feasible Alternative Solutions

Table 4.5 Feasibility of alternative solutions

Type	Alternatives considered	Feasible alternative to be considered further in Section 4.6
Alternative OWF location	Atlantic Array	x
Alternative OWF location	Rhiannon	x
Alternative OWF location	Navitus Bay	x
Alternative offshore cable corridor location	Cable corridor to Gorleston-on-Sea	x
Alternative offshore cable corridor location	Cable corridor to Lowestoft area	x
Alternative design	Fewer turbines	x
Alternative design	Raising of draught heights	x
Alternative design	Marker buoys instead of cable protection	x
Alternative design	Less/ no cable protection	x

4.6 Step 5: Assessment of Effects of Feasible Alternative Solutions on Natura 2000 sites

147. Step 5 is not applicable, as there are no feasible alternative solutions.

4.7 Assessment of Alternatives Summary

148. Feasible alternative solutions which could host a comparable large scale offshore wind farm and meet the Project Need and Objectives have not been identified based on the analysis presented above.

149. Paragraphs 6.2.1 and 7.3.1 of the Information to Support HRA report (document 5.3) list the design and mitigation measures adopted by Norfolk Vanguard Limited with regard to benthic ecology and ornithology interests. In addition, further mitigation commitments were made during the Examination, including:

- a 5m increase in turbine draught height;
- a refined layout to reduce collision risk;
- removal of the 9MW turbine option to allow the maximum number of turbines to be reduced; and
- a reduction in cable protection from 10% of the cable length to 5%.

150. The Applicant is also making a number of additional mitigation commitments in response to the Request for Information from BEIS, as detailed in the Additional

Mitigation report (document reference ExA; Mit; 11.D10.2) submitted on 28 February 2020.

151. The information presented in this document demonstrates the careful and extensive consideration of alternatives that has been undertaken by Norfolk Vanguard Limited, encompassing alternative offshore sites, landfall locations, export cable routing, and different scales and designs of development. All of which have informed the current project envelope for Norfolk Vanguard.

5 IROPI

5.1 Introduction

152. Having determined that there are no feasible alternative solutions which would meet the Project Need or Objectives, consideration is given to the IROPI case. In order to define the IROPI case for a plan or project, the DEFRA (2012) Guidance states that:

"In practice, plans and projects which enact or are consistent with national strategic plans or policies, may be more likely than others to show IROPI – e.g. those covered by or consistent with a National Policy Statement or identified within the National Infrastructure Plan, especially if the plan itself has been assessed using the Habitats Regulations."

153. Therefore, a key component of outlining the IROPI case for Norfolk Vanguard is the review of relevant national strategic plans or policies.

154. The Habitats Directive does not define IROPI, however the DEFRA Guidance provides the following definitions:

- Imperative: the plan or project is necessary (whether urgent or otherwise) for social or economic benefit, human health, public safety, or beneficial consequences of primary importance to the environment.
- Overriding: the interest served by the plan or project outweighs the harm to the integrity of the site as assessed in light of the weight to be given to the protection of such sites under the directive.
- Public Interest: a public good is delivered rather than a solely private interest.

155. The Able Marine Energy Park case set a precedent regarding IROPI for offshore wind projects, as the port facility was deemed to meet IROPI through supporting the development of OWFs (Department for Transport (DfT), 2013). In this case, the Secretary of State concluded that: "*the benefits of the project [Able Marine Energy Park], if fully realised, in terms of its contribution to the local, regional and national economy, its contribution to sustainable energy and carbon reduction, and the creation of employment opportunities in a disadvantaged area, are of major significance. The Secretary of State is satisfied that these benefits would outweigh significantly the residual adverse impacts of the project after mitigation and after taking in to account the proposed ecological compensatory measures. He therefore agrees with the Panel's recommendation that development consent should be given for the project*."

5.2 Policy and Legislation

156. A number of key national and international policies, legislation and commitments support the IROPI case for OWFs.

5.2.1 The COP21 UN Paris Agreement

157. The Paris Agreement (12 December 2015), ratified by the UK, sets out the need to limit the increase in global average temperature to *"well below"* 2°C above pre-industrial levels and to pursue *"efforts to limit the temperature to 1.5°C"*. To achieve this long term target, the text states (emphasis added) "*the parties aim to reach global peaking of greenhouse gas emissions as soon as possible*". The Agreement also includes a ratcheting mechanism on climate action, with countries having to communicate nationally determined contributions to reducing global emissions. The first global "stocktake" is to take place in 2023 and a stocktake will follow every five years thereafter.

