The Planning Inspectorate
Yr Arolygiaeth Gynllunio

REPORT on the IMPLICATIONS for EUROPEAN SITES

Proposed Norfolk Vanguard Offshore Wind Farm

An Examining Authority report prepared with the support of the Environmental Services Team

Planning Inspectorate Reference: EN010079

09 May 2019

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1 INTRODUCTION

1.1 Background

1.1.1 Norfolk Vanguard Limited (the Applicant) has applied to the Secretary of State for a development consent order (DCO) under section 37 of the Planning Act 2008 (PA2008) for the proposed Norfolk Vanguard Offshore Wind Farm (the application). The Secretary of State has appointed an Examining Authority (ExA) to conduct an examination of the application, to report its findings and conclusions, and to make a recommendation to the Secretary of State as to the decision to be made on the application.

1.1.2 The relevant Secretary of State is the competent authority for the purposes of the Habitats Directive[1], the Habitats Regulations[2] and the Offshore Marine Regulations[3] for applications submitted under the PA2008 regime. The findings and conclusions on nature conservation issues reported by the ExA will assist the Secretary of State in performing his duties under the Habitats Regulations and the Offshore Marine Regulations.

1.1.3 This Report on the Implications for European Sites (RIES) compiles, documents and signposts information provided within the DCO application, and the information submitted throughout the examination by both the Applicant and Interested Parties (IPs), up to Deadline 7 of the examination (2 May 2019) in relation to potential effects on European Sites[4]. It is not a standalone document and should be read in conjunction with the examination documents referred to.

1.1.4 It is issued to ensure that IPs, including the statutory nature conservation body (SNCB) (Natural England (NE)), are consulted formally on Habitats Regulations matters. This process may be relied on by the Secretary of State for the purposes of Regulation 63(3) of the Habitats Regulations and Regulation 28(4) of the Offshore Marine Regulations. Following consultation, the responses will be considered by the ExA in making their recommendation to the Secretary of State and made available to the Secretary of State along with this report. The RIES will not be revised following consultation.

[1] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as codified) (the 'Habitats Directive').

[2] The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations).

[3] The Conservation of Offshore Marine Habitats and Species Regulations 2017 (the Offshore Marine Regulations) apply beyond UK territorial waters (12 nautical miles). These regulations are relevant when an application is submitted for an energy project in a renewable energy zone (except any part in relation to which the Scottish Ministers have functions).

[4] The term European Sites in this context includes Sites of Community Importance (SCIs), Special Areas of Conservation (SACs) and candidate SACs, Special Protection Areas (SPAs), possible SACs, potential SPAs, Ramsar sites, proposed Ramsar sites, and any sites identified as compensatory measures for adverse effects on any of the above. For a full description of the designations to which the Habitats Regulations apply, and/ or are applied as a matter of Government policy, see PINS Advice Note 10.

1.2 Documents used to inform this RIES

1.2.1 Documents used to inform this RIES are referred to in square brackets [] in the text of this report; that reference can be found in the Examination library published on the National Infrastructure Planning website at the following link:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-002014-EXAMINATION%20LIBRARY.pdf

1.3 Structure of this RIES

1.3.1 The remainder of this report is as follows:

- **Section 2** details the European sites and potential impacts (including in-combination impacts) that were identified within the DCO application. It provides a summary of related matters discussed during the examination period, up to and including Deadline 7.
- **Section 3** provides an overview of the Applicant's assessment of likely significant effects (LSE). It provides an overview of where IPs disputed the Applicant's conclusions, together with any additional European sites and qualifying features screened for potential LSEs during the examination.
- **Section 4** provides an overview of the Applicant's assessment of adverse effects on integrity (AEOI) of European sites. It provides an overview of where IPs have disputed the Applicant's conclusions.
- **Section 5** provides an overview of what consideration has been given to alternatives and IROPI during the examination.
- **Annex 1** lists the European sites considered by the Applicant at the screening stage.
- **Annexes 2 and 3** comprise matrices for the European sites and qualifying features for which the Applicant's conclusions were disputed in relation to potential LSEs and AEOI of European sites. They summarise the evidence submitted by the Applicant and IPs up to and including Deadline 7 of the Examination.

2 OVERVIEW

2.1 Identification of European Sites

2.1.1 The project is not connected with or necessary to the management for nature conservation of any of the European site(s) considered within the Applicant's assessment.

2.1.2 The Applicant's Information for the Habitats Regulations Assessment ('the HRA Report') [APP-045] submitted with the DCO application considered 168 European sites; these are listed in Annex 1 of this RIES. No additional European Sites for which the UK is responsible were identified for consideration by any interested party during the examination.

2.1.3 The Applicant has identified potential impacts on European sites in other European Economic Area States ([APP-045] and [APP-046]). However, only UK European sites are addressed in this report.

Screening criteria

2.1.4 The European sites considered for screening were established based on the search criteria described below.

2.1.5 *Marine mammal Special Areas of Conservation (SACs)/Sites of Community Interest (SCIs)* (section 2.1 of Appendix 5.1 [APP-046]):

- harbour porpoise – any European site within the harbour porpoise North Sea Management Unit where the species is a grade A, B or C feature;
- grey seals – any European site within 1,000km where the species is a grade A, B or C feature; and
- harbour seal – any European site within 300km where the species is a grade A, B or C feature.

2.1.6 *Benthic ecology SACs* (section 3.2 of Appendix 5.1 [APP-046]) - European sites within the southern North Sea which directly overlap with a component of the Proposed Development and European sites where the interest features are within the range for interaction (e.g. the pathway is not too long for sediment deposition).

2.1.7 *Fish SACs* (section 4.2 of Appendix 5.1 [APP-046]) – European sites which directly overlap with a component of the Proposed Development; European sites where the interest features are within the range for interaction (e.g. the pathway is not too long for sediment deposition); European sites from which an interest feature's resources (e.g. prey/habitat could) are within the range for interaction; and European sites from which an interest feature's foraging area or migratory route are within the range for interaction.

2.1.8 *Offshore ornithological Special Protection Areas (SPAs) and Ramsar sites* (section 5.2 of Appendix 5.1 [APP-046]) – European sites which directly overlap with a component of the Proposed Development;

European sites within the foraging range; European sites from which an interest feature's resources (e.g. prey/habitat) are within the range for interaction; and European sites from which an interest feature's foraging area or migratory route are within the range for interaction.

2.1.9 *Onshore* (section 1.5 of the HRA Report [APP-045] - a 5km buffer zone around the onshore infrastructure was applied to capture onshore European sites that could potentially be affected by the Proposed Development. Although The Broads SAC falls outside of the 5km buffer zone, it was added to the assessment following consultation with NE in March 2018 (paragraph 90 of [APP-045]).

Examination

2.1.10 The Applicant's updated screening and integrity matrices [AS-044][REP7-035] also referred to the Outer Thames Estuary Extension pSPA. The ExA understands that the proposal for the Outer Thames Estuary pSPA extension is to extend the boundary of the existing SPA in several places to protect the internationally important colonies of little tern and common tern[5], which are qualifying features of the existing Outer Thames Estuary SPA that have been considered in the application documents and during the examination.

2.2 Potential effects

2.2.1 The potential effects assessed by the Applicant are summarised in Table 2.1 below.

Table 2.1 Potential effects assessed by the Applicant (adapted from [REP1-010])

Site Type	Feature(s)	Potential effects
Special Protection Area (SPA) / Ramsar sites	Birds (offshore)	Collision mortality Displacement/disturbance Barrier effect In-combination effects
	Birds (onshore)	Direct effects within SPA boundary Direct effects on ex-situ habitats Indirect effects within SPA boundary Indirect effects on ex-situ habitats
Special Area of Conservation/Site of Community	Benthic habitats	Temporary physical disturbance Habitat loss Introduction of new substrate

[5] https://www.gov.uk/government/consultations/outer-thames-estuary-special-protection-area-extension-comment-on-proposals Accessed on 7 May 2019

Site Type	Feature(s)	Potential effects
Importance (SAC/SCI)		Smothering due to increased suspended sediment In-combination effects
	Marine mammals	Underwater noise Vessel interactions Indirect effects on prey Changes to water quality In-combination effects
	Fish	Permanent loss (and introduction of new sediment where applicable) Temporary physical disturbance Smothering due to increased suspended sediment Re-mobilisation of contaminated sediments Underwater noise and vibration Electromagnetic fields (EMF) In-combination effects
	Terrestrial	Direct effects (e.g. habitat loss) Impacts on ex-situ habitats functionally connected to the SAC Impacts from alterations to geology and land contamination Disturbance due to groundwater / hydrology changes Impacts from noise disturbance Impacts from changing air quality Impacts from light disturbance Impacts from visual disturbance In-combination effects

Examination

2.2.2 The Greater Wash SPA and Outer Thames Estuary SPA were considered within the HRA Report [APP-045], however, disturbance/displacement of red throated divers (RTDs) during the operational phase was not assessed. NE raised concerns in this regard and considered that a LSE should be screened in due to the possibility of disturbance/displacement of RTDs from operations and maintenance vessels [RR-106][REP1-049].

2.2.3 Similarly, whilst Breydon Water SPA, Broadland SPA and North Norfolk Coast SPA were considered within the HRA Report [APP-045], collision risk to non-seabird migrants of these sites was not assessed.

NE [RR-106][REP1-049] considered that migration modelling and collision risk should be assessed for Bewick's swan and avocet.

2.2.4 See the relevant European Site matrices for further details on these issues.

2.3 In-combination assessment

Onshore

2.3.1 In-combination effects were assessed by the Applicant for Paston Great Barn SAC. The projects which have been identified as potentially giving rise to effects upon Paston Great Barn SAC in-combination with the Norfolk Vanguard (NV) project were identified in Table 9.11 of [APP-045].

2.3.2 In-combination effects were not assessed for the River Wensum SAC, Norfolk Valley Fens SAC and The Broads SAC on the basis that the project alone was not determined to have the potential for AEOI, therefore there is "*no real prospect of an in-combination effect occurring with another plan or project*" (section 9.3.1.4 [APP-045]).

2.3.3 However, during the examination, NE [RR-106] noted that the Hornsea Project Three cable route passes about 360m to the east of Booton Common[6] and that construction periods may overlap with NV. As such, it suggested that the in-combination assessment for Norfolk Valley Fens SAC be revisited. See the Norfolk Valley Fens SAC matrices for further details.

Marine mammals

2.3.4 The HRA Report [APP-045] assessed in-combination effects from:

- piling noise;
- vessel collision risk;
- changes to prey resource; and
- disturbance from other noise-generating activities (e.g. UXO clearance, seismic surveys, other construction activities and operation and maintenance activities).

2.3.5 Offshore wind farms included in the in-combination assessment for disturbance of harbour porpoise are presented in Table 8.33 and use the NE tiered approach.

Benthic habitats

2.3.6 The in-combination assessment was restricted to Norfolk Boreas as no other projects/plans are considered to have the potential to affect the Haisborough, Hammond and Winterton (HHW) SAC.

[6] Booton Common Site of Special Scientific Interest (SSSI) is a component of the Norfolk Valley Fens SAC

Ornithology

2.3.7 In-combination collision mortality was assessed by the Applicant for:

- lesser black-backed gull (LBBG) of the Alde-Ore Estuary SPA (section 6.3.1.1.2 of [APP-045]); and
- gannets and kittiwakes of the Flamborough & Filey Coast (FFC) proposed SPA [7] (sections 6.3.2.1.2 and 6.3.2.2.2 of [APP-045]).

2.3.8 The Applicant assessed in-combination collision risk following NE's tiered approach and the projects considered are detailed in Tables 6.5, 6.6 and 6.7 of [APP-045].

2.3.9 In-combination displacement effects were assessed for RTDs of the Greater Wash SPA (section 6.3.3.2.2 of [APP-045]). Norfolk Boreas Wind Farm was the only future wind farm development considered to be located close enough to the coast to directly impact the Greater Wash SPA.

Examination

2.3.10 Several overarching matters related to the in-combination assessments were discussed during the examination, including:

- the use of data from Hornsea Project Three and Thanet Extension offshore wind farms;
- the use of data from non-UK wind farms;
- population modelling approaches; and
- fishing as a project.

2.3.11 These matters are discussed further in section 2.5 of this RIES.

2.3.12 Site-specific in-combination issues are detailed in the relevant European Site matrices.

2.4 Applicant's HRA Report conclusion

2.4.1 The Applicant [APP-045] concluded that there would be a LSE on 12 European sites (see Table 3.1 of this RIES), however there would be no AEOI on any of these sites, either alone or in-combination with other projects.

2.4.2 These conclusions were refuted by IPs during the examination, as discussed throughout the remainder of this RIES.

[7] Flamborough & Filey Coast was a proposed SPA (pSPA) at the time the Norfolk Vanguard DCO application was submitted. The site was classified as a SPA during the pre-examination stage. The site is therefore referred to as the SPA throughout this RIES.

2.5 HRA matters considered during the examination

Key issues

2.5.1 The key HRA matters discussed during the examination were as follows:

- collision risk modelling (CRM) – choice of Band model and evidence supporting the Applicant's model parameters;
- the need for CRM of non-seabird migrants of Broadland SPA, Breydon Water SPA and North Norfolk Coast SPA;
- assessment of displacement impacts for:
  - auks and gannet of FFC SPA;
  - common scoter of Greater Wash SPA;
  - RTD of Greater Wash SPA and Thames Estuary SPA;
- in-combination collision mortality of little gull of the Greater Wash SPA;
- population modelling approaches for the in-combination assessment of LBBG of Alde-Ore Estuary SPA and gannet and kittiwake of the FFC SPA;
- baseline data for the offshore cable route through the HHW SAC;
- effects from cable burial and protection on the reef and sandbank features of the HHW SAC, including the ability to microsite through areas of reef which may colonise since the baseline surveys;
- in-combination effects from underwater noise during construction on the harbour porpoise population of the Southern North Sea SAC[8];
- baseline data for wintering birds at Broadland SPA and Ramsar site;
- effects on foraging and commuting habitat for Barbastelle bats of Paston Great Barn SAC;
- impacts to groundwater at Norfolk Valley Fens SAC and The Broads SAC;
- restoration and sediment management at the River Wensum SAC; and

[8] At the time of application, the Southern North Sea European site was a cSAC. The site was formally designated by the UK as a SAC in February 2019 (see http://jncc.defra.gov.uk/page-7243). As such, the site is therefore referred to as the Southern North Sea SAC throughout this RIES.

- in-combination effects with Hornsea Project Three onshore cable.

2.5.2 Details of the above issues can be found in the footnotes to the screening and integrity matrices in Annexes 2 and 3 of this RIES. However, the overarching methodological issues relating to CRM and in-combination assessment are detailed below as they are applicable to more than one European site and/or qualifying feature.

2.5.3 A summary of the objections to the use of cable protection is also included below, to provide background information on the discussions related to potential effects on both the sandbank and reef features of the HHW SAC.

Collision risk modelling

Model used

2.5.4 The Applicant's CRM calculations [APP-217] were produced using scripted versions (in R) of the Band (2012) model (hereafter referred to as the Applicant's stochastic CRM).

2.5.5 NE [RR-106][REP1-088] raised several concerns over the Applicant's stochastic CRM and highlighted that not all of the CRM input data or the Band outputs requested during the Evidence Plan process had been provided.

2.5.6 The Royal Society for the Protection of Birds (RSPB) [RR-197] was similarly concerned and considered that the Applicant's CRM underestimated collision mortality. It advocated the use of the Marine Science Scotland (MSS) stochastic CRM. It undertook its own indicative recalculation of collision risk (using Band 2012 and the MSS model) and was of the view that impacts had not been adequately assessed [REP1-112].

2.5.7 At Deadline 1, the Applicant provided the CRM input parameters (Annex 1 of Appendix 3.2 [REP1-008]) (except the R code) and comparisons of its stochastic CRM outputs with the outputs from Band (2012) model (Annex 2 of Appendix 3.2) and the MSS model (section 1.5 of Appendix 3.2) [REP1-008]) (Q3.3 of [REP1-007]). The Applicant concluded that its stochastic model, the MSS model and the Band deterministic model all calculate collisions in the same way and (given the same input parameters) produce the same collision estimates.

2.5.8 The RSPB [REP4-070] considered there was insufficient detail presented to enable comparison with the MSS model and continued to recommend the MSS model over the Applicant's stochastic model. However, the Applicant subsequently explained it had encountered errors in the MSS model and therefore did not consider it appropriate to use the model (Q23.64 of [REP4-040] and [REP4-051]).

2.5.9 NE [REP4-062] agreed the MSS model should not be relied on and continued to advise that conclusions are based on deterministic/Band 2012 model outputs.

2.5.10 Further to these discussions, and as a result of change to the worst case scenario, the Applicant provided a number of revisions to the CRM[9]; firstly at Deadline 6 [REP6-021], secondly as an additional submission between Deadline 6 and 7 [AS-043] which was accepted at the discretion of the examining authority, and lastly at Deadline 7 [REP7-062] (see below for further details). These were based on the Band (2012) deterministic model; the results of which are detailed in the relevant screening and integrity matrices.

Median bird density values

2.5.11 NE ([RR-106][REP1-088], comments on Appendix 3.2 in [REP3-051],[REP4-062) and RSPB [RR-197][REP1-110] raised concerns over the use of median bird density values within the CRM and advised that mean values were used, as had previously been used for offshore wind farm assessments. They considered median values would predict lower collision mortalities than mean values.