5.2.2 The IPCC Special Report (SR) 1.5

158. 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* in response to an invitation contained in the Decision of the Conference of Parties United Nations Framework Convention on Climate Change to adopt the Paris Agreement. The IPCC accepted the invitation in April 2016 and the Special Report, known as 'SR 1.5', was published in October 2018.

159. SR 1.5 concludes that human-induced warming reached approximately 1°C above pre-industrial levels in 2017. At the present rate, global temperature will reach 1.5°C around 2040. SR 1.5 makes clear that:

> *"Delayed action, limited international cooperation, and weak or fragmented policies that lead to stagnating or increasing greenhouse gas emissions would put the possibility of limiting global temperature rise to 1.5°C above pre-industrial levels out of reach… warming will not be limited to 1.5°C or 2°C unless transformations in a number of areas achieve the required greenhouse gas emissions reductions. Emissions would need to decline rapidly across all of society's main sectors, including buildings, industry, transport, energy, and agriculture, forestry and other land uses."*

160. Following the publication of SR 1.5, the UK Government and devolved administrations wrote to the UK Committee on Climate Change and asked them to update their advice to Government on setting targets for carbon emissions in light of the SR 1.5 report and to consider whether the UK needs to reduce carbon emissions at a faster rate or to a greater extent than originally planned.

5.2.3 The Climate Change Act 2008 (2050 Target Amendment) Order 2019

161. The Climate Change Act 2008 (2050 Target Amendment) Order 2019 commits the UK to a net reduction in greenhouse gas emissions (against the 1990 baseline) of at least 34% by 2020 and 100% by 2050. A system of carbon budgets are used to act as "stepping stones", with each legally binding carbon budget to be set by Government for a five year period. A carbon budget is a cap on the amount of greenhouse gases emitted in the UK over the relevant five year period. Budgets must be set at least 12 years in advance to allow policy makers, businesses and individuals enough time to prepare.

162. The Climate Change Act 2008 also created a statutory body, the Committee on Climate Change, to advise on the appropriate level of each carbon budget. The budgets are designed to be a cost-effective way of achieving the UK's long term climate change objective and the first five carbon budgets have already been embedded into legislation (the Carbon Budget Order 2009, Carbon Budget Order 2011 and Carbon Budget Order 2016) and run up to 2032, with reduction targets of 37% by 2020 and 57% by 2030 respectively, as against 1990 levels.

5.2.4 EU Renewable Energy targets

163. In January 2008 the EC published a "20-20-20" targets package, which forms part of the European response to the challenges noted above. This included proposals for:

- a reduction in the EU's greenhouse gas emissions of at least 20% below 1990 levels;
- increasing the proportion of final EU energy consumption from renewable sources to 20%; and
- a 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

164. These targets were to be achieved by 2020, as set out in the EU Renewable Energy Directive (March 2009), but progress has been mixed. The 20% is split between Member States. For the UK, the EC's obligations include a 16% reduction in UK greenhouse gas emissions by 2020 and for 15% of all energy consumed in the UK to come from renewable sources by 2020. Although current renewable targets relate to 2020, the need to reduce carbon emissions is clearly a long term endeavour and that need does not end in 2020.

165. Irrespective of progress towards such targets, the UK is legally committed to delivering "at least 15%" (i.e. a minimum) of its energy demand from renewable sources. That commitment currently arises from the promotion of the use of energy from Renewable Sources Regulations 2011 Regulation 3. However, this is not a cap and

represents a minimum target. The UK renewable energy targets, therefore, are essentially unconstrained. This is highly relevant to the consideration of alternatives to Norfolk Vanguard and other offshore wind farms and re-enforced by DECC's Offshore Wind Sector Deal (see Section 5.2.10).

5.2.5 UK Energy Policy: Renewal Energy Strategy (2009) and Road Map: Updates (2012 and 2013)

166. The UK Renewable Energy Strategy set out the means by which the UK aimed (at that time) to meet both its legally binding, minimum target of 15% of energy consumption from renewable resources by 2020 and advance its longer term decarbonisation agenda out to 2030 and 2050.