2.5.12 The Applicant ([REP1-008], Q3.7 of [REP1-007], [REP3-004] and Q3.26 of [REP4-040]) explained that the distribution of seabird densities obtained from the analysis of survey data are very strongly skewed in most months and that it is common practice to use median values in the presence of skewed data. It did not agree that median values would lower collision estimates and provided comparisons of the collision predictions obtained using the mean densities alongside the median densities and those for the upper and lower 95% confidence interval density estimates (Section 1.7 of [REP1-008]). It considered the graphical outputs of monthly seabird density values used in the CRM and monthly mortality predictions obtained provide robust support for its position [REP3-004].

2.5.13 However, RSPB [REP2-035] argued the data was not skewed and continued to advocate the use of mean densities [REP4-070]. It noted the collision mortalities using mean densities were considerably higher than using median densities.

2.5.14 NE [REP4-062] and RSPB explained [REP4-070] that there was a strong precedent for using mean values in virtually every consented offshore wind farm and that using standard approaches and parameters has the benefit of allowing cumulative impact assessments to be carried out robustly.

2.5.15 Further to these discussions, the Applicant's revised CRM assessments [REP6-021] [AS-043] and [REP7-062] were presented based on mean values.

Revision to worst case scenario

2.5.16 At Deadline 4, the Applicant (Q23.64 of [REP4-040]) explained that it had removed the option to use the smallest and most numerous 9MW turbine. The increase in minimum turbine size was welcomed by the RSPB [REP6-038] and the Applicant's Deadline 6 updated CRM

[9] For gannet, kittiwake and LBBG. It also presented revised assessments of displacement (gannet, puffin, razorbill, guillemot and RTD), and combined displacement and collision risk for gannet.

[REP6-021] used parameters for the 10MW turbine as a worst-case scenario. The Applicant explained that this reduced collision risk for the project by approximately 10% [REP7-059].

2.5.17 Following a review of the project design, the Applicant revised the wind turbine layouts (in addition to exclusion of the 9MW turbine) and subsequently submitted an update to seabird collision risk estimates in an additional submission [AS-043]. The revised wind turbine layout[10] would be based on the following maximum proportion of turbines which could be installed in either site with two alternative scenarios, (a) and (b):

(a) the maximum proportion of turbines in NV West would be two-thirds (with one-third in NV East); or

(b) the maximum proportion of turbines in NV East would be half (with the other half in NV West).

2.5.18 The Applicant presented collision estimates for both scenario (a) and (b) for each species in order to identify the species-specific worst-case design, which reflected differences in the densities of a particular species across NV East and NV West; it confirmed that the higher estimate in each case represented the worst case for assessment. The Applicant stated that in all cases significantly lower collisions were estimated than those presented in the Deadline 6 CRM [REP6-021] and the average reduction in collision mortality was 34%.

2.5.19 The Applicant provided a revised assessment of effects (including an in-combination assessment) at Deadline 7 [REP7-062], which was based on the collision risk estimates presented in [AS-043]. For the avoidance of doubt, the relevant European site matrices in this RIES have referred to the values provided within the Applicant's Deadline 7 assessment.

Progress of discussions on CRM methodology at time of publication of the RIES

2.5.20 NE [REP7-075] welcomed the Applicant's revised assessments, confirming that the input parameters were as NE had previously advised. However, it advised that the assessment of impacts from the project alone should be undertaken using baseline mortality calculations using the adult colony figures and adult mortality rates. It also advised that consideration be given to the range of CRM predictions from using the upper and lower 95% confidence intervals of bird density (as these account for the greatest variation). At Deadline 7, NE [REP7-075] advised that it could not exclude AEOI for all European sites and therefore recommended consideration of impact mitigation through raised rotor blade draught heights above MHWS. See the relevant European Site matrices for further details.

[10] Secured through the detailed offshore design parameters in Requirement 2(3) of the draft DCO

2.5.21 Although the RSPB [REP6-038][REP7-083] confirmed that it was content with the parameters proposed for the CRM (with the exception of the gannet breeding season avoidance rate), it considered there would be significant in-combination impacts. It therefore suggested mitigation options including raising the draught height of rotors from 22.5m above MHWS depending on the results of collision risk modelling and referenced the raise in draught height of up to 35m above MHWS for the Hornsea Three project. It advised the Applicant to maximise relative turbine numbers in NV West as opposed to NV East.

2.5.22 The Applicant [REP7-059] explained that it had taken steps to reduce the predicted collision mortality by removing the 9MW turbine option from the project design and through the revised layout. It considered that impacts are at a level where there would be no AEOI.

2.5.23 At Deadline 7, the RSPB made several comments regarding the Applicant's approach [REP7-083], as follows:

- The Applicant had compared predicted change in population growth in 30 years' time against the current population growth rate, which does not account for the high probability the future population growth rate will likely be considerably different; the RSPB argued that this is not an adequate method for reaching conclusion of the significance of an effect.
- The RSPB acknowledged a historical precedent for the use of 1% of background mortality to determine whether AEOI on the SPAs can be excluded; however it considered the 1% value to be arbitrary and not scientifically evidenced. Therefore, the RSPB based its conclusions on the Counterfactual of Population Size outputs of density independent viability models as recommended in literature (Green et al., 2016 and Cook and Robinson, 2015), which indicate the percentage difference between the SPA population with and without additional mortality at the end of the lifetime of the wind farm.
- The Applicant had referred to precaution in its assessment; but the RSPB considered these instances to be far from proven.

In-combination effects

Hornsea Project Three and Thanet Extension

2.5.24 The HRA Report [APP-045] utilised 'preliminary estimates' of collision mortality for Hornsea Project Three and Thanet Extension wind farms. The Applicant updated the in-combination assessment [AS-006], following submission of DCO applications for these projects, stating that the overall conclusion of no AEOI remains.

2.5.25 The provision of the revised in-combination assessment was welcomed by NE. However, they noted methodological issues and uncertainties associated with the baseline data and assessments

completed by Hornsea Project Three and some methodological issues identified with the assessments for Thanet Extension. On that basis NE was unable to reach conclusions on the scale of in-combination displacement and collision risk impacts [RR-106][REP1-088][REP2-038].

2.5.26 NE subsequently confirmed [REP6-032] that the Hornsea Project Three examination had closed on 2 April 2019 and that due to insufficient baseline surveys it is not possible to rule out AEOI from the project. It therefore advised the Applicant to ensure that the assessment and figures presented for the NV project alone are as robust as possible and that the Applicant should consider opportunities to minimise the project alone impacts as much as possible. It suggested the Applicant could base their in-combination assessment on where there is some degree of certainty in the figures presented, e.g. for East Anglia Three cumulative totals, and then adding the figures for both NV and Thanet Extension. The Applicant could also run a separate assessment which includes Hornsea Project Three and present both figures. The RSPB [REP6-038] supported NE's concerns regarding the baseline data and their recommended approach to the use of Hornsea Three figures.

2.5.27 The Applicant's updated in-combination assessments [REP6-021], which was subsequently replaced by [REP7-062], therefore comprised two sets, one including and one excluding the Hornsea Project Three datasets (from the Hornsea Project Three Environmental Statement). They also included Thanet Extension values from the Thanet Deadline 3 submission.

2.5.28 Ørsted (the Hornsea Project Three Applicant) argued [REP7-081] that its ornithological baseline is robust, and its assessment is highly precautionary; therefore, it considered an AEOI could be excluded for the Hornsea Three Project. It did not agree that there is any basis upon which to depart from the normal approach of assessing in-combination effects and that until the Hornsea Three Project is determined, it must be considered within the NV in-combination assessment.

Population modelling approaches

2.5.29 In considering the implications of collision mortality from NV in-combination with other plans and projects, the Applicant referred to threshold levels of annual mortality that gannet and kittiwake populations could sustain, derived using Potential Biological Removal (PBR) [APP-045].

2.5.30 Both NE [RR-106][REP1-088] and RSPB [RR-197][REP1-112][REP4-070] argued against the use of PBR, recommending that Population Viability Analysis (PVA) is used as an alternative as it allows the effects of factors such as density dependence, population trends and demographic parameters to be investigated and enables comparison of the change in population size with and without a windfarm project.

2.5.31 The Applicant explained that the PBR outputs had been referred to as an additional source of predictions about population consequences

but are not relied upon to support the assessment (Q3.3 [REP2-044]).

2.5.32 In reaching its conclusion of no AEOI to breeding kittiwake and gannet of FFC SPA, the Applicant had referred to the PVA model undertaken for the Hornsea Project Two (paragraphs 213 and 248 of [APP-045]). NE [RR-106][REP1-088] and RSPB [REP1-112] argued that the PVA model was not adequate and listed a number of issues with the modelling approach.

2.5.33 The Applicant (Q23.26 of [REP1-007]) noted that the PVA models had previously been considered robust and explained that NE's advice had changed regarding how models are run and how results are presented. It asserted that that the models remain reliable, despite being produced before NE adopted the matched-pair advice. It argued (Q23.27 [REP2-004]) that:

- since the models were produced, the cumulative effects have not increased beyond the span of mortalities assessed and therefore the results remain valid; and
- the methods used are either identical, or very slightly modified, when compared with those currently recommended by NE and therefore there is no justification for model revisions.

2.5.34 It further referred to the updated PVA produced for the Hornsea Project Three which presented a comparison of outputs obtained with NE's preferred 'matched run' methods with the previous 'non-matched runs' and demonstrated that there is no difference in the median (or mean) result. The Applicant considered this reduced NE's justification to revise the PVA and that the remaining aspects which NE raised were not sufficient to warrant re-running the PVA.

2.5.35 Nevertheless, NE [REP4-062] continued to argue that the PVA results referred to by the Applicant are not reliable and advised [REP4-051] consideration of outputs from PVA models should be presented for any impacts where background mortality rate is increased by more than 1%. It advised that updated PVA may be required for species/populations for which current outputs were not conducted following current guidance to use a matched run approach, with counterfactual outputs and for a 30-year simulation period and that PVAs for Hornsea Project Three could be used to support the assessment.

2.5.36 With regard to LBBG of the Alde-Ore Estuary, the Applicant referred to the Galloper PVA model [APP-045]. NE [RR-106] and the RSPB [RR-197][REP1-110][REP1-112] both had concerns with this approach.

2.5.37 Both RSPB [REP6-038] and NE [REP6-032][REP7-075] advised that density independent models should be used to interpret the population scale impacts of the CRM.

2.5.38 The Applicant acknowledged the challenges in estimating density dependence, however considered this did not prevent exploration of alternative methods for simulating density dependence in PVA models

([REP7-059]). Its Deadline 6 and Deadline 7 updated assessments [REP6-021] and [REP7-062] presented both density dependent and density independent values to enable the difference in predictions to be seen. It used the Hornsea Project Three PVA for FFC SPA and its own PVA model for LBBG of Alde-Ore Estuary SPA. The Applicant also used the PVA to determine effects of collision mortality on the SPA populations from the project alone.

2.5.39 See the relevant European Site matrices for further details.

Fishing

2.5.40 The Applicant's assessment considered fishing as part of the environmental baseline. However, The Wildlife Trust (TWT) [RR-172][REP1-062][REP1-123][REP3-063] considered that fishing should not be part of the baseline but should be included in the in-combination assessment for all offshore European sites as a 'project'. It considered the Waddenzee [2004] ECR judgement and Defra policy[11] supported this position.

2.5.41 In response, the Applicant [REP3-004] referred to the draft HRA for the Review of Consents (RoC) for the Southern North Sea cSAC from which it inferred that the inclusion of commercial fisheries would have no effect on the conclusions reached in the in-combination assessment. It also referred to NE's response to a similar question on the Hornsea Three Project which it considered suggested that commercial fisheries would usually be captured as part of baseline unless activity is too variable to be adequately affected. The Applicant did not update its assessment as requested by TWT.

Cable protection at HHW SAC

2.5.42 The HRA Report [APP-045] stated that the requirement for cable protection was not yet determined, therefore a realistic worst-case scenario of up to 4km of protection per cable (8km in total) within the HHW SAC was adopted (ie 10% of the offshore export cable length). The maximum width and height of cable protection would be 5m and 0.5m, respectively.

Objections to cable protection

2.5.43 NE [RR-106][REP1-088][REP2-004][REP4-062][REP6-032] considered that the addition of hard substrate would be incompatible with conservation objectives for Annex I sandbanks and reef features and should not be used within Marine Protected Areas. It advised that cable protection has the potential to cause long-term impacts and/or permanent changes to interest features (including a loss of feature extent), could potentially be displaced over time and is unlikely to aid in the recovery of the HHW site (which NE considered to be in unfavourable status).

[11] Defra Policy to ensure that all existing and potential commercial fishing operations are managed in line with Article 6 of the Habitats Directive https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/345970/REVISED_APPROACH_Policy_and_Delivery.pdf

2.5.44 The Eastern Inshore Fisheries Conservation Authority [RR-180] also stated that cable protection is not desirable and not in keeping with the East Marine Plans.

2.5.45 The Applicant [REP2-003] acknowledged that cable protection would be a persistent change to the substrate. It considered that it would be most appropriate to agree with the Marine Management Organisation (MMO) (in consultation with NE) the type and source of cable protection (as well as the quantity, extent and location) based on the pre-construction survey data, latest scientific understanding, and relevant guidance at that time. This would be done through the Scour Protection and Cable Protection Plan[12].

2.5.46 NE [RR-106][REP1-088][REP6-032] advised the Applicant seeks to find alternatives to rock armouring for cable protection as to date all evidence from offshore wind farm developers suggests rock armouring cannot currently be removed. It advised that if there is no alternative then details should be provided as to how it would be removed at decommissioning as impacts could persist if left in situ.

2.5.47 Despite its objection to the use of cable protection, NE [RR-106] requested further details in order to undertake a meaningful assessment of the impacts from cable protection. It considered [Q5.12 & Q6.12 of [REP2-004] and [REP4-062]) that the Applicant's worst-case scenario for cable protection did not consider the localised diversity of sediment types and structure, which would result in cable protection being concentrated in particular areas/ habitats rather than a uniform distribution.

2.5.48 The Applicant ([REP2-003] and Q5.27 of [REP4-040) confirmed that it had assessed impacts from cable protection as permanent on the basis that it is unlikely to be practicable to lift cable protection and that there could be unacceptable health and safety implications in doing so.

2.5.49 During the examination, the Applicant undertook an interim cable burial study with a view to justifying and potentially refining the cable protection requirements[13]. It explained [REP6-004] that the study had identified that at least 95% of the offshore export cable length within the HHW SAC would be capable of burial. As a result, the length of potential cable protection required for unburied cable is 5% of the cable length within the HHW SAC, in addition to cable protection for cable/ pipeline crossings[14]; this was a reduction from the 10% assessed in the HRA Report. It confirmed that a final cable burial risk assessment study would be agreed and commissioned as part of the cable specification, installation and monitoring plan pursuant to Condition 14(1)(g) of Schedules 9 and 10 and Condition 9(1)(g) of Schedules 11 and 12 of the Deemed Marine Licences. It is

[12] As required under Condition 9(1)(e) of the transmission Deemed Marine Licences (Schedules 11 and 12 of the dDCO)

[13] Submitted at Deadline 7 as Appendix 1 of the outline HHW SAC Site Integrity Plan [REP7-026]

[14] The worst case cable scenarios for protection, reflecting commitments made in the Examination, were included in Table 3.1 of the Applicant's outline SIP [REP7-026].

at this time, prior to commencement of licenced activities, that the Applicant would select the proposed cable route based on the pre-construction survey data and in consultation with the MMO and NE.

2.5.50 NE [REP6-032] welcomed the Applicant's effort to reduce cable protection to 5%, although still considered this to be a significant amount within a designated site. It recommended that cable protection should not be permitted anywhere within designated sites as it would result in permanent change to reefs.

Timescales for installation of cable protection

2.5.51 In addition to concerns regarding the total volume and location of materials for cable protection, there were also concerns regarding the timing of execution and powers requested in the DCO.

2.5.52 The Applicant (Q5.12 of [REP1-007]) explained that cable protection may either be installed during construction or operation/ maintenance phases, up to the total volume that had been assessed. However, NE (Q5.12 of [REP2-036]) advised that it is not appropriate to undertake works over the lifetime of the project within a designated site. It advised [REP4-062][REP6-032] that the worst case scenario of cable protection proposed by the Applicant (ie 10% of the length of the cable corridor with the designated site) should only be assessed and restricted to the construction phase; and that any further request for cable protection over the lifetime of the project should be dealt with through a separate marine licence as repeated activities could prevent recovery of Annex I reef. Alternatively, there needs to be an agreed approach on how impacts to interest features would be avoided and/ or minimised during subsequent cable protection placement.

2.5.53 The MMO [REP6-030] similarly advised that it would not be appropriate to deploy cable protection over the lifetime of the project and that any post-construction cable protection should be subject to a separate marine licence.

2.5.54 The Applicant subsequently agreed with the MMOs suggestion that cable protection cannot be deployed during operation and maintenance, save in relation to cable protection already deployed which may be moved or extended to the extent assessed in the ES [REP7-040].

2.5.55 Further details on discussions regarding the impacts from cable protection are provided in the HHW SAC integrity matrix in this RIES.

2.6 Screening and integrity matrices

2.6.1 Screening and integrity matrices were not submitted with the DCO application documents; however, the Applicant provided these [AS-006] in response to the Planning Inspectorate's post-acceptance section 51 advice [PD-002]. Updated integrity matrices were subsequently provided by the Applicant at Deadline 2 in Appendix 23.1 [REP1-010].

2.6.2 The Applicant provided revised screening matrices in respect of the following sites as additional submissions [AS-044 and AS-045] (dated April 2019):

- Breydon Water SPA and Ramsar;
- Broadland SPA and Ramsar;
- Flamborough and Filey Coast SPA;
- North Norfolk Coast SPA and Ramsar; and
- Outer Thames Estuary SPA and pSPA extension.