167. The last update to the UK Renewable Energy Road Map was published on 6 November 2013 but the positive picture it sets out in respect of offshore wind has not changed. Nor has the recognised strategic importance of offshore wind, articulated in paragraph 140 and 141 (emphasis added):

"140 – offshore wind is an ideal technology for the UK where our shallow seas and strong winds make it an important national asset which will play a key role in enabling the UK to meet its legally binding 2020 renewable energy target. In the following decades, the UK has ambitious plans to decarbonise the economy as part of the drive to tackle climate change. As offshore wind becomes a more mature technology and costs fall, it has the potential to play a very significant role in the 2020s and out to 2050 alongside other low carbon technologies…

141 – the offshore wind sector has the potential to become one of significant strategic economic importance to the UK, supporting a competitive and quality UK supply chain and exporting expertise and technology all over the world. The UK is currently the world's biggest offshore wind market with more capacity deployed than any other country. We are very lucky to remain the biggest market up to 2020 and potentially beyond."

5.2.6 The UK Clean Growth Strategy (2017)

168. In October 2017 the UK Government published the Clean Growth Strategy (CGS). The CGS defines "clean growth" as *"growing our national income while cutting greenhouse gas emissions. Improving clean growth, while ensuring an affordable energy supply for business consumers, is at the heart of the UK's industrial strategy"*.

169. The introduction refers to the 2015 Paris Agreement (see above) and states that the actions and investments needed to meet the Paris commitments will ensure the shift to clean growth will be at the forefront of the policy decisions made by Government

in coming decades. Reference is also made to the 2008 Climate Change Act, which (as noted above) commits the UK to reducing greenhouse gas emissions by at least 80% by 2050. In order to meet the 4th and 5th carbon budgets (covering the periods 2023-2027 and 2028-2032), the Government has stated:

"we will need to drive a significant acceleration in the face of decarbonisation and in this strategy we have set out stretching domestic policies that keep us on track to meet our carbon budgets".

170. The CGS sets out a comprehensive list of policies and proposals that aim to accelerate the pace of clean growth, i.e. to deliver increased economic growth and decreased emissions, within the context of two guiding objectives:

(a) "to meet our domestic commitments at the lowest possible net cost to UK taxpayers, consumers and businesses"; and

(b) "to maximise the social and economic benefits for the UK from this transition."

171. Notably the CGS includes plans to commission a further 10GW of offshore wind capacity in the 2020s. More recently, the Government has clarified that it intends to increase offshore wind capacity by 1-2GW per year between now and 2030.

5.2.7 The UK Industrial Strategy (2017)

172. The Industrial Strategy White Paper (Industrial Strategy – "Building a Britain fit for the Future" UK Government November 2017) was published in November 2017. The Strategy's overall aim is to create an economy that boosts productivity and earning power throughout the UK. What are termed "grand challenges" are identified to put the UK at the forefront of the industry of the future. One of these is entitled "clean growth" and the Government states (page 42) *"we will maximise the advantages for UK industry from the global shift to clean growth – through leading the world in the development manufacture and use of low carbon technologies, systems and services which cost less than high carbon alternatives."* Thus, it is clear that low carbon technology, such as offshore wind farms, are a key component of the UK's broader industrial and economic strategy.

5.2.8 National Planning Policy

173. The DEFRA Guidance explains that a project which enacts or is consistent with national strategic plans or policies, such as one (or more) NPS, is likely to show a high level of public interest. As set out above, offshore wind farms (such as Norfolk Vanguard) are covered and strongly supported in principle by NPS EN-1 and EN-3.

174. The Applicant's evidence demonstrates overall that Norfolk Vanguard is consistent with and draws significant support from NPS EN-1 and EN-3. The basis for this conclusion in respect of the offshore environment is set out in ES Chapter 3 (Policy and Legislative Context) (paragraph 3.3.3.3) and Section 2.2 of the Planning Statement (document 8.02).

175. These NPS overwhelmingly recognise the indispensable nature of and urgency for substantially more renewable energy in general terms and specifically for offshore wind capacity, in the national interest. This is articulated throughout NPS EN-1 paragraphs 2.1.2, 2.2.1, 2.2.2, 2.2.8, 2.2.20, 3.1.1 to 3.1.4, 3.4.3 and, in particular, paragraph 3.4.5 which concludes:

"Paragraph 3.4.1 above sets out the UK commitments to sourcing 15% of energy from renewable sources by 2020. To hit this target and to largely decarbonise the power sector by 2030, it is necessary to bring forward new renewable electricity generating projects as soon as possible. The need for a new renewable electricity generating project is therefore urgent".