2.6.3 The Applicant also provided revised integrity matrices in respect of the following sites as additional submissions at Deadline 7 [REP7-035]:

- Alde-Ore Estuary SPA and Ramsar site;
- Flamborough and Filey Coast SPA;
- Flamborough Head and Bempton Cliffs SPA;
- Greater Wash SPA;
- Haisborough Hammond and Winterton SAC;
- Southern North Sea SAC;
- Breydon Water SPA and Ramsar site;
- Broadland SPA and Ramsar site;
- Flamborough and Filey Coast SPA;
- North Norfolk Coast SPA and Ramsar site; and
- Outer Thames Estuary SPA and pSPA extension.

2.6.4 There has been insufficient time between the receipt of the revised matrices referred to in paragraphs 2.6.2 – 2.6.3 and the publication of this RIES to use them as the basis for the RIES matrices. Nevertheless, their content has been considered, where appropriate. [AS-006] and [REP1-010] have therefore been used by the ExA as the basis for the matrices appended to this RIES[15]. The footnotes of the updated matrices have been revised to incorporate a summary of key examination discussions along with examination library references to documents where the discussions can be read in greater detail.

Screening matrices

2.6.5 The ExA noted some discrepancies between the qualifying features detailed in the Applicant's initial screening matrices [AS-006] and those listed on the JNCC website[16]. However, no representations were received in this regard during the examination. Given the high

[15] Only matrices for European sites and qualifying features which were subject to discussion during the examination have been updated.

[16] http://jncc.defra.gov.uk/page-4

number of screening matrices and in effort to focus the examination on the pertinent HRA issues, the ExA did not request the Applicant to update these matrices.

2.6.6 Screening matrices have been revised and appended to this RIES for European sites where the Applicant's screening conclusions were disputed during the examination. The screening matrices have therefore been revised for:

- FFC SPA;
- Greater Wash SPA;
- Outer Thames Estuary SPA and pSPA extension;
- Norfolk Valley Fens SAC;
- Broadland SPA and Ramsar site;
- Breydon Water SPA and Ramsar site; and
- North Norfolk Coast SPA and Ramsar site.

2.6.7 Of the screening matrices not revised in this RIES, the ExA is of the opinion that IPs agree with the conclusions drawn in the Applicant's matrices [AS-044] as no comments have been received from IPs to the contrary[17].

Integrity matrices

2.6.8 The integrity matrices which have been revised and appended to this RIES are for European sites and qualifying features where the conclusions of the Applicant's assessment of effects on integrity were disputed during the examination. The integrity matrices have therefore been revised for:

- Alde-Ore Estuary SPA*;
- FFC SPA;
- Greater Wash SPA;
- Outer Thames Estuary SPA and pSPA extension;
- HHW SAC*;
- Southern North Sea SAC*;
- Paston Great Barn SAC*;
- River Wensum SAC*;
- Norfolk Valley Fens SAC;
- The Broads SAC*;
- Broadland SPA and Ramsar site;

[17] With the exception of Paston Great Barn SAC and River Wensum SAC where there is disagreement around whether the proposals constitute mitigation.

- Breydon Water SPA and Ramsar site; and
- North Norfolk Coast SPA and Ramsar site.

* No matters relating to the screening process of these European sites were discussed during the examination; therefore the Applicant's screening matrices [AS-044] have not been revised for these sites.

2.6.9 Of the European sites for which a LSE was identified by the Applicant ([APP-045][REP1-010]), no matters were raised during the examination regarding:

- Humber Estuary SAC; and
- The Wash and North Norfolk SAC.

2.6.10 As such, the Applicant's screening and integrity matrices [AS-044][REP7-035] have not been revised for these sites. The ExA is of the opinion that the IPs therefore agree with the conclusions drawn in these matrices.

3 STAGE 1: LIKELY SIGNIFICANT EFFECTS

3.1 The Applicant's Assessment

3.1.1 The Applicant screened the European sites listed in Annex 1 of this RIES for LSEs.

3.1.2 The process through which the Applicant screened in offshore European sites (i.e. identified a LSE) was based on a number of factors including predicted zones of impact/ influence, foraging ranges, migration patterns, the distance of a site from the Proposed Development and survey data.

3.1.3 Of the European sites screened, the Applicant concluded that the project is likely to give rise to significant effects, either alone or in-combination with other projects or plans, on the qualifying features of the 14 European sites listed in Table 3.1 below.

3.1.4 The locations of the onshore sites for which a LSE was identified by the Applicant are shown on Figure 5.5 [APP-045]. Offshore sites for which a LSE was identified by the Applicant are shown on Figures 5.1, 5.2, 5.3 and 5.4 [APP-045].

3.1.5 The HRA Report [APP-046] concluded that there would be no potential for LSE from NV for any of the European sites which has migratory fish species as a qualifying feature.

Table 3.1: European sites, qualifying features and potential impacts for which the Applicant concluded a LSE in [APP-045]

European site	Feature	Impact
Alde-Ore Estuary SPA	LBBG (breeding)	Collision mortality (alone and in-combination)
Flamborough & Filey Coast SPA	Gannet (breeding) Kittiwake (breeding)	Collision mortality (alone and in-combination)
Flamborough Head and Bempton Cliffs SPA[18]	Kittiwake (breeding)	Collision mortality (alone and in-combination)
Greater Wash SPA	RTD (non-breeding)	Construction disturbance and displacement due to cable laying (alone and in-combination)
	Little gull (non-breeding)	Collision mortality (alone and in-combination)
Haisborough, Hammond and Winterton SAC	Sandbanks slightly covered by seawater at all times Reef	Permanent loss (and introduction of new substrate where applicable) Temporary physical disturbance Smothering due to increased suspended sediment Re- mobilisation of contaminated sediments In-combination effects

[18] Paragraph 53 of [APP-045] states that "*Flamborough Head and Bempton Cliffs SPA is entirely within the Flamborough and Filey Coast pSPA and relevant features of the former are features of the larger, latter pSPA. Therefore, these are considered under Flamborough and Filey Coast pSPA and not unnecessarily repeated.*" NE [REP1-049] agreed that Flamborough Head and Bempton Cliffs SPA is now subsumed into the designated Flamborough and Filey Coast SPA and the former can therefore be removed from the list. The ExA has applied a similar approach to this RIES; any statements made in relation to Flamborough & Filey Coast SPA apply equally to Flamborough Head and Bempton Cliffs SPA.

European site	Feature	Impact
Southern North Sea SAC	Harbour porpoise	Auditory injury Disturbance from underwater noise Disturbance from vessels Collision mortality (vessel interactions) Changes to prey resource Changes to water quality In-combination effects
Humber Estuary SAC	Grey seal	Disturbance at haul out sites Collision mortality (vessel interactions) Disturbance when foraging at sea In-combination effects at haul out sites In-combination effects at sea
The Wash and North Norfolk SAC[19]	Harbour seal Grey seal	Disturbance at haul out sites Collision mortality (vessel interactions) Disturbance when foraging at sea In-combination effects at haul out sites In-combination effects at sea
Winterton-Horsey Dunes SAC[19]	Grey seal	Disturbance at haul out sites Collision mortality (vessel interactions) Disturbance when foraging at sea In-combination effects at haul out sites

[19] The HRA Report [APP-045] explained that although grey seal is not a qualifying feature at The Wash and North Norfolk SAC (which includes Blakeney Point) or Winterton-Horsey Dunes SAC, it is recognised that these sites are important for the population, as breeding, moulting and haul-out sites; therefore this was taken into account within the HRA.

European site	Feature	Impact
		In-combination effects at sea
River Wensum SAC	Watercourse of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Desmoulin's whorl snail	Direct effects within the ex-situ habitats of the SAC Indirect effects within the SAC from geology/contamination/groundwater/hydrology effects Indirect effects within ex-situ habitats of the SAC from geology/contamination/groundwater/hydrology effects In-combination effects
Paston Great Barn SAC	Barbastelle bats	Direct effects in ex-situ habitats of SAC Indirect effects in ex-situ habitats from light and groundwater/hydrology effects In-combination effects
Norfolk Valley Fens SAC	Alkaline fens; Northern Atlantic wet heaths with *Erica tetralix*; European dry heaths; Molinia meadows on calcareous, peaty or clayey-silt-laden soils; Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*;	Indirect effects on features present within ex-situ habitats of the SAC arising from air quality and groundwater / hydrology effects In-combination effects

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

3.2 Summary of HRA screening outcomes during examination

3.2.1 In response to Q23.13 and Q23.14, NE confirmed [REP1-088] that it generally agreed with the European sites and features screened in by the Applicant.

3.2.2 However, there were several matters discussed during the examination relating to the identification of LSEs for the European sites, features and potential impacts detailed in Table 3.2; NE considered a LSE should be identified for all of the features listed. The final column of the table confirms whether the Applicant agreed a LSE should be identified during the examination.

Table 3.2: European sites, features and potential impacts discussed during examination with regard to LSEs

European site	Feature(s)	Potential Impact	LSE agreed by the Applicant?
Flamborough & Filey Coast SPA	Auk	Operational displacement (alone and in-combination)	Yes
	Gannet	Operational displacement (alone and in-combination)	Yes
Greater Wash SPA	Common scoter	Construction and operational disturbance/ displacement (alone and in-combination)	No
	RTD	Operational disturbance/ displacement (alone and in-combination)	Yes (project alone) Unclear (in-combination)
Outer Thames Estuary SPA and pSPA extension	RTD	Operational disturbance/ displacement (alone and in-combination)	Yes (project alone) Unclear (in-combination)
Broadland SPA and Ramsar site[20]	Great bittern Bewick's swan Whooper swan Eurasian wigeon	Impacts to ex-situ habitats	No

[20] Note: NE did not explicitly confirm which qualifying features/criterion of the Broadland SPA and Ramsar site it considered there should be a LSE, however the ExA has inferred its concerns related to all qualifying features/criterion.

European site	Feature(s)	Potential Impact	LSE agreed by the Applicant?
	Gadwall Northern shoveler Eurasian marsh harrier (breeding) Hen harrier Ruff Ramsar Criterion 2		
Broadland SPA and Ramsar site	Non-seabird migrants	Collision mortality	Yes
Breydon Water SPA and Ramsar site			
North Norfolk Coast SPA and Ramsar site			

3.2.3 There are some European sites and qualifying features where the screening conclusion reached by the Applicant lacks clarity as they were not specifically addressed within the Applicant's screening matrices or HRA Report, nor have they been explicitly referred to during the examination. These are:

- FFC SPA – Seabird assemblage;
- Broadland Ramsar site – Ramsar criterion 6;
- Breydon Water Ramsar site – Ramsar criterion 5 and 6;
- North Norfolk Coast SPA - Montagu's harrier; and
- North Norfolk Coast Ramsar site – Ramsar criterion 5 and 6.

3.2.4 See the relevant screening and integrity matrices in this RIES for further details.

3.2.5 In addition, NE noted the 'semi-natural dry grasslands and scrubland facies on calcareous substrates', 'narrow mouthed whorl snail' or 'Desmoulin's whorl snail' features of the Norfolk Valley Fens SAC as being features for which concerns remain (Q23.61 of [REP1-088]). However, as noted in the Norfolk Valley Fens SAC screening matrix of this RIES, NE's representations lack clarity in this regard.

3.3 Mitigation measures in the screening stage

3.3.1 The 2018 ruling by the Court of Justice of the European Union (the CJEU) on the interpretation of the Habitats Directive in the case of People Over Wind and Sweetman vs Coillte Teoranta (2018) ('the Sweetman judgement'), confirmed that mitigation should not be taken into account at screening stage.

3.3.2 The application documents identified a number of measures to avoid LSE, including those detailed below:

- trenchless crossings to screen out direct LSEs at the River Wensum SAC (paragraph 86 of [APP-047]);
- limited construction hours (7am-7pm) to screen out construction noise effects on barbastelle bats at Paston Great Barn SAC (paragraph 102 of [APP-045]);
- (unspecified) mitigation to avoid a LSE on harbour porpoise of the Southern North Sea SAC from lethal effects and permanent auditory injury of piling and the clearance of unexploded ordnance (Table 8.4 of [APP-045]); and
- micrositing of the offshore cable to avoid permanent loss of Annex I reef at the HHW SAC (paragraph 67 of [APP-045]).

3.3.3 In response to the ExAs questioning, NE (Q23.15 of [REP1-088]) advised that it would consider the activities noted above to be mitigation.

3.3.4 The Applicant (Q23.15 of [REP1-007]) considered mitigation to be "*measures that are intended to avoid or reduce the harmful effects of the envisaged project on the site concerned*". With regard to trenchless crossing and construction hours, it argued that these are not intended to avoid or reduce harmful effects of projects but are inherent features of the works. With regard to UXO clearance[21]/piling noise mitigation and cable routing, the Applicant confirmed that these were mitigation measures and have been assessed within Stage 2.

3.3.5 As a result of the disagreement regarding trenchless crossing at the River Wensum SAC and construction hours at Paston Great Barn SAC, the ExA has progressed these impacts to the integrity stage; this is reflected within the relevant integrity matrices of this RIES.

[21] Note the Applicant subsequently confirmed that UXO clearance did not form part of the authorised works.

4 STAGE 2: ADVERSE EFFECTS ON INTEGRITY

4.1 Conservation objectives

4.1.1 The conservation objectives for the European sites in Table 3.1 of this RIES (ie those for which a LSE was identified by the Applicant at the point of the DCO application) were included within the Applicant's HRA Report (Chapters 6, 7, 8 and 9 of the HRA Report [APP-045].

4.1.2 During the Examination, NE provided revised conservation advice for the HHW SAC in [REP6-032] and the Applicant provided a copy of the Southern North Sea SAC Conservation Objectives and Advice on Operations dated March 2019 at Deadline 7 [REP7-052].

4.1.3 Of the additional sites for which a LSE was identified during examination (Outer Thames Estuary SPA, Broadland SPA and Ramsar site, Breydon Water SPA and Ramsar site and North Norfolk Coast SPA and Ramsar Site), the conservation objectives were provided by the Applicant at Deadline 7 [REP7-053].

4.2 The Integrity Test

4.2.1 The Applicant concluded that the Proposed Development would not adversely affect the integrity of any European site, either alone or in-combination with other plans or projects [APP-045].

4.2.2 NE agreed (Q23.29 and 23.53 of [REP1-088]) with the Applicant's conclusion of no AEOI to the Humber Estuary SAC, Winterton-Horsey Dunes SAC and The Wash and North Norfolk Coast SAC. Integrity matrices for these sites have therefore not been reproduced within this RIES as the ExA is content with those submitted by the Applicant in [REP1-010].However, NE was not satisfied that it can be concluded beyond all reasonable scientific doubt that the project would not have an AEOI on any of the European sites detailed in Table 4.1 of this RIES [RR-106] and made numerous representations throughout the examination about various matters relating to all these sites.

4.2.3 The RSPB [REP1-112] also did not agree an AEOI could be ruled out for kittiwakes and gannets of the FFC SPA or LBBG of the Alde-Ore Estuary SPA and made numerous representations throughout the examination.

4.2.4 The MMO, the Whale and Dolphin Conservation society (WDC) and TWT made several representations relating to impacts to harbour porpoise of the Southern North Sea SAC.

4.2.5 At the time of issuing the RIES, the Applicant remained of the view that an AEOI could be ruled out for all conservation features of European sites. However, several disagreements remained with some IPs, as identified in the final column of Table 4.1. A summary of the issues discussed during the examination is also included in Table 4.1. Further details are provided in the relevant integrity matrices (Annex 3 of this RIES).

Table 4.1 European sites, features and potential impacts subject to discussion during the examination with regard to effects on integrity

European site	Feature(s)	Key matters discussed during examination	No AEOI agreed with IPs by D7?[22]
Alde-Ore Estuary SPA	LBBG	Overarching CRM methodological issues Seasonal apportioning of impacts Seasonal definitions In-combination effects (including population modelling approach) Predator management	No
Flamborough & Filey Coast SPA	Kittiwake	Overarching CRM methodological issues Seasonal apportioning of impacts Nocturnal activity factor In-combination assessment	No
	Gannet	Overarching CRM methodological issues Avoidance rates Seasonal definitions Seasonal apportioning of impacts Operational displacement Nocturnal activity factor In-combination assessment	No
	Razorbill	Operational displacement (alone and in-combination)	No

[22] Note that if there is any ambiguity as to whether there is agreement that an AEOI can be excluded, a precautionary approach has been adopted by the ExA. See the relevant matrices within Annex 3 of this RIES for further details.