5.2.9 The declaration of Climate Emergency and the UK Government committing to Net Zero carbon emissions by 2050

176. The UK Government declared a climate emergency in May 2019 and many cities and towns have also declared a climate emergency. This led to The Climate Change Act 2008 (2050 Target Amendment) Order 2019 which commits the UK to a net reduction in greenhouse gas emissions (against the 1990 baseline) to net zero; a reduction of 100% by 2050 (described in Section 5.2.3). The UK was the first major economy to set this legally binding target, which demonstrates full understanding of the need for urgent action to expand renewable energy and to decarbonise traditional energy supply. The UK Government has recognised the need to escalate climate action and for it to be a top priority. The construction of Norfolk Vanguard as part of the TCE Round 3 plans, with a 1.8GW capacity, would significantly contribute to meeting the new and increased ambition of the net-zero target.

177. The Government's statutory body's Progress Report on reducing emissions for 2019 (CCC, 2019) was critical of the Government's climate change action, although acknowledging the achievement in setting the new legal target. Of the 25 headline policy actions outlined in the 2018 Progress Report to Parliament (CCC, 2018), only one had been delivered in full, ten "had not shown even partial progress" and not even a third of the indicators were on track. The 2019 Progress Report states:

"Projected progress. The Government's own projections demonstrate that its policies and plans are insufficient to meet the fourth or fifth carbon budgets (covering 2023-

2027 and 2028-2032). This policy gap has widened in the last year as an increase in the projection of future emissions outweighed the impact of new policies.

Too often efforts have been isolated to single departments or have progressed too slowly. The foundations in the Clean Growth Strategy have not been developed into a coordinated approach that will deliver even the existing carbon budgets."

178. One of the key policy actions is to "*Develop robust contingency plans that allow for additional low carbon generation to be brought forward in the event of delay or cancellation of planned projects, or imports of electricity below projected levels*." This policy action has not been achieved and, therefore, there is no contingency for projects being cancelled or even significantly delayed.

179. This is highlighted by TCE's recent offshore wind portfolio reporting, which shows that there is only a very small level of contingency in delivering the capacity required. The delivery of renewable energy must progress with far greater urgency (CCC, 2019).

5.2.10 The DECC (2019) Offshore Wind Sector Deal

180. The Industrial Strategy: Offshore Wind Sector Deal was agreed and published in 2019 and commits the UK to almost quadruple offshore wind capacity to at least 30GW by 2030, generating one-third of the UK's electricity. The Sector Deal sets the strategy to generate thousands of high-quality jobs, create opportunities and a strong UK supply chain. Norfolk Vanguard, with the capacity of 1.8GW, is imperative to meeting this target.

181. An independent review by Martin Whitmarsh was commissioned to inform the Offshore Wind Sector Deal. Whitmarsh (2019) stated: "*Offshore wind can provide a cost effective and low carbon route to providing at least 50% of the future electricity demands of the UK. The offshore wind sector has matured rapidly over the past few years in the waters around the UK and it is now capable of providing a reliable supply with proven technology. If government can now provide a long-term strategy and commitment to the sector, it is reasonable to expect private investment to continue to fund the growth of the UK offshore electricity generation capacity, with projects becoming subsidy-free in the 2020s."*

182. TCE Round 4 Information Memorandum published in 2019 illustrates how there is only a very small level of contingency in capacity if it is assumed that all Round 3 Wind Farms and Extensions will be consented and successfully go through CfD to be constructed and operational, in order to enable the UK to meet the 2030 30GW target (The Crown Estate, 2019). In this context it is worth noting that, at the time of the announcement of Zone Development Agreements in 2010, Round 3 was expected to provide 32GW in total, yet in 2020 the capacity of operational OWFs (from all leasing

rounds to date) is only 8.5GW[10] with the last six Round 3 OWFs currently in planning, totalling approximately 10GW.

5.3 Imperative

183. The plan or project is necessary (whether urgent or otherwise) for social or economic benefit, human health, public safety, or beneficial consequences of primary importance to the environment.