European site	Feature(s)	Key matters discussed during examination	No AEOI agreed with IPs by D7?[22]
	Guillemot	Operational displacement (alone and in-combination)	No
	Puffin (part of the seabird assemblage)	Operational displacement (alone and in-combination)	No
	Seabird assemblage	Conclusions unclear Qualifying features not specifically addressed within the Applicant's integrity matrices or HRA Report nor explicitly referred to during the examination.	
Greater Wash SPA	RTD	Displacement and mortality rates Mitigation In-combination effects with Hornsea Project Three	No
	Little gull	Overarching CRM methodological issues In-combination assessment	No
	Common scoter	Displacement and mortality rates	No
Outer Thames Estuary SPA and pSPA extension	RTD	Displacement and mortality rates Mitigation	No
Haisborough Hammond and Winterton	Sandbanks	Sandwave levelling impacts and effectiveness Cable installation impacts Restoration conservation objective Dredging	No

European site	Feature(s)	Key matters discussed during examination	No AEOI agreed with IPs by D7?[22]
SAC		Mitigation and site integrity plan Cable Protection	
	Reef	Baseline (datasets) Reef avoidance (micrositing) Reef recovery Restoration conservation objective – avoiding areas of future reef Colonisation of cable protection/ scour protection/ foundations Site integrity plan	No
Southern North Sea SAC	Harbour porpoise	Effectiveness of mitigation measures including noise limits Monitoring In-combination effects and Site Integrity Plan	No
Paston Great Barn SAC	Barbastelle bat	Quantification of habitat loss/ severance/ fragmentation Mitigation and monitoring	No
River Wensum SAC	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation Desmoulin's whorl snail	Sediment management and restoration/reinstatement Pollution control	No
Norfolk Valley Fens SAC	Alkaline fen Alluvial forests with Alnus glutinosa and Fraxinus excelsior Calcareous fens Cladium mariscus and	Changes to groundwater flow Sediment management and restoration/reinstatement Pollution control	Yes

European site	Feature(s)	Key matters discussed during examination	No AEOI agreed with IPs by D7?[22]
	species of the Caricion davallianae European dry heaths Molinia meadows on calcareous, peaty or clayey-silt-laden soils Northern Atlantic wet heaths with Erica tetralix	In-combination effects with Hornsea Three Project	
The Broads SAC	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp Natural eutrophic lakes with Magnopotamion or Hydrocharition – type vegetation Transition mires and quaking bogs Calcareous fens with Cladium mariscus and species of the Caricion davallianae Alkaline fens Alluvial forests with Alnus glutinosa and Fraxinus excelsior Molinia meadows on calcareous, peaty or clayey-silt-laden soils Desmoulin's whorl snail Fen orchid Ramshorn snail	Changes to groundwater flow Sediment management and restoration/reinstatement Pollution control	No
Broadland SPA and Ramsar site	Great bittern Bewick's swan Whooper swan Eurasian wigeon	Non-seabird migrant collision mortality Wintering bird survey data, impacts of cropping rotation and mitigation	No

European site	Feature(s)	Key matters discussed during examination	No AEOI agreed with IPs by D7?[22]
	Gadwall Northern shoveler Eurasian marsh harrier (breeding) Hen harrier Ruff		
	Ramsar criterion 6	Non-seabird migrant collision mortality	Yes
Breydon Water SPA and Ramsar site	Common tern Avocet Bewick's swan Golden plover Assemblage qualification	Non-seabird migrant collision mortality	Yes
	Ramsar criterion 5 and 6		Yes
North Norfolk Coast SPA and Ramsar site	Great bittern Pink-footed goose Dark-bellied brent goose Eurasian wigeon Eurasian marsh harrier Montagu's harrier Pied avocet Red knot Sandwich tern Common tern Little tern	Non-seabird migrant collision mortality	Yes

European site	Feature(s)	Key matters discussed during examination	No AEOI agreed with IPs by D7?[22]
	Ramsar criterion 5 and 6		Yes

5 ALTERNATIVES, COMPENSATION AND IROPI

5.0.1 The ExA asked the Applicant, at the HRA ISH on 24 April 2019, what consideration it had given to the application of alternatives, compensatory measures and imperative reasons of overriding public interest (IROPI) under the HRA process, in relation to any of the features for which an AEOI has been identified or which remains uncertain.

5.0.2 The Applicant [REP7-039] confirmed that it did not intend to submit any information as it considered that an AEOI could be excluded for all European sites. The Applicant was of the view that if there were unresolved matters after the examination had closed, the Applicant would be asked to provide such information by the Secretary of State.

ANNEX 1: EUROPEAN SITES CONSIDERED BY THE APPLICANT AT THE SCREENING STAGE (TAKEN FROM [AS-044])

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
1	Abberton Reservoir SPA & Ramsar	✓				
2	Abers - Côtes des légendes SAC		✓			
3	Alde, Ore and Butley Estuaries SAC			✓		
4	Alde-Ore Estuary SPA & Ramsar	✓				
5	Archipel des Glénan SAC		✓			
6	Baie De Canche Et Couloir Des Trois Estuaires SCI		✓		✓	
7	Baie de Morlaix SAC		✓			
8	Baie de Seine Occidentale SCI		✓			
9	Baie de Seine Occidentale SPA	✓				
10	Baie de Seine Orientale SAC	✓				
11	Bancs Des Flandres SAC		✓	✓		
12	Bancs Des Flandres SPA	✓				
13	Bassurelle Sandbank SCI			✓		
14	Benfleet and Southend Marshes SPA & Ramsar	✓				
15	Berwickshire and North Northumberland Coast SAC		✓	✓		
16	Blackwater Estuary (Mid-Essex Coast Phase 4) SPA & Ramsar	✓				
17	Borkum-Riffgrund SCI		✓		✓	
18	Borkum-Riffgrund SPA	✓				
19	Braemar Pockmarks SAC			✓		
20	Breydon Water SPA & Ramsar	✓				

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
21	Broadland SPA & Ramsar	✓				
22	Bruine Bank pSPA	✓				
23	Buchan Ness to Collieston Coast SPA	✓				
24	Calf of Eday SPA	✓				
25	Cap Sizun SAC		✓			
26	Caps Gris Nez SPA	✓				
27	Chausey SCI	✓				
28	Chesil Beach and The Fleet SPA & Ramsar	✓				
29	Chichester and Langstone Harbours SPA & Ramsar	✓				
30	Colne Estuary (Mid-Essex Coast Phase 2) SPA & Ramsar	✓				
31	Copinsay SPA	✓				
32	Coquet Island SPA	✓				
33	Côte de Granit Rose-Sept Iles SAC	✓				
34	Cromarty Firth SPA & Ramsar	✓				
35	Crouch and Roach Estuaries (Mid-Essex Coast Phase 3) SPA & Ramsar	✓				
36	Deben Estuary SPA & Ramsar	✓				
37	Dengie (Mid-Essex Coast Phase 1) SPA & Ramsar	✓				
38	Doggerbank SCI		✓			
39	Doggersbank SCI		✓			
40	Dornoch Firth and Loch Fleet SPA & Ramsar	✓				
41	Dünenlandschaft Süd-Sylt SAC		✓			
42	Dunes De La Plaine Maritime Flamande SAC		✓	✓		
43	East Caithness Cliffs SPA	✓				
44	Essex Estuaries SAC			✓		
45	Estuaire de la Canche, dunes picardes plaquées sur l'ancienne falaise, forêt d'Hardelot		✓			

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
	et falaise d'Equihen SCI					
46	Estuaire de la Seine SCI		✓			
47	Estuaires Et Littoral Picards SAC		✓		✓	
48	Exe Estuary SPA & Ramsar	✓				
49	Fair Isle SPA	✓				
50	Falaise du Bessin Occidental SPA	✓				
51	Falaises Du Cran Aux Oeufs et du Cap Gris-Nez, Dunes du Chatelet, Marais de Tardinghen et Dunes de Wissant SCI		✓	✓		
52	Falaises et Pelouses du Cap Blanc Nez, du Mont d'Hubert, des Noires Mottes, du Fond de la Forge et du Mont de couple SCI			✓		
53	Faray and Holm of Faray SAC		✓			
54	Farne Islands SPA	✓				
55	Fetlar SPA	✓				
56	Firth of Forth SPA & Ramsar	✓				
57	Firth of Tay & Eden Estuary SPA & Ramsar	✓				
58	Flamborough and Filey Coast pSPA	✓				
59	Flamborough Head SAC			✓		
60	Forth Islands SPA	✓				
61	Foula SPA	✓				
62	Foulness (Mid-Essex Coast Phase 5) SPA & Ramsar	✓				
63	Fowlsheugh SPA	✓				
64	Frisian Front pSPA	✓				
65	Gibraltar Point SPA & Ramsar	✓				
66	Great Yarmouth North Denes SPA	✓				
67	Greater Wash pSPA	✓				
68	Gule Rev SCI		✓			

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
69	Haisborough, Hammond and Winterton SAC			✓		
70	Hamburgisches Wattenmeer SCI		✓			
71	Hamford Water SPA & Ramsar	✓				
72	Helgoland mit Helgoländer Felssockel SAC		✓			
73	Hermaness, Saxa Vord and Valla Field SPA	✓				
74	Hornsea Mere SPA	✓				
75	Hoy SPA	✓				
76	Humber Estuary SAC		✓	✓	✓	
77	Humber Estuary SPA & Ramsar	✓				
78	Hund und Paapsand SCI		✓			
79	Imperial Dock Lock, Leith SPA	✓				
80	Inner Dowsing, Race Bank and North Ridge SCI			✓		
81	Inner Moray Firth SPA & Ramsar	✓				
82	Isle of May SAC		✓			
83	Klaverbank SCI		✓			
84	Knudegrund SAC		✓			
85	Kosterfjorden-Väderöfjorden SAC		✓			
86	Küsten- und Dünenlandschaften Amrums SAC		✓			
87	Lindisfarne SPA & Ramsar	✓				
88	Littoral Cauchois SAC		✓			
89	Littoral Seino-Marin SPA	✓				
90	Loch of Strathbeg SPA & Ramsar	✓				
91	LØnstrup RØdgrund SAC		✓			
92	Margate and Long Sands SCI			✓		
93	Marwick Head SPA	✓				
94	Medway Estuary and	✓				

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
	Marshes SPA & Ramsar					
95	Minsmere-Walberswick SPA & Ramsar	✓				
96	Montrose Basin SPA & Ramsar	✓				
97	Moray and Nairn Coast SPA & Ramsar	✓				
98	Mousa SPA	✓				
99	Muhlenberger Loch/Nesssand SCI		✓			
100	Nationalpark Niedersächsisches Wattenmeer SCI		✓			
101	Noordzeekustzone SAC		✓	✓	✓	
102	Norfolk Valley Fens SAC					✓
103	North Caithness Cliffs SPA	✓				
104	North Norfolk Coast SPA & Ramsar	✓				
105	North Norfolk Sandbanks and Saturn Reef SAC			✓		
106	Northumbria Coast SPA & Ramsar	✓				
107	Noss SPA	✓				
108	NTP S-H Wattenmeer und angrenzende Küstengebiete SAC		✓			
109	Oosterschelde SAC		✓			
110	Orfordness - Shingle Street SAC			✓		
111	Östliche Deutsche Bucht SPA	✓				
112	Ouessant-Molène SAC		✓			
113	Outer Thames Estuary SPA	✓				
114	Panache De La Gironde Et Plateau Rocheux De Cordouan SAC		✓			
115	Papa Stour SPA	✓				
116	Papa Westray (North Hill and Holm) SPA	✓				
117	Paston Great Barn SAC					✓
118	Pentland Firth Islands SPA	✓				
119	Pertuis Charentais SAC		✓			

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
120	Portsmouth Harbour SPA & Ramsar	✓				
121	Presqu'ile De Crozon SAC		✓			
122	Ramsar-Gebiet S-H Wattenmeer und angrenzende Küstengebiete SPA	✓				
123	Récifs Gris-Nez Blanc-Nez SCI		✓	✓		
124	Ridens et dunes hydrauliques du détroit du Pas-de-Calais SCI		✓	✓		
125	River Derwent SAC				✓	
126	River Wensum SAC					✓
127	Ronas Hill - North Roe and Tingon SPA	✓				
128	Rousay SPA	✓				
129	Sandbanker ud for Thorsminde SAC		✓			
130	Sandbanker ud for Thyboron SAC		✓			
131	SBZ 1 / ZPS 1 SAC		✓			
132	SBZ 2 / ZPS 2 SAC		✓			
133	SBZ 3 / ZPS 3 SAC		✓			
134	Scanner Pockmark SAC			✓		
135	Schleswig-Holsteinisches Elbastuar und angrenzende Flachen SAC		✓			
136	Seevogelschutzgebiet Helgoland SPA	✓				
137	Skagens Gren og Skagerrak SAC		✓			
138	Solent and Southampton Water SPA & Ramsar	✓				
139	Southern North Sea cSAC		✓			
140	St Abb`s Head to Fast Castle SPA	✓				
141	Steingrund SAC		✓			
142	Store Rev SCI		✓			
143	Stour and Orwell Estuaries SPA & Ramsar	✓				

No.	Designated site	Ornithology	Marine Mammals	Benthic Habitats	Fish	Terrestrial
144	Sumburgh Head SPA	✓				
145	Sydlige Nordsø SAC		✓			
146	Sylter Außenriff SCI	✓				
147	Teesmouth and Cleveland Coast SPA & Ramsar	✓				
148	Thames Estuary and Marshes SPA & Ramsar	✓				
149	Thanet Coast and Sandwich Bay SPA & Ramsar	✓				
150	Thanet Coast SAC			✓		
151	The Broads SAC					✓
152	The Swale SPA & Ramsar	✓				
153	The Wash and North Norfolk Coast SAC		✓	✓		
154	The Wash SPA & Ramsar	✓				
155	Thyboron Stenvolde SCI		✓			
156	Tregor Goëlo SAC		✓			
157	Troup, Pennan and Lion`s Heads SPA	✓				
158	Unterelbe SCI		✓			
159	Unterems und Außenems SCI		✓			
160	Vadehavet med Ribe Å, Tved Å og Varde Å vest for Varde SAC		✓			
161	Vlaamse Banken SAC		✓	✓	✓	
162	Vlakte van de Raan SCI/SAC		✓		✓	
163	Voordelta SAC and SPA	✓	✓	✓	✓	
164	Waddenzee SPA	✓				
165	Waddenzee SAC		✓	✓		
166	West Westray SPA	✓				
167	Westerschelde & Saeftinghe SAC		✓		✓	
168	Ythan Estuary, Sands of Forvie and Meikle Loch SPA	✓				

ANNEX 2: SCREENING MATRICES (STAGE 1)

Screening matrices key

The following abbreviations/symbols are used within the screening matrices:

- ✓ = agreement between Interested Parties and the Applicant that LSE **cannot** be excluded
- **?** = no agreement between Interested Parties and the Applicant that a LSE can be excluded, or no information provided for the feature/impact*
- × = agreement between Interested Parties and the Applicant that LSE **can** be excluded
- C = construction
- O = operation
- D = decommissioning

* For the purpose of these matrices, a precautionary view has been adopted and features have been screened in and taken forward to the integrity matrices in Annex 3.

Where effects are not applicable to a particular feature they are greyed out.

1) FLAMBOROUGH & FILEY COAST SPA

EU Code: UK9006101													
Distance to NSIP: 205km													
European site features*	**Likely effects of NSIP**												
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination			
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	
Black-legged kittiwake (breeding)		✓ **a**		× b	× b	× b	× b	× b	× b	× c	✓ **a**	× c	
Northern gannet (breeding)		✓ **d**		× e	✓ e, **f**	× e	× g	× g	× g	× c	✓ **d, h**	× c	
Common guillemot (breeding)		× i		× j	✓ **k**	× j	× j	× l	× j	× c	✓ **m**	× c	
Razorbill (breeding)		× i		× j	✓ **k**	× j	× j	× l	× j	× c	✓ **m**	× c	
Seabird assemblage (including puffin)		× i, n		× j, n	✓ **k, n**	× j, n	× j,n	× l,n	× j,n	× c, n	✓ **m,** n	×c, n	

KITTIWAKE

(a) **<u>Collision mortality</u>** – The Applicant's screening matrix [AS-044] stated that Band model estimates of collision mortality indicate that LSE cannot be ruled out at the screening stage.

(b) **<u>Displacement/disturbance/barrier effects</u>** - Flamborough and Filey Coast (FFC) pSPA is 205km from the Norfolk Vanguard (NV) site. Thaxter et al. (2012) report a mean foraging range of breeding kittiwakes as 24.8km, and a maximum recorded foraging distance of 120km. RSPB have recorded one or two even longer foraging distances. However, it is exceptional for breeding kittiwakes to travel more than 200km from the colony when foraging. The Applicant's initial screening matrix [AS-006] stated that the NV site therefore represents no barrier or loss of foraging habitat for breeding kittiwakes at FFC SPA. Migrating

birds may avoid the wind farm, so could be affected by a barrier effect or loss of foraging habitat. However, since many kittiwakes from UK colonies migrate to Canadian waters, the Applicant considered that the scale of any habitat loss or barrier effect is negligible for this species in the context of migrations over tens of thousands of kilometres.

The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

ALL FEATURES

(c) **In-combination effects (construction and decommissioning)** - The Applicant's screening matrix [AS-044] stated that the predicted effect attributable to NV is so small that it would not significantly contribute to or alter the overall in-combination assessment for these features at FFC SPA.

GANNET

(d) **Collision mortality** - The Applicant's screening matrix [AS-044] stated that Band model estimates of collision mortality indicate that LSE cannot be ruled out at the Screening stage.

(e) **Construction and decommissioning displacement/disturbance**– the Applicant's screening matrix [AS-044] notes that construction and decommissioning impacts are temporary and localised therefore LSE can be ruled out. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

(f) **Operational displacement** – The Applicant's screening matrix [AS-044] states that FFC SPA is 205km from the NV site. Thaxter et al. (2012) report a mean foraging range of breeding gannets as 92.5km, and a maximum recorded distance of 590km. The NV site is therefore considerably beyond the mean foraging range of breeding gannets, but within their maximum range. Breeding gannets from FFC SPA may therefore be affected by displacement and barrier effects. However, Searle et al. (2014) found that even with offshore wind farms located considerably closer to a gannet breeding colony, impacts of displacement and barrier effects were negligible for this species because of its very long foraging range and large area used for foraging. However, Natural England (NE) [RR-106] raised concerns regarding uncertainty in the abundance estimates used in the Applicant's operational displacement assessment. The Applicant responded with the Operational Auk and Gannet Displacement: update and clarification note (Appendix 3.3 of [REP1-008]) which presented revised displacement impact predictions from 60-80% displacement and 1% mortality (Table 5) for the project alone.