5.3.1 Socio-economic benefit

184. The offshore wind industry presents an opportunity to utilise and further develop the UK's maritime engineering skills, particularly during a time when other industries are in decline (such as shipbuilding and North Sea oil), in order to secure supply chain and other employment opportunities in the UK. The importance of maximising opportunities for the involvement of local businesses and communities in offshore wind has been highlighted as a key success factor for the sector in the UK (TCE, 2014). As offshore wind supply chains are developing mainly in areas of low economic productivity, which have significant socio-economic challenges, the benefit to local communities and businesses is very important. The replacement of existing infrastructure with new technologies also represents significant investment in the UK economy.

185. The CGS (BEIS, 2017) sets out how the Government intends to invest in clean growth technology between 2015 and 2021, including in innovation in the power sector (and renewables). Additionally, in March 2018, the UK offshore wind sector committed to a Sector Deal which will aim to increase offshore wind capacity to 30GW (up from the 13GW) by 2030 (Renewable UK, 2018). The 2030 vision envisages an investment of £48 billion in UK offshore wind infrastructure.

186. The need to maximise social and economic opportunities for the UK from energy infrastructure investment, is noted in the CGS (BEIS, 2017). The UK Offshore Wind Sector Deal (Renewable UK, 2018) aims to create 27,000 skilled jobs across the UK (up from 11,000) mainly in coastal areas by 2030. The CEBR (2012) estimates that, by 2030, offshore wind could increase GDP by 0.6% and support 173,000 jobs.

187. The CGS concludes that between 1990 and 2016, the UK reduced its emissions by 42% while the economy grew by 67%. Further analysis has concluded that, by continuing to develop on this, significant economic benefits can be captured from these decarbonising trends. By taking no action, the UK economy could miss out on a

[10] https://www.renewableuk.com/page/UKWEDhome/Wind-Energy-Statistics.htm

potential low carbon economy growth of 11% per year between 2015 and 2030 (four times faster than the average 2.7% growth rate in UK GDP) (BEIS, 2017).

188. The UK is able to continue growth in the offshore wind sector by maximising domestic energy resources and utilising the vast offshore wind resource to which the UK has access. An assessment in June 2017 of Europe's offshore wind resources found that the UK has the greatest potential for offshore wind out of all assessed EU member states in the Atlantic, North Sea and Baltic Sea areas and at present, has the largest installed capacity in the world. The assessment looked at gross resource potential, technical resource potential and economically attractive resource potential, and found that the UK topped all other countries in all three categories (Wind Europe, 2017).

189. A key commitment within the Green Paper: Building our Industrial Strategy (HM Government, 2017) is to "*lead the world in delivering clean energy technology*" and to support innovation in this area. The aim is for "*the UK to be a global leader in innovation, science and research and our Industrial Strategy will help us to deliver our ambitious CO_2 reduction targets while, creating jobs and opportunities for people across the country*". The energy sector in the UK plays a central role in the economy by boosting the economy and providing new jobs and skills.

190. The UK Government has stated, in response to the challenge of energy security and withdrawal from the EU, that they are broadening Great Britain's power generation base, through new offshore wind to ensure long term security and is committed to delivering dependable, secure and low-carbon energy (BEIS, 2018).

191. Offshore clean energy is supported by the New Anglia Local Enterprise Partnership for Norfolk and Suffolk (New Anglia LEP, 2015) due to the economic benefits the sector brings to Norfolk and Suffolk. The aim of the New Anglia LEP is to lead economic growth and job creation in these areas by 2026. Hence it is clear that Norfolk Vanguard would provide strong socio-economic benefits to the UK, as well as to Norfolk and East Anglia.

192. The Applicant is committed to maximising the socio-economic benefits of Norfolk Vanguard and has engaged in early supply chain engagement, as well as educational initiatives, to facilitate the enhancement of local supply chain and employment opportunities associated with the project. Evidence of the skills and supply chain engagement was submitted at Deadline 1 of the Norfolk Vanguard Examination (document reference ExA;WQApp19.1;10;D1.3).

5.3.2 Human health

193. As discussed in Section 4.2.1.2, DECC (2011) predicts that a continuation of global emission trends could lead average global temperatures to rise by up to 6°C by the end of this century. The potential impacts associated with such a global temperature rise include impacts on human health and increased poverty.