The Applicant confirmed that the gannet Biologically Defined Minimum Population Scales (BDMPS) used to apportion impacts in the non-breeding season to the Flamborough & Filey Coast SPA were those presented for the UK North Sea and Channel in Furness (2015) (Q23.44 of [REP1-007], however NE stated it could not obtain the same figures used by the Applicant (Q23.44 in [REP2-

036]). It requested clarity regarding the non-breeding season used by the Applicant [REP3-051] and advised there was a LSE on gannet from operational displacement from the project alone ([REP1-049], comments on Appendix 3.3 in [REP3-051]). The Applicant (Q23.78 of [REP4-040]) subsequently stated that less than 1 individual from the FFC would be at risk of displacement mortality across the entire non-breeding period and this result would only be very slightly altered if NE's alternative estimated apportioning rates were used. It did not consider gannet to be a species of concern with regard to displacement impacts due to its wide-ranging habits, varied prey and as very few gannets were recorded at NV during the breeding season (Q23.80 of [REP4-040]). It therefore considered a LSE could be ruled out due to gannet displacement from NV alone. However, NE advised that a LSE could not be ruled out for the project alone [REP6-032] and the Applicant's updated screening matrices [AS-044] screen in a LSE.

(g) **Barrier effects** – The Applicant's updated screening matrix [AS-044] states that gannets are not considered at risk of barrier effects due to their wide ranging habits, and migrating gannets cover very large distances, extending from the North Sea to West Africa, so that slight local effects would be negligible in the context of their large migrations and area use, therefore LSE can be ruled out.

(h) **In-combination displacement** – In-combination displacement was not addressed in the Applicant's screening matrix [AS-044]. However, The HRA Report concluded there would be no potential for an LSE from displacement effects for gannets from FFC SPA alone or cumulatively during any period of the year (paragraphs 50 and 202 of [APP-045]).

NE [RR-106] advised that the Applicant should undertake a similar approach to gannet cumulative displacement as it did for auks i.e. to sum the bird abundance estimates for each relevant offshore wind farm and put this total through a displacement matrix, and then assess with a range of displacement of 60-80% and mortality of 1-10%. The Applicant (response to Q23.5 [REP1-007]) considered that it had utilised the appropriate ecological information for gannet and that the predicted displacement impact was extremely small and provided sufficient justification to rule out a LSE for the project alone and in-combination. It explained (Q23.81 of [REP4-040]) that gannet in-combination displacement assessment had not been required for previous offshore wind farm applications, therefore there were no assessments upon which it can build.

NE has not explicitly stated it considers there to be a LSE; however, the ExA has progressed this feature to the integrity matrix on the basis that NE has confirmed it considers there to be a LSE from displacement for the project alone [REP6-032]. In addition, the Applicant's Deadline 6 response [REP6-021] referred to AEOI; therefore the ExA has progressed this feature to the integrity matrix.

GUILLEMOT, RAZORBILL AND PUFFIN

(i) **Collision mortality** - The Applicant's revised screening matrix [AS-044] stated that common guillemots, razorbills and puffins tend to fly low over the sea so have a very low risk of collision mortality, therefore a LSE can be ruled out. The Applicant's screening matrices [AS-044] also explained that FFC SPA is 205km from the NV site. Thaxter et al. (2012) report a mean foraging range of breeding common guillemots as 37.8km, and a maximum recorded distance of 135km. Thaxter et al. (2012) report a mean foraging range of breeding razorbills as 23.7km, and a maximum recorded distance of 95km. The Applicant concluded that the NV site is therefore considerably beyond the normal foraging range of breeding common guillemots and razorbills from FFC SPA. It is therefore unlikely that any breeding adults from FFC SPA are at collision risk at the NV site during the breeding season. During the nonbreeding season, birds from FFC SPA are likely to be mixed with the large BDMPS populations of these species so that apportioning of the impact of the low level of collision mortality apportions a negligible impact to FFC SPA. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

(j) **Construction and decommissioning displacement/disturbance and barrier effects -** The Applicant's updated screening matrix [AS-044] stated that construction and decommissioning impacts are temporary and localised therefore LSE can be ruled out. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

(k) **Operational displacement/disturbance** - The Applicant's HRA Report [APP-045] ruled out the potential for a LSE to auks from operational displacement from the project alone and in-combination. The Applicant's updated screening matrix [AS-044] stated that the NV site is considerably beyond the normal foraging range of these species from FFC SPA. It is therefore unlikely that any breeding adults from FFC SPA will be present at NV during the breeding season. During the nonbreeding period, birds from FFC SPA are likely to be mixed with the large BDMPS populations of these species so that apportioning of the impact of the low level of displacement to this very large BDMPS population apportions a negligible impact to FFC SPA. However, the Applicant [AS-044] noted that NE consider an LSE cannot be ruled out and therefore concluded a LSE.

(l) **Operational barrier effects -** The Applicant's screening matrix [AS-044] stated that since NV is beyond the normal foraging range of breeding common guillemots, razorbills and puffins from FFC SPA, there will be no breeding season barrier impact for those populations. During the nonbreeding period birds from FFC SPA are likely to be mixed with the large BDMPS populations of these species so that apportioning of the impact of the low level of displacement to this very large BDMPS population apportions a negligible impact to FFC SPA. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

(m) **In-combination operational displacement** – The Applicant's HRA Report [APP-045] ruled out the potential for a LSE to auks from operational displacement from the project alone and in-combination. Whilst NE [RR-106] agreed that mortality for auks is likely to be at the low end of the range, it did not agree to the use of a 1% mortality rate for the in-combination displacement assessment. It advised a range of mortality rates from 1-10% and displacement rates of 30-70% (ie the same as was used by the Applicant for the assessment of auk displacement from the project alone). This position was supported by the Royal Society for the Protection of Birds (RSPB) [REP2-034][REP4-070]. NE also requested the assessments considered uncertainty in the abundance

estimates by providing displacement predictions using lower and upper 95% confidence intervals and [RR-106]23. In response, the Applicant presented revised operational displacement impact predictions for puffin, razorbill and guillemot covering a range of displacement and mortality rate scenarios for both the project alone and in-combination with other windfarms (Appendix 3.3 of [REP1-008]). It concluded [REP5-004] that NV would, at most, cause the mortality of 10 guillemots and 4 razorbills from the FFC SPA populations of c. 40,000 pairs and 10,000 pairs respectively; levels of impact so small they would not make a detectable contribution to an in-combination impact therefore an LSE can be ruled out.

The Applicant (Appendix 3.3 of [REP1-008]) also provided a review of auk displacement evidence and argued that a 50% displacement rate and a 1% mortality rate was precautionary for guillemot and razorbill. However, NE (comments on Appendix 3.3 in [REP3-051]) argued that studies have shown varying displacement effects of razorbills and guillemots and that that Applicant had not provided 'much actual evidence to justify a 1% mortality rate as being precautionary'. It also identified errors in the Applicant's data, raised concerns with the assessment and noted that the Applicant had not provided evidence for puffin. Therefore, NE reiterated the need to consider predicted impacts across the range of values it had recommended in its relevant representation and confirmed that it did not agree with the Applicant's decision to screen out a LSE from operational in-combination displacement on common guillemot, razorbill and seabird assemblage, including Atlantic puffin.

Although the Applicant stated at Deadline 5 that a LSE can be ruled out for in-combination displacement [REP5-004], it's updated screening matrices [AS-044] screened in a LSE.

SEABIRD ASSEMBLAGE

(n) The seabird assemblage was not included in the Applicant's screening matrix [AS-044], however is present on the Natural England Conservation Objectives for the site[24]. NE has raised concerns regarding puffin (see footnote (l) of this matrix). For the purpose of this matrix, the ExA has drawn the same conclusions as for other auks.

[23] Note this statement (para 4.2.5 of [APP-045]) was stated to apply to all relevant species

[24] http://publications.naturalengland.org.uk/publication/5400434877399040 (accessed on 15 April 2019)

2) GREATER WASH SPA

EU Code: UK9020329												
Distance to NSIP: 0km from the export cable; 36km from the array area												
European site features	**Likely effects of NSIP**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Little tern (breeding)		× a		× a	× a	× a		× a		× a	× a	× a
Common tern (breeding)		× a		× a	× a	× a		× a		× a	× a	× a
Sandwich tern (breeding)		× a		× a	× a	× a		× a		× a	× a	× a
Red throated divers (non-breeding)		× b		✓ **c**	✓ **d**	× e		× b		✓ **c**	✓ **d**	× j
Little gull (non-breeding)		✓ **f**		× g	× g	× g		× g		× j	✓ **f**	× j
Common scoter (non-breeding)		× h		**?** h, **i**	**? i**	× h		× h		× j	**? i**	× j

LITTLE TERN, COMMON TERN AND SANDWICH TERN

(a) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's HRA Report [APP-045] stated that the mean maximum foraging range of breeding terns was reported by Thaxter et al. (2012a) to be 6.3km for little tern, 15.2km for common tern and 49km for Sandwich tern. The Applicant's screening matrix noted that, the tern colonies are at locations along the Norfolk coast which are beyond these foraging distances from the NV site. Therefore, the Applicant ruled out connectivity between the SPA and NV site on the basis of distance. Furthermore, these species tend to forage in coastal waters rather than

offshore. Hence, collision risk, displacement and barrier effects were excluded by the Applicant. NE confirmed that it agreed with the Applicant's decision to screen out a LSE to terns [REP3-051].

RED-THROATED DIVERS (RTDs)

(b) **Collision mortality and barrier effects** - The Applicant's screening matrix [AS-044] stated that RTDs fly close to the sea surface and are therefore at extremely low risk of collisions or barrier effects. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

(c) **Construction disturbance/displacement** - The Applicant's screening matrix [AS-044] stated that LSE cannot be ruled out at the screening stage as LSE from displacement/disturbance to nonbreeding red-throated divers as a result of construction work (specifically for export cable laying operations through part of the Greater Wash SPA) may occur.

(d) **Operational disturbance/displacement** - The Applicant's screening matrix [AS-044] stated that displacement/disturbance of RTD during operation is considered negligible as the increase in vessel traffic within the SPA due to NV would be negligible compared to the current baseline. However, NE considered that a LSE should be screened in due to the possibility of disturbance/displacement of RTDs from operations and maintenance vessels [RR-106][REP1-049]. It acknowledged that impacts would depend on the operations and maintenance (O&M) port (not yet determined) and whether vessels would pass through the SPAs.

NE [RR-106][REP1-088] also noted that the Applicant's assessment of operational displacement at NV west had used only data for birds on water, whereas SNCB guidance is to use data for birds in flight and on water. The Applicant acknowledged this error and updated the assessment (Appendix 3.1 - Red Throated Diver Displacement [REP1-008]) with the correct data.
The Applicant submitted a note on Red Throated Diver Displacement (Appendix 3.1 of [REP1-008]). It noted that the operation and maintenance would result in the addition of 1.2 vessel movements per day which would result in small changes from the baseline given the extent of existing vessel movements (almost 100 vessel movements per day). NE [REP1-088] advised that this would be a 1% increase to the baseline and could cause disturbance and that consideration be given to the speed at which the operation and maintenance vessels move. [REP3-051]. The Applicant's updated screening matrix [AS-044] subsequently screened in a LSE for this impact, both alone and in-combination.

(e) **Decommissioning disturbance/displacement** - The Applicant's screening matrix [AS-044] stated that displacement/disturbance of red-throated diver during decommissioning is considered negligible as the increase in vessel traffic within the SPA due to NV would be negligible compared to the current baseline. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

LITTLE GULL

(f) **Collision mortality** - The Applicant's screening matrix [AS-044] stated that there is potential for little gull connectivity between the SPA and the NV site, therefore LSE cannot be ruled out at screening for collision risk impacts to nonbreeding little gull.

(g) **Disturbance/displacement** - The Applicant's screening matrix [AS-044] stated that displacement of little gulls by offshore wind farms appears to be negligible and there would be no LSE for this SPA feature as a consequence of displacement or barrier effects. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

COMMON SCOTER

(h) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that surveys found no common scoters in the NV site since this species favours waters <20m in depth. Common scoter was also only present at very low densities along the export cable route, therefore no LSE for this SPA feature is predicted. The Applicant's conclusions relating to collision mortality or barrier effects were not disputed during the examination, however see footnote (i) of this matrix regarding disturbance/displacement.

(i) **Disturbance/displacement** - NE did not agree with the Applicant's decision to screen out the feature common scoter ([REP1-088], comments on Appendix 23.1 in [REP3-051] and [REP6-032]). It considered that "*the LSE screening should be a coarse filter and as the offshore cable route passes through the Greater Wash SPA, this would indicate a potential impact pathway for species sensitive to disturbance/displacement from the presence of vessels and hence an LSE concluded for the common scoter, RTD and tern qualifying features*[25]*. The analysis of whether the cable corridor overlaps spatially with the distributions of these species should then be considered within the Appropriate Assessment*" (Q23.41 of [REP1-088]). The Applicant (Q23.85 of [REP4-040]) considered NE was unnecessarily precautionary due to the very low likelihood of spatial overlap and a realistic period of installation through the SPA measured in weeks and continued to conclude the risk of LSE can be excluded [REP7-059][AS-044]. However, taking a precautionary view, the ExA has progressed this feature to the integrity matrix for effects both alone and in-combination.

ALL FEATURES

(j) **In-combination effects** - The Applicant's screening matrix [AS-044] stated that the predicted effect attributable to NV is so small that it would not significantly contribute to or alter the overall in-combination assessment for these features at Greater Wash SPA.

[25] As noted in footnote (a), NE subsequently agreed with the Applicant's decision to screen out impacts to sandwich tern, common tern and little tern of the Greater Wash SPA [REP3-051]

3) OUTER THAMES ESTUARY SPA and pSPA*

EU Code: UK9020309A												
Distance to NSIP: 21km												
European site features	**Likely effects of NSIP**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Red throated divers (non-breeding)		× a		× b	✓ **c**	× d		× a		× e	✓ **c**	× e
Little tern (breeding)		× f		× f	× f	× f		× f		× f	× f	× f
Common tern (breeding)		× f		× f	× f	× f		× f		× f	× f	× f

* As noted in the main text of this RIES, the Applicant's updated screening matrices [AS-044] also referred to the Outer Thames Estuary Extension pSPA; this was the first mention of the pSPA within the examination. For the purposes of this RIES, the ExA has applied the same conclusions of the Outer Thames Estuary SPA to the pSPA.

RED-THROATED DIVERS (RTDs)

a) **Collision mortality and barrier effects -** The Applicant's screening matrix [AS-044] stated that RTDs fly close to the sea surface and are therefore at extremely low risk of collisions or barrier effects. Survey data indicate a negligible risk of collision mortality or of a barrier effect. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

b) **Construction displacement/disturbance** - The Applicant's screening matrix [AS-044] stated that Great Yarmouth may be used as a port for construction vessels for the NV site; this port is located very close to the northern extent of the SPA however is outside the main concentrations of RTDs. This, together with the extent of existing vessel movements in the area means the addition of construction traffic as a result of NV would make little difference to the existing baseline and therefore the Applicant considered the potential for LSE to be negligible. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

c) **Operational displacement/disturbance** - The Applicant's initial screening matrix [AS-006] stated that displacement/ disturbance during operation is considered negligible as the increase in vessel traffic within the SPA due to NV would be negligible compared to the existing baseline. However, NE considered that a LSE should be screened in due to the possibility of disturbance/displacement of RTDs from operations and maintenance vessels [RR-106][REP1-049]. It acknowledged that impacts would depend on the operations and maintenance (O&M) port (not yet determined) and whether vessels would pass through the SPAs. The Applicant stated that Great Yarmouth may be used as a port and argued that it is located very near the northern edge of the Outer Thames Estuary SPA and outside the main concentrations of RTDs. It considered that the magnitude of potential impact would be very small (approximately 1.2 vessel movements per day) and that the additional movements from NV would result in small changes from the baseline given the extent of existing vessel movements (almost 100 vessel movements per day); therefore the risk of LSE was ruled out (Q23.13 and Q23.14 of [REP2-044] and Appendix 3.1 – Red Throated Diver Displacement [REP1-008]).

   NE [REP3-051] advised that consideration be given to the speed at while the operation and maintenance vessels move. Following NE's advice, the Applicant's updated screening matrix [AS-044] subsequently screened in a LSE for both the project alone and in-combination.

d) **Decommissioning displacement/disturbance** - The Applicant's screening matrix [AS-044] stated that displacement/ disturbance during decommissioning would be negligible as the increase in vessel traffic within the SPA due to NV would be negligible compared to the existing baseline. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

e) **In-combination effects** - The Applicant's screening matrix [AS-044] stated that the predicted effect attributable to NV is so small that it would not significantly contribute to or alter the overall in-combination assessment for these features in the Outer Thames Estuary SPA. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination)

LITTLE TERN AND COMMON TERN

f) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that little tern and common tern have maximum foraging ranges from colonies of 11km and 30km respectively (Thaxter et al. 2012), which suggests there could be connectivity between the SPA and NV site, however this is the distance to the seaward edge of the SPA, and the coastal colonies are beyond foraging range of the NV OWF sites . Furthermore, these species tend to forage in coastal waters rather than offshore and since the breeding colonies are beyond foraging range connectivity can be ruled out. Therefore, collision risk, displacement and barrier effects were excluded by the Applicant. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

4) NORFOLK VALLEY FENS SAC

EU Code: UK0012892

Distance to NSIP: 0.6-5km (5 sites within 5km)

European site features	**Likely effects of NSIP**																										
	Direct effects (e.g. habitat loss) on land within 5km			Impacts on features outside 5km of the onshore project area			Impacts on ex-situ habitats functionally connected to the SAC			Disturbance due to ground-water / hydrology changes within 5km			Effects from noise disturbance within 5km			Effects from changing air quality within 5km			Effects from light disturbance within 5km			Effects from visual disturbance within 5km			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Northern Atlantic wet heaths with *Erica tetralix*	× a		× a	× b		× b	× c	× c	× c	✓ **d**	✓ **d**	✓ **d**	× e		× e	✓ **d**		✓ **d**	× e		× e	× e		× e	✓ **f**	✓ **f**	✓ **f**
European dry heaths	× a		× a	× b		× b	× c	× c	× c	✓ **d**	✓ **d**	✓ **d**	× e		× e	✓ **d**		✓ **d**	× e		× e	× e		× e	✓ **f**	✓ **f**	✓ **f**
Semi-natural dry grassland and scrubland facies on calcareous substrates (*Festuco-Brometalia*)	**? g**		**? g**	**? g**		**? g**	**? g**	**? g**	**? g**	**? g**	**? g**	**? g**	**? g**		**? g**	**? g**		**? g**	**? g**		**? g**	**? g**		**? g**	**? g**	**? g**	**? g**
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	× a		× a	× b		× b	× c	× c	× c	✓ **d**	✓ **d**	✓ **d**	× e		× e	✓ **d**		✓ **d**	× e		× e	× e		× e	✓ **f**	✓ **f**	✓ **f**
Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	× a		× a	× b		× b	× c	× c	× c	✓ **d**	✓ **d**	✓ **d**	× e		× e	✓ **d**		✓ **d**	× e		× e	× e		× e	✓ **f**	✓ **f**	✓ **f**

Alkaline fens	× a		× a	× b		× b	× c	× c	× c	✓ **d**	✓ **d**	✓ **d**	× e		× e	✓ **d**		✓ **d**	× e		× e	× e		× e	✓ **f**	✓ **f**	✓ **f**
Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*)	× a		× a	× b		× b	× c	× c	× c	✓ **d**	✓ **d**	✓ **d**	× e		× e	✓ **d**		✓ **d**	× e		× e	× e		× e	✓ **f**	✓ **f**	✓ **f**
Narrow-mouthed whorl snail	**? g**		**? g**	**? g**		**? g**	**? g**	**? g**	**? g**	**? g**	**? g**	**? g**	**? g**		**? g**	**? g**		**? g**	**? g**		**? g**	**? g**		**? g**	**? g**	**? g**	**? g**
Desmoulin's whorl snail	**? g**		**? g**	**? g**		**? g**	**? g**	**? g**	**? g**	**? g**	**? g**	**? g**	**? g**		**? g**	**? g**		**? g**	**? g**		**? g**	**? g**		**? g**	**? g**	**? g**	**? g**

NORTHERN ATLANTIC WET HEATHS WITH *ERICA TETRALIX,* EUROPEAN DRY HEATHS, MOLINIA MEADOWS ON CALCAREOUS, PEATY OR CLAYEY-SILT-LADEN SOILS (*MOLINION CAERULEAE*), CALCAREOUS FENS WITH *CLADIUM MARISCUS* AND SPECIES OF THE *CARICION DAVALLIANAE,* ALKALINE FENS AND ALLUVIAL FORESTS WITH *ALNUS GLUTINOSA* AND FRAXINUS EXCELSIOR (*ALNO-PADION, ALNION INCANAE, SALICION ALBAE*)

a) **Direct impacts on features within 5km** – The Applicant's screening matrix [AS-044] stated that direct impacts on features within 5km of the onshore project area have been screened out as they are beyond the range of potential direct impact. The HRA Report [REP-045] confirmed that all sites which comprise Norfolk Valley Fens are located 570m or more from onshore infrastructure. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

b) **Impacts on the features of the Norfolk Valley Fens SAC beyond 5km of the onshore project area** - The Applicant's screening matrix [AS-044] stated that direct impacts on the features of the Norfolk Valley Fens SAC beyond 5km of the onshore project area have been screened out due to distance. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

c) **Impacts on ex-situ habitats functionally connected to the SAC -** The Applicant's screening matrix [AS-044] stated that effects of the project on ex-situ habitats functionally connected to the SAC have been screened out from further assessment as qualifying features of the SAC are all habitats or non-mobile species. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

d) **Disturbance due to groundwater/hydrology and air quality changes** - The Applicant's screening matrix [AS-044] screened in a LSE from potential indirect effects due to alterations to the groundwater/hydrology regime and air quality changes (5 component SSSIs have therefore been screened in to further assessment).

e) **Effects from noise, visual or light disturbance** - The Applicant's screening matrix [AS-044] stated that the qualifying features of the Norfolk Valley Fens SAC are not sensitive to noise, visual, or light disturbance and therefore there is no potential LSE and these have been screened out. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

f) **In-combination effects** were not addressed in the Applicant's screening matrix [AS-044], however were included within the Applicant's integrity matrix [REP7-035]. As a LSE has been screened in for impacts from the project alone, the ExA has progressed this feature to the integrity matrix for in-combination effects.

SEMI-NATURAL DRY GRASSLANDS AND SCRUBLAND FACIES ON CALCAREOUS SUBSTRATES, NARROW MOUTHED WHORL SNAIL and DESMOULIN'S WHORL SNAIL

g) The HRA Report explained that the Norfolk Valley Fens are comprised of 17 separate sites; 5 of which fall within 5km of the onshore infrastructure, and only one (Booton Common Site of Special Scientific Interest (SSSI)) is located within 1km (the maximum extent of zone of influence). The Applicant explained that the Booton Common SSSI citation did not include the 'semi-natural dry grasslands and scrubland facies on calcareous substrates', 'narrow mouthed whorl snail' or 'Desmoulin's whorl snail' features (paragraph 102 of [APP-045]), as such they were not considered further in the assessment and a LSE was screened out of the Applicant's matrices [AS-044].

Nevertheless, NE identified these as features for which concerns remain (response to Q23.61 [REP1-088]), although it did not provide reasons in support of their concern. For the purpose of these matrices, the ExA has progressed the features to the integrity matrix on a precautionary basis.

5) BROADLAND SPA AND RAMSAR SITE

EU Code: SPA - UK9009253; Ramsar – UK11010																
Distance to NSIP: 53km (offshore project area); 3.6km (onshore project area)																
	Likely effects of NSIP															
	Collision mortality			*Displacement/ disturbance*			*Barrier effects*			*Impacts to habitats*			*In-combination*			
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	
SPA qualifying features																
Great bittern *(breeding)*		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Bewick's swan (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Whooper swan (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Eurasian wigeon (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Gadwall (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Northern shoveler (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Eurasian marsh harrier (breeding)		✓ b, **c**		× b	× b	× b		× b		**? d,** e			**? d**	✓ **c,** f	× f	
Hen harrier (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Ruff (non-breeding)		✓ a, **c**		× a	× a	× a		× a		**? d,** e			**? d**	✓ **c,** f	× f	
Ramsar criterion																
Ramsar criterion 2: rare species and habitats within the										× e			× e	× e	× e	

biogeographical zone context															
Ramsar criterion 6: species/populations occurring at levels of international importance (tundra swan, Eurasian wigeon, gadwall, Northern shoveler, pink-footed goose and greylag goose)		? g		? g	? g	? g		? g		? g			? g	? g	? g

BEWICK'S SWAN, WHOOPER SWAN, GADWALL, NORTHERN SHOVELER, RUFF, BITTERN AND HEN HARRIER

a) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's updated screening matrix [AS-044] stated that survey data show no evidence of these Broadland SPA features occurring in the onshore project area, and that migrations of birds from this SPA are likely to result in negligible numbers passing through the onshore project area during migration.

The Applicant's conclusions regarding displacement/disturbance and barrier effects have not been disputed by any IPs (by Deadline 7 of the examination), however see footnote (c) of this matrix regarding collision mortality.

MARSH HARRIER

b) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's updated screening matrix [AS-044] did not include marsh harrier, however the Applicant's initial screening matrix [AS-006] stated that marsh harrier is a migrant species. Satellite tracking suggests that marsh harriers migrate overland to the south coast of England and over the Channel to France, rather than across the North Sea and a LSE was screened out.

The Applicant's conclusions regarding displacement/disturbance and barrier effects have not been disputed by any IPs (by Deadline 7 of the examination), however see footnote (c) of this matrix re collision mortality.

ALL SPA FEATURES

c) **Collision mortality (alone and in-combination)**- The Applicant's HRA Report [APP-045] and initial screening matrix [AS-006] did not specifically address non-seabird migrant collision. However, Section 13.6.2.2 of ES Chapter 13 [APP-337] explained that collision risk for non-seabird migrants (including waders and wildfowl) had been assessed for the adjacent East Anglia THREE wind farm based on knowledge of migration flight paths and migratory population sizes. Modelling was undertaken for 23 species and none were at risk of significant collision whilst on migration. The Applicant stated that the migrant collision assessment used wide migration corridors which also covered NV, therefore results from this assessment would be almost identical to those which would be generated for NV.

NE [RR-106][REP1-049] did not agree with this approach, advising that the species are considered for migration modelling and CRM using the NV turbine specifications and site locational information. It noted there are SPAs with Bewick's swan and avocet as qualifying features located on the Norfolk Coast that are in the shadow of NV. NE advised that coastal SPAs with wintering waterbirds as qualifying species (namely Broadland SPA, Breydon Water SPA and potentially the North Norfolk Coast SPA) should be screened in (Q 23.53 of [REP1-088]). NE also advised that cumulative CRM impacts on non-seabird migrants should be assessed as Vanguard East is located immediately north of East Anglia 3 and so birds migrating north and south may encounter both sites. Also, if NV is built across both Vanguard East and Vanguard West then birds migrating east-west could encounter both sites.

At Deadline 3, the Applicant provided collision estimates for the NV project alone and cumulatively with the adjacent East Anglia THREE Offshore Wind Farm [REP3-038]. Collision mortality was calculated using the migrant extension of the Band (2012) CRM with avoidance rates from 98 to 99.8% (the most appropriate precautionary rate for each species were highlighted). The Applicant concluded that there would be no LSE of the features of the SPAs due to collision mortality either from the project alone of cumulatively with East Anglia THREE wind farm (Q23.70 of [REP4-040]). Nevertheless, the Applicant's updated screening matrix [AS-044] subsequently concluded a LSE for both the project alone and in-combination.

ALL SPA FEATURES AND RAMSAR CRITERION 2

Impacts to habitats

d) **Ex-situ habitats** - The HRA Report [APP-045] noted that wintering qualifying features of the Broadland SPA are likely to utilise a range of supporting habitats outside the boundary of the SPA (ex-situ habitats) over the winter months. However, the Applicant explained that wintering bird surveys of the ex-situ habitats recorded waterbird counts that are considered to not be of a scale of national or greater importance, or to be a significant component of the Broadland SPA and Ramsar [APP-045] and

[AS-044]. Consequently, these ex-situ habitats are not considered to be important habitats for the qualifying features of the Broadland SPA and Ramsar and a LSE was screened out by the Applicant.

However, NE [RR-106] advised that the low numbers of qualifying bird species may have been due to the cropping regime at the time of the survey. The Applicant (response to Q23.49 [REP1-007]) explained that a single year of surveys was agreed with NE during the evidence plan process; this was acknowledged by NE [REP5-017]. The Applicant considered that the majority of crops were in place over winter within the wintering bird survey area and therefore the surveys provided a robust estimate of the use of these habitats by qualifying features of the Broadland SPA and Ramsar site.

NE did not explicitly confirm that it considers there to be a LSE, however it referred to AEOIs in [REP5-017][REP6-032]. The ExA has progressed this feature to the integrity matrix on a precautionary basis for the project alone and in-combination.

e) **In-situ habitats** – The HRA Report [APP-045] stated that Broadland SPA and Ramsar is located 3.6km from the onshore project area, therefore direct and indirect effects are screened out as the site is beyond the zone of influence of any environmental parameters associated with the construction and operation of the project.

f) **In-combination effects displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that the predicted effect attributable to NV is so small that it would not significantly contribute to or alter the overall in-combination assessment for these features at Breydon Water SPA and Ramsar.

RAMSAR CRITERION 6

g) **Collision mortality, displacement/disturbance, barrier effects** to Ramsar criterion 6 species have not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044].

6) BREYDON WATER SPA AND RAMSAR SITE

EU Code: SPA - UK9009181; Ramsar – UK11008													
Distance to NSIP: 53km													
European site features	**Likely effects of NSIP**												
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination			
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	
SPA qualifying features													
Common tern (breeding)		× a		× a	× a	× a		× a		× d	× d	× d	
Avocet (non-breeding)		✓ **b**		× c	× c	× c		× c		× d	✓ **b,** d	× d	
Bewick's swan (non-breeding)		✓ **b**		× c	× c	× c		× c		× d	✓ **b,** d	× d	
Golden plover (non-breeding)		✓ **b**		× c	× c	× c		× c		× d	✓ **b,** d	× d	
Assemblage qualification		✓ **b**		× c	× c	× c		× c		× d	✓ **b,** d	× d	
Ramsar criterion													
Ramsar criterion 5: assemblages of international importance		**? e**		**? e**	**? e**	**? e**		**? e**		**? e**	**? e**	**? e**	
Ramsar criterion 6: species/populations occurring at levels of international importance (including tundra swan, northern lapwing, and identified for possible future consideration: pink-footed		**? e**		**? e**	**? e**	**? e**		**? e**		**? e**	**? e**	**? e**	

goose, Eurasian wigeon, northern shoveler, European golden plover and black-tailed godwit)												

COMMON TERN

a) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that the SPA is far beyond the maximum foraging range of common tern (30km) so has no breeding season connectivity. Numbers of SPA common tern migrating through the NV site are likely to be extremely small relative to BDMPS. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

AVOVET, BEWICK'S SWAN, GOLDEN PLOVER, ASSEMBLAGE QUALIFICATION

b) **Collision mortality (alone and in-combination)** -See footnote (c) of the Broadland SPA and Ramsar site screening matrix within this RIES.

c) **Displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that survey data show no evidence of Breydon Water SPA features occurring in the NV site, and migrations of birds from this SPA are likely to result in negligible numbers passing through the NV site during migration. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

d) **In-combination effects displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that the predicted effect attributable to NV is so small that it would not significantly contribute to or alter the overall in-combination assessment for these features at Breydon Water SPA and Ramsar.

RAMSAR CRITERION 5 AND RAMSAR CRITERION 6

e) **Collision mortality, displacement/disturbance and barrier effects** to Ramsar criterion 5 and 6 species has not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044].

7) NORTH NORFOLK COAST SPA AND RAMSAR SITE

EU Code: SPA - UK9009031; Ramsar – UK11048												
Distance to NSIP: 80km												
European site features	**Likely effects of NSIP**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Great bittern (breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Pink-footed goose (non-breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Dark-bellied brent goose (non-breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Eurasian wigeon (non-breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Eurasian marsh harrier (breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Montagu's harrier (breeding)		**? e**		**? e**	**? e**	**? e**		**? e**		**? e**	**? e**	**? e**
Pied avocet (breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Red knot (non-breeding)		✓ **a**		× b	× b	× b		× b		× d	✓ **a**	× d
Sandwich tern (breeding)		× c		× c	× c	× c		× c		× d	× d	× d
Common tern (breeding)		× c		× c	× c	× c		× c		× d	× d	× d
Little tern (breeding)		× c		× c	× c	× c		× c		× d	× d	× d

Ramsar criterion												
Ramsar criterion 1: large expanse of undeveloped coastal habitat*												
Ramsar criterion 2: vascular plant, lichen and invertebrates*												
Ramsar criterion 5: assemblages of international importance		? f		? f	? f	? f		? f		? f	? f	? f
Ramsar criterion 6: species/populations occurring at levels of international importance (including sandwich tern, common tern, little tern, red knot, pink-footed goose, dark-bellied brent goose, Eurasian wigeon, northern pintail, and identified for possible future consideration: ringed plover, sanderling, bar-tailed godwit)		? f		? f	? f	? f		? f		? f	? f	? f

* Potential impacts to Ramsar criterion 1 and 2 species have not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044]. However, the Ramsar site is located outside of the onshore 5km screening radius detailed within the HRA Report therefore potential for effects to habitats have not been addressed within this matrix.

WIGEON, PINK-FOOTED GOOSE, BRENT GOOSE, KNOT, AVOCET

a) **Collision mortality (alone and in-combination)** - See footnote (c) of the Broadland SPA and Ramsar site screening matrix within this RIES.

b) **Displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that survey data show little or no evidence of North Norfolk Coast SPA features wigeon, pink-footed goose, brent goose, knot, avocet, or bittern

occurring in the NV site, and migrations of birds from this SPA are likely to result in negligible numbers passing through the NV site during migration. It also noted that marsh harrier is a migrant species and that satellite tracking suggests that marsh harriers migrate overland to the south coast of England and over the Channel to France, rather than across the North Sea. The Applicant's conclusions have not been disputed by any IPs (by Deadline 7 of the examination).

LITTLE TERN, COMMON TERN AND SANDWICH TERN

c) **Collision mortality, displacement/disturbance and barrier effects** - The Applicant's screening matrix [AS-044] stated that little tern, common tern and Sandwich tern have maximum foraging ranges from colonies of 11km, 30km and 54km respectively (Thaxter et al. 2012), so there is no connectivity between the SPA and NV site. Furthermore, these species tend to forage in coastal waters rather than offshore. Therefore, collision risk, displacement and barrier effects can be excluded. The Applicant's conclusion has not been disputed by any IPs (by Deadline 7 of the examination).