194. DECC (2014) outlines the following potential health risks resulting from climate change:

- Existing health problems become worse as temperatures increase.
- Malnutrition could become more widespread as crop yields are affected by increased drought conditions in some regions, leading to reduced food production.
- Warmer temperatures could increase the range over which disease-carrying insects are able to survive and thrive.
- Vulnerable people will be at risk of increased heat exposure and the number of deaths due to temperature extremes is expected to increase in the future (although in the long term there will likely be fewer health problems related to cold temperatures).
- Decreasing food production, an increase in health issues associated with climate change, and more extreme weather will slow economic growth, making it increasingly difficult to reduce poverty.

195. The World Meteorological Organization (WMO) reported that between 2001 and 2010 extreme weather events caused more than 370,000 deaths worldwide (including a large increase in heatwave deaths from 6,000 to 136,000) – 20% higher than the previous decade (DECC, 2014).

196. In the UK, floods and droughts have had significant health impacts, including fatalities in recent years. In addition, health impacts as a result of climate change are likely to be more far-reaching than the immediate dangers of flooding. Climate change effects such as flooding have potential to impact on mental health and provide other indirect impacts as a result of disruption to critical supplies of utilities such as electricity and water (Health Protection Agency, 2012).

197. The switch to renewable sources of energy has both air quality and associated human health benefits. A recent study has demonstrated the huge beneficial impacts on human health from decarbonisation, stating that "*Our estimates suggest that overall around 3.5 million or so premature deaths from air pollution worldwide could be prevented annually from phasing out fossil fuels at today's population. If all sources of air pollution from human activities could be eliminated, our estimates show that more*

than five million premature deaths from air pollution would be prevented annually." (LSHTM, 2019).

198. Generating and harnessing energy from low carbon, renewable sources, such as offshore wind, is one of the solutions available to substantially reduce carbon emissions. Norfolk Vanguard would make a significant contribution both to the achievement of UK decarbonisation targets and to global commitments to mitigating climate change.

5.3.3 Public safety

199. The UK CCC (2017) reported that 2016 was the hottest year on record, which represents the fifth time in the 21st century that a new record high annual temperature has been set (along with 2005, 2010, 2014, and 2015) (NOAA, 2016). 2019 was the second hottest year globally since records began in 1880 (Copernicus Climate Change service, 2020).

200. Climate change has been greatly affecting coastal areas in the UK in recent years, including in Norfolk, where coastal erosion has become a greater problem now than in the past due to a combination of increasing storm frequency (due in part to climate change) and the already sensitive nature of the Norfolk Coast to this erosion.

201. As discussed in Section 4.2.1.2, DECC (2011) predicted global temperatures could rise by up to 6°C by the end of this century, with potential impacts including an increased frequency of extreme weather events such as floods and drought and reduced food supplies.

202. The frequency and extent of extreme weather events are increasing around the world and have been seen in the UK, with heat waves becoming more frequent and lasting longer, as well as an increase in intense, heavy rainfall causing flood events.

203. Should global temperatures rise by 2°C above the pre-industrial average, the UK could see a 30% decrease in river flows during 'dry' periods and a 5-20% increase in river flows during 'wet' periods. In addition, between 700 and 1,000 more heat-related deaths are predicted per year in South-East England (DECC, 2014).

204. Increased temperatures, changes to rainfall patterns, and an increased risk of extreme weather events will reduce the production of major food crops. This would result in an increasing gap between food demand and supply. Since trade networks are increasingly global, the effects of extreme weather events in one part of the world will affect food supply in another. For example, floods or droughts that damage crops in Eastern Europe or the US can directly affect the cost and availability of food in the UK (DECC, 2014).

5.3.4 Consequences for the Environment

205. Global warming places many species at greater risk, with a loss of suitable habitat due to changing conditions. Species may migrate to areas where conditions remain suitable (e.g. marine species moving further north in the UK to cooler climates), however, there may be insufficient new habitats available or no pathway for migration.

206. Rapid, large changes in global temperatures and changes in rainfall patterns may lead to the extinction of certain species that cannot adapt rapidly. Extinctions and changes in the number of species in a population will have significant impact on food chains (DECC, 2014).

207. Further investment in renewable energy and offshore wind energy generation are imperative in helping to mitigate these effects.

5.4 Overriding

208. The relevant public interests relating to Norfolk Vanguard must be set against the weight of the interest protected by the Birds and Habitats Directives, having regard to the nature and extent of the harm identified to the relevant Natura 2000 interests.

209. The overriding nature of the public interest served by renewable energy production, and offshore wind energy, is evidenced by the suite of legislation and policy documentation summarised above. In terms of the balancing act relating to harm to Natura 2000, the following key points should be borne in mind:

- First there is an absence of any priority habitats or species which are particularly rare or endangered in the FFC SPA, AOE SPA or HHW SAC (so socio-economic benefits can be considered for IROPI). At the same time, since the Birds Directive and the Habitats Directive differentiates "priority" habitats and species from other protected habitats and species, with the former receiving a higher level of protection, any AEoI identified in relation to Norfolk Vanguard would not relate to features receiving the highest level of protection.
- Second, the scale of the impacts predicted from Norfolk Vanguard are minimal and the impact prediction is highly precautionary.
- Third, in the consideration of harm against benefits, Norfolk Vanguard would deliver benefits relating to human health, public safety and (significantly) beneficial consequences of primary importance to the environment. The recent EU funded SEANSE[11] project has assessed the impact of climate change on key bird and harbour porpoise species (Rijkswaterstaat Zee & Delta, 2020). The

[11] Strategic Environmental Assessment North Sea Energy as an aid for Maritime Spatial Planning.

research concluded that prey availability effects due to climate change is the pressure/pathway that in the present day appears to have the largest impact on seabird population at the wider North Sea level, and is likely to be responsible for a substantially greater effect than impacts resulting from any of the other activities (including collision risk). Hence the benefits would clearly outweigh the harm.

- The considerations relating to human health, public safety and the beneficial consequences to the environment associated with renewable energy carry greatest weight and are considered to override the competing interest of preserving Annex 1 habitats and species, particularly noting the small scale of the predicted effects detailed in Appendices 1 to 3.

5.5 Public Interest

210. Offshore wind, as a source of renewable energy, offers the UK a wide range of benefits from economic growth to energy security and decarbonisation. Norfolk Vanguard has the potential to make a significant contribution to renewable energy supply and, consequently, help provide these benefits to the UK and globally.

211. A dataset produced by the CCC (2016b) calculated cumulative deployment figures (TWh/year) for different forms of electricity generation in the UK from 2015 through to 2030. For offshore wind, the fifth carbon budget target for 2020 is 36.6 TWh/year which doubles in 10 years to 72.4 TWh/year for 2030. Calculations show that Norfolk Vanguard would generate approximately 7.0 TWh/year using the calculation below:

1800MW x 8760h/year x 50% capacity factor[12] x 90% availability[13]

212. Therefore, with a total installed maximum capacity of 1.8GW, Norfolk Vanguard alone has the potential to contribute nearly 5% to the current deployment figure and 10% to the UK cumulative deployment figure for 2030.

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

214. Norfolk Vanguard would have a design life of approximately 30 years, after which it may be repowered (subject to separate consenting). During its operation the Project

[12] Capacity factor is the ratio of actual energy produced by the turbine to the maximum capacity of the turbine
[13] Availability is the ability of the wind farm, as a whole, to generate power, given appropriate weather and grid conditions. It is a percentage to account for loss of energy associated with the amount of time that the turbines are unable to produce electricity.

would contribute to reaching global, European and national targets on CO_2 reduction and renewable energy production.

215. The public interest in developing Norfolk Vanguard, therefore, relates to:

- socio-economic benefits (Section 5.3); and
- contribution to mitigation of the effects of climate change, including:
    - effects on human health (Section 5.3.2); and
    - effects on public safety (Section 5.3.3).

5.6 IROPI Summary

216. Given the above, the IROPI case for Norfolk Vanguard – particularly given its contribution to reducing greenhouse gas emissions – has added force and is imperative, overriding and in the public interest.

6 COMPENSATORY MEASURES

217. The obligation under Article 6(4), if no alternative solutions and IROPI can be demonstrated, is for the relevant Member State to take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected.