ALL FEATURES

d) **In-combination effects** - The Applicant's screening matrix [AS-044] stated that the predicted effect attributable to NV is so small that it would not significantly contribute to or alter the overall in-combination assessment for these features at North Norfolk Coast SPA and Ramsar.

MONTAGU'S HARRIER

e) Montagu's harrier was not included in the Applicants screening matrix [AS-044] and was not assessed by the Applicant in [APP-045] or [REP3-038]; however, it is present on the Natural England Conservation Objectives for the site.

RAMSAR CRITERIA 5 AND 6

f) Potential impacts to Ramsar criterion 5 and 6 species have not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044].

ANNEX 3: ADVERSE EFFECTS ON INTEGRITY MATRICES (STAGE 2)

Integrity matrices key

The following abbreviations/symbols are used within the integrity matrices:

- **?** = Applicant and Interested Parties do not agree that an AEOI can be excluded, or no information provided for the feature/impact
- × = AEOI **can** be excluded
- C = construction
- O = operation
- D = decommissioning

Where effects are not applicable to a particular feature they are greyed out.

1) ALDE-ORE ESTUARY SPA

EU Code: UK9009112												
Distance to NSIP: 92km												
European site features	**Adverse effect on integrity**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Lesser black-backed gulls (breeding)		**? a**, c									**? b**, c	

LESSER BLACK-BACKED GULLS

a) **Collision mortality -** The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] concluded that Band model predictions of collision mortality suggest between 9 and 27 collisions per year for lesser black-backed gulls (LBBG) (the lower value represents all turbines being located in Norfolk Vanguard (NV) East, and the higher value represents all turbines being located in NV West). It estimated the total population size during the breeding season (including urban populations) within a foraging range (141km) of the NV site to be approximately 26,000, of which birds (of all ages) associated with Alde-Ore Estuary SPA would represent approximately 25% (paragraphs 172-181 of [APP-045]). During the autumn and spring migration periods birds from Alde-Ore Estuary SPA make up 3.3% of the Biologically Defined Minimum Population Scales (BDMPS) population, and in winter these birds make up 5% of the BDMPS (paragraphs 183-184 of [APP-045]). Applying these percentages to the higher of the total collision predictions indicates a maximum Alde-Ore Estuary SPA mortality of 3 (or 6 if the extended breeding season is used, paragraphs 187-188 of [APP-045]). These represent increases of 0.3% to 0.6% on natural mortality which are below detection limits (taken as 1%) and so are considered negligible by the Applicant (paragraph 189 of [APP-045]). Consequently, the Applicant concluded there would be no AEOI of the Alde-Ore Estuary SPA from the project alone (paragraph 190 of [APP-045]). This was disputed during the examination, as detailed below.

Seasonal apportioning of impacts – NE [REP1-088][REP7-075] confirmed it was content with the apportioning rates used by the Applicant for the non-breeding season. However, NE [RR-106][REP1-088] queried the robustness of the evidence supporting the approach to apportion 25% of impacts to LBBG during the breeding season, stating that the Applicant had not taken account of the distance each colony is from the NV site, or segregation; that there may be some colonies within the foraging range that should be considered; and that the Applicant had doubled the summed urban colonies figure based on the age of the data. It advised [REP7-075] that tracking data and the Applicant's original submission documents show evidence of potential connectivity between LBBGs from the Alde-Ore Estuary SPA and NV. RSPB [RR-197][REP1-110] similarly disagreed with the Applicant's methods and considered it unlikely that urban gulls would forage offshore to the same extent as those breeding at coastal 'natural' colonies and that the inclusion of urban birds therefore dilutes the potential significance of the impact. NE and the RSPB advocated the approach in Scottish Natural Heritage (SNH) guidance 2018 which is based on foraging range and colony factors [REP1-112][REP7-083].

The Applicant (response to Q23.35 of [REP1-007] and WQ 23.71 of [REP4-040]) responded stating that tracking data indicated very low connectivity between breeding LBBG at Alde-Ore Estuary SPA and the NV site. It concluded that less than 3.5% of the LBBGs at NV during chick-rearing period are likely to originate from the Alde-Ore Estuary SPA and therefore considered apportioning 25% of breeding season impacts to the SPA as highly precautionary.

However, NE (Q23.35 [REP2-036] [REP3-051][REP4-062]) advised that tracking data would vary between years and that the foraging behaviour of town colonies still required consideration. RSPB [REP2-035][REP4-070] did not agree that diets from urban and rural coastal colonies would be similar and its position on apportionment remained unchanged.

At Deadline 6, the Applicant (Section 2.4 of [REP6-021]) explained that the LBBG mean breeding season foraging range is 72km from colonies; the mean maximum foraging range is 141km; and a maximum recorded foraging range is 181km. The Alde-Ore Estuary SPA is 92km and is the only British LBBG SPA colony within maximum foraging range from NV; non-SPA LBBG colonies also exist, including urban colonies in Suffolk & Norfolk and it is likely birds from these are present at NV. It stated that data shows urban colony numbers have been increasing, whilst SPA colony numbers have been decreasing since 2000. The Applicant concluded:

- For the breeding season – based on relative population sizes and colony distance, combined with age ratios, the breeding adults from Alde-Ore Estuary SPA would comprise less than 17% of the on-site birds, while tracking data suggests this percentage would most likely be less than 3%.
- During migration – birds associated with the Alde-Ore Estuary SPA represent about 3.3% of the BDMPS; therefore, it is likely that about 3.3% of the estimated collision mortality during the autumn and spring migration periods would affect birds associated with the Alde-Ore SPA population, of which around 60% would be breeding adults (i.e. 2% of the total collision mortality would be breeding adults from Alde-Ore Estuary SPA).

- During winter – the proportion of birds from the Alde-Ore Estuary SPA would be approximately 5% of the BDMPS populations; hence, no more than 5% of the estimated collision mortality on the LBBG population during winter would be apportioned to the Alde-Ore Estuary SPA breeding population.

Further to these discussions, the Applicant's Deadline 7 updated CRM [REP7-062] was presented based on the above seasonal apportionment figures. (Both breeding season values have been used in the assessment for the breeding season and represent upper and lower limits on apportioning rates, derived from the available evidence). The Applicant provided further detailed justification for these apportioning rates in [REP7-062].

NE [REP7-075] acknowledged that the variable ecology of LBBG between individuals within a colony and between seasons and years had made it difficult to determine an actual figure for use in apportionment. Therefore, it advised a full range of apportionment rates for the breeding season be considered, with a focus on rates between 10 and 30% to provide a realistic worst-case scenario of the proportion of birds from the SPA. The RSPB [REP7-083] noted that the Applicant's approach does not conform with NE's advice and did not agree with the apportioning out of juveniles. It argued that doubling the 17% breeding season apportioning value would be reasonable and appropriate and has based its conclusions on that value.

Seasonal definitions – NE [RR-106][REP1-088] advised that as NV is located within the mean-maximum foraging range of LBBG from the Alde-Ore Estuary SPA, the breeding season should be defined as the full breeding season presented in Furness (2015). The Applicant confirmed that the assessment for LBBG considered both the migration free and extended breeding season [REP2-036]. However, NE [RR-106][REP1-088][REP4-062] stated that it was unclear whether the Applicant had adjusted the migration seasons to account for overlapping months. The Applicant [REP6-021],stated that it considered the migration free season to be more appropriate for assigning collisions to the SPA; nonetheless it also presented the full breeding season in its Deadline 7 revised CRM [REP7-062].

Deadline 7 revised CRM [REP7-062] – Further to discussions during the examination of how the Applicant had apportioned impacts, seasonal definitions and its overall approach to CRM (see above in this matrix and section 2.5 of this RIES), the Applicant provided a revised CRM assessment at Deadline 7 [REP7-062] which predicted that most collisions would occur during the second half of the breeding season and during early autumn (June to August). The Deadline 7 CRM concluded that during the migration-free breeding season (May to July) the total number of predicted collisions was 9.9. For the full breeding season, the total number of predicted collisions was 21.4 – equating to up to 4 birds from the SPA; this would result in an increase in mortality of less than 1% which is undetectable against the range of background variation. The Applicant [REP7-062] noted the relevant conservation objective to restore LBBG breeding numbers from the present level of about 2,000 pairs to the designation population size of about 14,000 pairs. It did not consider the number of predicted LBBG collisions at NV would materially alter the natural mortality for the population and therefore concluded no AEOI from the project alone.

NE [REP7-075] considered that the predicted apportioned collision mortality from NV alone of 4 LBBGs from the Alde-Ore Estuary SPA (range 0-11 birds) equated to 0.96% (0.04-2.41%) of baseline mortality of the colony and that this gave further weight to the need to consider impacts on the Alde-Ore SPA through a PVA. It advised [REP7-075] that further assessment is required and highlighted a potential for AEOI from collision risk alone and in-combination with other plans and projects; NE therefore advised consideration of impact mitigation through raised rotor blade draught heights above MHWS.

b) **In-combination collision mortality** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that the in-combination assessment suggested mortality of 33 birds attributable to the Alde-Ore Estuary SPA population of LBBGs. Compared with the estimated natural mortality of about 940 birds per year, the additional in-combination mortality would increase the mortality rate from 14.10% to 14.6%, an increase of 3.5%. However, this mortality rate falls to 20, equating to an increase in mortality of 2% if as-built wind farm designs are used in place of consented designs (paragraph 197 of [APP-045]). Previous population modelling for Galloper Offshore Wind Farm found that an additional mortality of 25 would reduce the growth rate of the population by 0.3% (paragraph 198 of [APP-045]). The Applicant therefore concluded that given the degree of precaution in collision assessments, the likelihood of an AEOI due to in-combination collisions is sufficiently small that it can be ruled out (paragraph 200 of [APP-045]).

Deadline 7 revised CRM **[REP7-062]** - Further to discussions during the examination of how the Applicant had apportioned impacts, its overall approach to CRM and population modelling (see above in this matrix and section 2.5 of this RIES), the Applicant provided a revised assessment at Deadline 7 [REP7-062]. The revised assessment used NE's preferred apportioning rates and included all wind farms within the mean maximum foraging range (141km). It concluded the following in-combination mortality:

- *Non-breeding season* – Cumulative LBBG non-breeding season mortality was estimated at 368.9 birds. Across all age classes the Alde-Ore Estuary SPA represents approximately 3.3% of the BDMPS autumn population, about 3.3% of the BDMPS spring population and a maximum of 5% of the BDMPS winter population Therefore a weighted Alde-Ore Estuary SPA percentage of 4% has been calculated (5 months at 3.3% and 4 months at 5%). This indicates that up to 15 birds (369 x 4%) could die from the Alde-Ore Estuary SPA population during the non-breeding season (of which 0.4 are attributed to NV
- *Breeding season* – Cumulative breeding season mortality was estimated as 170.1 including Hornsea Project Three and 152.8 excluding Hornsea Project Three. When considering all wind farms within 141km (the mean maximum foraging range) of the Alde-Ore Estuary SPA (Greater Gabbard, Gunfleet Sands, Kentish Flats, London Array, Scroby Sands, Sheringham Shoal, Thanet, Thanet Extension, Dudgeon, East Anglia ONE, Galloper and East Anglia THREE) as being those with the potential to contribute to mortality on the SPA population at that time of year; the total breeding season mortality for these wind farms is 67.3, to which NV adds 4. The SPA is estimated to represent 30% of the total Norfolk and Suffolk LBBG population, therefore the breeding season total was estimated to be 23.

- *Annual mortality* – The annual mortality of LBBG from the Alde-Ore SPA is therefore 38 in total (of which NV contributes up to 4); compared to an estimated natural mortality of about 460 birds a year this would represent an increase in mortality of 8.3%.

The Applicant [REP7-062] argued that updating consented assessments to reflect as-built wind farm designs in comparison to original full consent envelopes reduces predicted mortality by an average of 33%; which would result in annual mortality of 26.7 and an increase in background mortality of 5.8%. The RSPB [REP7-083] reiterated its view that it is only acceptable to consider the 'as built' windfarm envelopes if these have been secured in an amended DCO and hence there is legal certainty for the reduction in turbine numbers.

However, NE [REP7-075] advised that further assessment is required regarding the apportionment of impacts to other windfarm projects in the in-combination assessment. It confirmed [REP7-075] the Applicant's approach to apportion 4% of in-combination impact in the non-breeding season was acceptable but considered that the generic rate of 30% apportionment to the total breeding season collision predictions from all wind farms within 141km of the SPA was overly simplistic; it advised using the apportionment rates used by the other wind farms in their assessments.

Population modelling approach - NE [RR-106] argued that the Galloper PVA model was not adequate due to several issues with the models. It advised that these issues should be considered by the Applicant before any conclusions can be made regarding the significance of in-combination collision impacts on LBBG. RSPB [REP1-112] considered there was not the required level of confidence to exclude an AEOI and that based on the Applicant's figures (which as noted in footnote (a), it considered underestimated mortality) the in-combination mortality would result in an increase of background mortality of 3.5%. It recommended that a that a full assessment, including PVA, should be carried out [RR-197][REP1-110][REP1-112].

The Applicant therefore developed a PVA for the LBBG population [REP6-020] at Deadline 6 using demographic rates taken from a review conducted by British Trust for Ornithology (BTO) and run 1,000 times for both density dependent and density independent versions. NE [REP7-075] confirmed that the model had been run as per its advice. However, it advised that a larger number of simulations would potentially be needed to generate reliable results (ie 5,000 simulations) and requested the Applicant to set out how it had calculated the metrics. NE did not consider there was evidence to support the Applicant's assumption in [REP6-020] that baseline population growth would be in excess of 10% and stated that it could not validate the Applicant's conclusion.

At Deadline 7, the Applicant provided updated graphs of counterfactuals of population size and population growth rate, estimated across 5,000 simulations and the inclusion of 95% confidence intervals to respond to NE's concerns [REP7-063]. It concluded [REP7-062) that with a worst-case adult mortality of 40, the population growth rate would be 1.3% lower than the baseline (density independent model) or 0.4% (density dependent model). The Applicant considered that this is very unlikely to have a detectable

effect on the population and therefore the likelihood of this resulting in a population decline is very small. It highlighted the precaution in the assessment (including the use of the much higher mortality predictions estimated for consented wind farm designs rather than for the as built designs and over-estimated nocturnal activity) and noted such a more realistic collision estimate predicts a growth rate reduction of no more than 0.9% (density independent). It argued that the breeding success and hence population trend of LBBG appeared to be mainly determined by the amount of predation, disturbance and flooding at the site. The Applicant concluded that there would be no AEOI from collision impacts on LBBG in-combination with other plans and projects.

However, NE advised [REP7-075] that if the additional mortality from the windfarm is 40 adults per annum, then the population of the Alde-Ore Estuary SPA after 30 years would be 8.5% lower than without the additional mortality using the density dependent model and 25.3% lower using the density independent model. The population growth rate would be reduced by 0.2% using the density dependent model and 1.0% using the density independent model, which would be counter to the restore conservation objective at the site. NE [REP7-075] [REP7-075] therefore highlighted a potential for AEOI from collision risk alone and in-combination with other plans and projects and advised consideration of impact mitigation through raised rotor blade draught heights.

The RSPB [REP7-083] undertook its own calculations presenting Counterfactuals of Population size as percentage reduction in population after 30 years. It concluded that in-combination mortality has the potential to cause significant declines in the Alde-Ore Estuary SPA LBBG population and that AEOI cannot be excluded as result of predicted in-combination collision mortality with other plans and projects.

c) **Predator management** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that the breeding success, and hence the population trend, of LBBGs in the Alde-Ore Estuary SPA population appears to be mainly determined by the amount of predation, disturbance and flooding occurring at this site (paragraph 201 of [APP-045]). Increased predation and disturbance by foxes has been considered the main factor causing reductions in breeding numbers and management measures to reduce access by foxes has resulted in some recovery of numbers of gulls. The main driver of gull numbers in this SPA therefore appears to be suitable management at the colonies to protect gulls from predators. This aspect, taken together with the degree of precaution in reported collision assessments for other offshore wind farms, including the use of the much higher mortality predictions estimated for consented wind farm designs rather than for the as built wind farm designs, means the likelihood of an AEOI of the SPA due to in-combination collisions of LBBGs is considered sufficiently small by the Applicant that it can be ruled out (paragraph 200 of [APP-045]). The Applicant suggested further discussions with NE could be held to discuss predator management measures to offset in-combination collision mortality (paragraph 201 of [APP-045]).

RSPB [RR-197][REP1-110][REP1-112] did not agree that measures of this sort could lawfully be considered as mitigation and noted concerns over the uncertainty as to the relative importance of factors affecting the LBBG population. In response, the Applicant provided evidence in relation to the efficacy of predator control at the SPA (response to Q3.3(m) [REP1-007]), but confirmed that such measures had not been considered in reaching the conclusion of no AEOI, rather they were additional measures which could be undertaken to enhance the status of the population (response to Q23.20 [REP1-007]). The Applicant's revised CRM [REP6-021] and [REP7-062] continued to reference offsetting of impacts; the RSPB [REP7-083] considered this continuing reference to be unhelpful as it implies that predation management could be considered to mitigate impacts.