218. However, as set out above, the Applicant has not identified an AEoI on any European site and, therefore, does not consider it necessary to identify compensatory measures. Furthermore, the nature and extent of compensatory measures can only be addressed if and when the precise nature of any AEoI has been identified and quantified, in this case by the competent authority. Specifically, the Applicant cannot know at this stage:

    a. Whether the Examining Authority has advised, or the Secretary of State will conclude, that there is an adverse effect either alone or in-combination.

    b. If the Examining Authority has advised, or the Secretary of State, concludes an adverse effect:

        i. which particular species and/or habitats this relates to;

        ii. to what degree the contended impact is predicted to be above the acceptable threshold for each relevant species or habitat (i.e. the level at which there would be no AEoI); and

        iii. insofar as in-combination concerns arise, what proportion of an adverse effect is considered to be attributable to Norfolk Vanguard as compared to any other plans or projects.

219. Notwithstanding, and following without prejudice discussions with Natural England, the Applicant has set out potential in-principle compensatory measures in the event that the Applicant's primary case (that Article 6(4) need not be invoked) is not accepted, in whole or in part, and the Secretary of State is considering this issue. Appendices 1 (document ExA; IROPI; 11.D10.3.App1), 2 (document 8.24) and 3 (document 8.25) provide in-principle compensation proposals for FFC SPA, AOE SPA and the HHW SAC, respectively, and have been discussed with Natural England and the MMO. The Applicant has set out how the measures could be secured, within Schedule 17 of the draft DCO.

220. Other measures which have been considered but are not proposed to be taken forward (should this be necessary) are also described, together with the reasons for not progressing them.

221. In putting forward these measures the Applicant has in mind the following key principles:

a. DEFRA's Guidance recognises that, in designing compensation requirements, competent authorities and SNCBs should ensure the requirements are *"flexible to ensure adequate compensation without going further than necessary"*. DEFRA has in mind a case where the harm to the site proves to be less than anticipated, such that compensatory measures could be scaled back.

b. Insofar as compensatory measures may be found to be necessary, it has previously been established (10.175 and 10.176 of the Panel's findings and recommendations to the Secretary of State on the Able Marine Energy Park Order 24 February 2018) that the standard of "no reasonable scientific doubt" is not applicable to compensatory measures.

c. There is no legal authority on how the protection of the "overall coherence of Natura 2000" should be interpreted or applied. However, MN 2000 Guidance advises that, amongst other things, it would be necessary to consider the relative importance of a site to the coherence of the network. This could be done by reference to the species and/or habitats protected, the site's conservation objectives, the number and status of the habitats and species for which it has been designated, and its role in securing an adequate geographical distribution in relation to the range of the habitats and species concerned.

d. MN 2000 gives the example of a project that will damage an area of a rare habitat type with a very restricted range, and for which the site in question is one of the very few sites designated for that habitat type, where the compensatory measures may need to be substantial. Conversely, if the project will damage a habitat for a species which has a wide range across the EU, and for which the site in question has only a minor role to play in its conservation, the compensatory measures may be much less onerous.

e. The principle of proportionality is a fundamental principle of EU law contained in Article 5 of the Treaty on the Functioning of the European Union and is to be applied generally. The use of the word "necessary" imports proportionality into the Habitats Directive.

7 CONCLUSION

222. **The Applicant's primary case is that Article 6(4) is not engaged in relation to the FFC SPA, the AOE SPA or the HHW SAC as a result of Norfolk Vanguard (either alone or in-combination), as an AEoI can be ruled out for all sites. This is discussed further in the Ornithology Position Statement (document reference ExA; Pos; 11.D10.2) and HHW SAC Position Statement (ExA; Pos; 11.D10.1).**

223. Should the Secretary of State be minded to disagree with this position and conclude an AEoI following Appropriate Assessment, the evidence presented in this document shows that there are no feasible alternative solutions which would deliver the Project Objectives (Section 4.2.3) or the Need for the Project (Section 4.2.1). In addition, there is a clear case for IROPI underpinned by extensive International, National and Regional policy and legislation.

224. Appendices 1, 2 and 3 demonstrate deliverable proposals for compensatory measures in relation to kittiwake and the FFC SPA, lesser black back gull and the AOE SPA and Annex 1 habitats of the HHW SAC. In addition, the Applicant has set out how the compensatory measures could be secured within Schedule 17 of the draft DCO submitted on 28 February 2020.

225. As a result, all aspects of Article 6(3) and 6(4) of the Habitats Directive can be satisfied and Norfolk Vanguard consented.

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