2) FLAMBOROUGH & FILEY COAST SPA

EU Code: UK9006101												
Distance to NSIP: 205km												
European site features	**Adverse effect on integrity**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Black-legged kittiwake (breeding)		× a, i									**? b, j**	
Northern gannet (breeding)		**? c, i**			**? d**						***? e, f, g, h, j***	
Common guillemot					× k, r						***? l, r***	
Razorbill					**? m, r**						***? n, r***	
Seabird assemblage (including puffin)					**? o,** p, **r**						***? o, q, r***	

KITTIWAKE

a) **<u>Collision mortality</u>** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] estimated collision mortality of kittiwakes at the NV site as being between 59 and 158 birds per year (the higher value represents all turbines in NV East, the lower value represents all turbines in NV West). Based on a precautionary assessment, the number of kittiwakes apportioned to the Flamborough & Filey Coast (FFC) SPA population was 12.4 (paragraph 240 of [APP-045]). From a population of approximately 141,000 this represents a negligible addition to natural mortality (note that this population count is likely to be an underestimate, since it is based on 37,618 pairs, while the 2017 population was estimated to be 51,000 pairs, 35% larger). The Applicant concluded that kittiwake collision mortality due to NV alone would have no AEOI of the FFC SPA (paragraph 244 of [APP-045]). This was disputed during the examination, as detailed below.

Seasonal apportioning of impacts - The Applicant's HRA Report [APP-045] apportioned 16.8% of birds present during the breeding season to the FFC SPA colony. However, NE had concerns over the Applicant's use of a 16.8% apportionment figure [RR-106][REP1-049][REP3-051]. Both NE [RR-106][REP1-088] and RSPB [RR-197][REP1-112][REP6-038] advised that the Applicant should consider the RSPB kittiwake tagging data from 2017 which indicates that birds from the FFC SPA do forage within the NV site, particularly NV West, and then revisit the breeding season apportionment.

The Applicant [REP2-003] expressed concerns about the RSPB kittiwake data and explained (Q23.72 of [REP4-040]) that it had followed the approach adopted for the Dogger Bank Creyke Beck, Dogger Bank Teesside and East Anglia THREE projects. Nevertheless, at Deadline 6, the Applicant incorporated the RSPB kittiwake tagging data into its assessment to inform the estimates of connectivity between the FFC SPA and NV. It concluded that a precautionary upper value of 26.1% of kittiwakes at NV could be from the FFC SPA adult (breeding) population and considered this to be a precautionary figure as it does not allow for the presence of breeding adults from closer colonies, nor of Russian and Norwegian immatures. The Applicant refuted NE's suggestion that a wider range of possible breeding season connectivity percentages should be considered (including up to 100% of birds at NV during the breeding season being treated as birds from the FFC SPA) [REP6-021].

The 26.1% breeding season apportioning rate was further justified by the Applicant in the Deadline 7 revised assessment (see below); NE was unable to comment on this justification before publication of this RIES. However, it advised [REP7-075] the Applicant to present data on the proportions of adult kittiwakes recorded in their baseline surveys in order to provide some level of confidence in the assumption that kittiwakes in the breeding season at NV would be predominantly immatures. It continued to advise presentation of a range of apportionment rates due to the difficulties in determining an apportionment figure. It highlighted concerns that the 26.1% value was not suitably precautionary and considered the 86% value obtained from the SNH tool should be applied by the Applicant.

The RSPB [REP6-038] also did not agree with the apportioning rates used by the Applicant and was concerned with the assumption of a 250km foraging range given that the current maximum foraging range is 350km (based on recent tag recoveries). It suggested [REP7-083] doubling the Applicant's 26.1% value would be a reasonable approach; it therefore based its conclusions on that value.

Deadline 7 revised CRM - Further to discussions during the examination of how the Applicant had apportioned impacts, its overall approach to CRM (see above in this matrix and section 2.5 of this RIES) and nocturnal activity factors (see footnote (i) of this matrix below), the Applicant provided a revised assessment at Deadline 7 [REP7-062] This stated that there is very little evidence for connectivity between the FFC SPA and NV East and that there is more compelling evidence for connectivity to NV West; therefore, the

Applicant based its conclusion on collisions at NV West. It concluded that the maximum predicted collision mortality for the full breeding season would be 7.7 individuals and that the worst-case total mortality of FFC SPA kittiwakes at NV would be 15.1 individuals) (15.0 individuals in the migration free breeding season). It concluded that an addition of up to 15.1 individuals would increase mortality rate by 0.12% which would be undetectable against natural variation and there would be no AEOI.

NE [REP7-075] highlighted the need for further assessment regarding the apportioning of collision risk impacts to the SPA for the project alone (see above). However, it undertook its own calculations applying an 86% breeding season apportionment rate and concluded an annual total of 68 kittiwake collisions from the FFC SPA; equating to a 0.53% of baseline mortality (designated population) or 0.46% (2017 population). It noted that collision predictions based on the upper 95% confidence intervals of the density data does equate to more than 1% of baseline mortality of the FFC SPA colony. Using the Hornsea Project Three PVA and an additional mortality from Vanguard alone of 50 adults per annum, then the population of FFC SPA after 30 years would be 1.6% lower than it would have been in the absence of the additional mortality; at 100 adults per annum the population would be 3.2% lower. NE concluded that growth rate would be reduced by 0.1%. Based on these PVA outputs, Natural England advised that a conclusion of no AEOI of the kittiwake feature of the FFC SPA from collision risk from NV alone can be reached.

b) **In-combination collision mortality** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] explained that the in-combination assessment suggested a collision mortality of between 351 and 358 birds from FFC SPA population per year (this includes final submission estimates for the Hornsea Project Three and Thanet Extension Offshore Wind Farms). At the average mortality rate of 0.156, the natural mortality of the population is 22,000. An addition of up to 358 to this would increase the mortality rate by 1.6% (paragraph 247 of [APP-045]). Precautionary, density independent population modelling has found that this level of mortality would reduce the median population growth rate by a maximum of 0.5% (note the reduction in growth rate is 0.43% for an alternative set of demographic rates and 0.1% with the inclusion of density dependence, paragraph 248 of [APP-045]). The Applicant considered that these reductions represent a very small risk to the population's conservation status. The Applicant noted that NE no longer advocate the use of potential biological removal (PBR) for assessing impacts, but noted that the number of predicted in-combination kittiwake collisions attributed to the FFC SPA remains below the previously determined sustainable levels estimated using this method, and furthermore this level of mortality is not predicted to trigger a risk of population decline based on precautionary population modelling and despite the precautionary nature of collision risk assessments (e.g. including impacts for consented designs rather than as-built ones). Therefore, the Applicant concluded that there would be no AEOI of FFC SPA from impacts on kittiwake due to NV in-combination with other projects (paragraph 254 of [APP-045]). This was disputed during the examination, as detailed below.

Deadline 7 revised CRM - Further to discussions during the examination of how the Applicant had apportioned impacts, its overall approach to CRM and population modelling (see above in this matrix and section 2.5 of this RIES) and nocturnal activity factors (see footnote (i) of this matrix), the Applicant provided a revised assessment at Deadline 7 [REP7-062]. This calculated an in-combination

total, all age class, annual FFC SPA kittiwake population collision estimate of 495.5 individuals (337.6 individuals without Hornsea Project Three); this would represent an increase in background mortality of 3.8% (2.6% without Hornsea). The Applicant confirmed [REP7-059] that it its approach for the assessment assumed connectivity for other wind farms based on estimates presented in the East Anglia THREE assessment (as advised by NE).

Using the Hornsea Project Three PVA, the Applicant calculated that the maximum reduction in the population growth rate, at a mortality of 500, would be 0.6% (density independent) (0.4% without Hornsea) which it considered would represent a very small risk to the population's conservation status. It noted that breeding numbers at the FFC SPA have been relatively stable over the last 20 years (although an RSPB unpublished report suggests a 0.4% annual growth rate) and appears to be in favourable conservation status. It also noted that the relevant conservation objective is to maintain favourable conservation status of the gannet population, subject to natural change. The Applicant concluded that in-combination kittiwake collisions would not be at a level which would trigger a risk of population decline but may result in a slight reduction in the growth rate currently seen at this colony, and so would not have an AEOI of the SPA.

Although NE [REP7-075] confirmed that its methodological concerns had been addressed, it stated [REP2-038][REP4-062] [REP6-032] that the in-combination threshold for kittiwake from FFC SPA had already been reached at the end of the East Anglia Three examination and therefore all subsequent projects continue to add to this cumulative collision total. It considered that the contribution of Vanguard alone to the in-combination total for FFC SPA appears likely to be a substantial one and that there is a clear risk of a significant population decline from its current, apparently broadly stable level, and would in any event be counter to the restore conservation objective required for FFC SPA kittiwake. It advised that an AEOI cannot be excluded when considered in-combination with other plans and projects; it therefore advised consideration of impact mitigation through raised rotor blade draught heights.

The RSPB [REP7-083] considered that the Applicant's description of the conservation status of kittiwakes at the FFC SPA did not reflect the long-term decline seen at the colony and did not agree the population can be considered to be at favourable conservation status. It highlighted that the recently published draft Supplementary Advice on Conservation Objectives[26] notes the obligation to avoid deterioration of the site and states that NE has advised in-combination mortality at offshore wind farms could result on AEOI.

[26]https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9006101&SiteName=flamb&SiteNameDisplay=Flamborough+and+Filey+Coast+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=

The RSPB [REP7-083] also argued that the Hornsea Project Three PVA demographic rates do not account for recent decline in kittiwake productivity at FFC SPA and advised that the PVA be rerun using the most recent sit-specific demographic rates, including productivity. It undertook its own calculations presenting Counterfactuals of Population size as percentage reduction in population after 30 years and concluded that in-combination mortality has the potential to cause significant declines in the FFC SPA kittiwake population and that AEOI cannot be excluded as result of predicted in-combination collision mortality with other plans and projects.

GANNET

c) **Collision mortality** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that collision mortality of gannets at the NV site was estimated at between 45 and 111 birds per year (the higher value with all turbines located in NV East, the lower with all turbines located in NV West), 60% of which was predicted in the autumn. Apportioning of the higher estimate to the FFC SPA population gives an annual mortality of 23 individuals, from a population of approximately 49,000 birds (paragraphs 206 – 207 of [APP-045]). At an average natural mortality rate of 0.191, the baseline mortality is approximately 9,300. An addition of 23 to this increases the mortality rate by 0.24%, which is less than the threshold for detectability (1%). The Applicant therefore concluded that there would be no AEOI of FFC SPA as a result of gannet collisions from NV alone (paragraph 210 of [APP-045]). This was disputed during the examination, as detailed below.

Avoidance rate - RSPB [RR-197][REP1-112][REP4-070][REP6-038][REP7-083] disagreed with the 98.9% avoidance rate used by the Applicant for gannet during the breeding season, stating that a 98% avoidance rate is more appropriate. However, the 98.9% avoidance rate was advocated by NE [RR-106][REP1-088]. The RSPB [REP7-083] confirmed that it would base its conclusions on the use of a 98% avoidance rate for the breeding season.

Seasonal definitions - The HRA Report [APP-045] apportioned 100% of the total collisions to the FFC SPA in the breeding season. However, NE [RR-106] noted that only the migration-free breeding season (May to July) had been used for gannet assessments. It advised [RR-106][REP1-088] that as NV is located within the mean-maximum foraging range of gannets from the FFC SPA colony, the breeding season should be defined as the full breeding season presented in Furness (2015); this could alter the number of collisions in each season and hence the overall annual figure apportioned to the FFC SPA. This concern was shared by RSPB [RR-197][REP1-112].

The Applicant (response to Q23.36 [REP1-007]) noted differences in the interpretation of the breeding season amongst studies. It justified the use of the migration-free breeding season on the basis that tracking data suggests gannets breeding at FFC SPA do not normally forage in the vicinity of NV. It stated that peak gannet numbers seen at NV occur during autumn migration but are most likely to be birds from different colonies; and that gannet numbers at NV during breeding season are low and most likely to be birds

migrating through the area rather than breeding adults from FFC SPA. Nevertheless, the Applicant stated that using the Furness (2015) breeding season of March to September, there would be an increase in background mortality by 0.36% and stated that this would not alter the conclusion that the project alone would not result in AEOI. The Applicant also applied the JNCC breeding season of May to September and concluded that this would result in slightly lower collision mortality than the Applicant had originally calculated.

RSPB [REP1-112] welcomed the Applicant's calculations of the full breeding season but sought clarity as to whether the calculations were undertaken using mean or median monthly bird densities. NE [REP2-037][REP4-062] stated the outstanding CRM issues and needed to be resolved before it could agree to the Applicant's assessment.

Seasonal apportioning of impacts – The HRA Report apportioned 4.2% and 5.6% of the total collisions to the FFC SPA in autumn and spring, respectively. The Applicant (response to Q3.11 [REP1-007]) confirmed that the gannet BDMPS used in the non-breeding season apportionment of gannets to the FFC SPA were those presented in Furness (2015). However, NE [REP2-037] stated that it did not calculate the same apportionment figures as the Applicant and advised figures of 4.8% for autumn and 6.2% for spring (which were slightly higher than those used by the Applicant of 4.2% for autumn and 5.6% for spring). It considered that if the Applicant wishes to use their preferred values, clarification was required as to how they were calculated. [REP2-036][REP3-051][REP4-062].

NE [RR-106] also raised concerns that the Applicant had applied a colony figure of birds of all ages in the gannet apportionment. It noted that as the existing PVAs were on adult currency, the calculations of baseline mortality should also be undertaken on adult currency. The Applicant (response to Q3.11 [REP1-007]) confirmed that it had used an all ages survival rate and that if an adult mortality rate was used, this would increase background mortality by 0.06% and 0.024% - below the 1% increase threshold at which effects are considered detectable and therefore would not alter the conclusions of the assessment.

The Applicant (Q23.72 of [REP4-040]) explained its approach to seasonal apportionment followed that adopted for the Dogger Bank Creyke Beck, Dogger Bank Teesside and East Anglia THREE projects.

Deadline 7 revised CRM - Further to discussions during the examination of how the Applicant had apportioned impacts, its overall approach to CRM and seasonal definitions (see above in this matrix and section 2.5 of this RIES) and nocturnal activity factors (see footnote (i) of this matrix), the Applicant provided a revised assessment at Deadline 7 [REP7-062] using the full breeding season, both its own and NE's preferred apportioning rates and a 98.9% avoidance rate. This concluded the predicted mortality using NE's preferred rates is 32.8 adults; this would increase mortality rate by 1.8% (designated count) and 1.5% (2017 count) for the project

alone. Using the upper confidence estimate, there would be 65.8 collisions. The Applicant acknowledged the mean predictions are over the 1% threshold for detection, however noted the precaution in its assessment and that the gannet population appeared to be in favourable conservation status as gannet breeding numbers have increased in all counts. Using the Hornsea Project Three PVA, the Applicant calculated that the maximum reduction in the population growth rate, at an adult mortality of 75, would be 0.3% (density independent). It considered that this level of mortality represents a negligible risk to the population status and concluded no AEOI for the project alone.

NE [REP7-075] agreed with the Applicant's apportioned figure of 33 collisions and noted that even with the revised layout, the mortalities would equate to more than 1% of baseline mortality of the colony. Its own calculation of the upper range of collisions was 94 bird mortalities; this would equate to a 12.3% reduction in population after 30 years and that growth rate would be reduced by 0.5%. It advised [REP7-075] that further assessment is required, and that consideration should be given to the uncertainty/variability in the bird densities/abundances and that this would likely have implications for the figure used in the in-combination assessment.

d) **Operational displacement** - The Applicant submitted an assessment of displacement risk for gannet at Deadline 6 [REP6-021]; this presented a range of displacement rates between 60% and 80% displacement and 1% mortality. Apportioning 100% of gannet displacement mortality to the FFC SPA and using Natural England's preferred rates in spring and autumn (4.8% and 6.2% respectively (see footnote(c)), the worst-case mortality due to NV was estimated to be between 2.5 and 3.3. This would be an increase the mortality rate by a maximum of 0.04% (designated population). The Applicant concluded there is no risk of an AEOI of the SPA population due to displacement from the NV project alone.

   However, NE [REP7-075] advised that further assessment is required, and that consideration should be given to the uncertainty/variability in the bird densities/abundances and therefore the range of predictions considering the upper and lower 95% confidence intervals of the bird density/abundances should be presented. NE explained that this would likely have implications for the figure used in the in-combination assessment.

e) **In-combination collision mortality** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that the in-combination assessment suggests a maximum collision mortality of 200 birds from FFC SPA population per year. This additional mortality would increase the mortality rate by 2.1% (paragraph 212 of [APP-045]). Precautionary, density independent population modelling has found that this level of mortality would reduce the median population growth rate by a maximum of 1%, which compares with the actual annual growth rate of this population over the last 25 years of 10% (paragraph 213). This indicates that this level of in-combination mortality represents a negligible risk to this population's status. The Applicant considered that the number of predicted in-combination gannet collisions attributed to the FFC SPA is not at a level which would trigger a risk of

population decline, and population modelling in fact indicates that the in-combination mortality predicted would only slow, rather than halt, the population increase currently seen at this colony. Therefore, the Applicant concluded that there would be no AEOI of FFC SPA from impacts on gannet due to NV in-combination with other projects (paragraphs 219-221 of [APP-045]).

Deadline 7 revised CRM –Further to discussions during the examination of how the Applicant had apportioned impacts, its overall approach to CRM, seasonal definitions and population modelling (see above in this matrix and section 2.5 of this RIES) and nocturnal activity factors (see footnote (i) of this matrix), the Applicant provided a revised assessment at Deadline 7 [REP7-062]. This calculated an in-combination total, all age class, annual FFC SPA gannet population collision estimate of 244 adults (225 adult without Hornsea Project Three); this would represent an increase in background mortality between 13.6% (designated population) and 11.2% (2017 count) (12.5% and 10.4% without Hornsea). Using the Hornsea Project Three PVA, the Applicant calculated that the maximum reduction in the population growth rate, at an adult mortality of 250, would be 1.1% (density independent). The Applicant considered the gannet population to be in favourable conservation status as gannet breeding numbers have increased in all counts and noted that the relevant conservation objective is to maintain favourable conservation status of the gannet population, subject to natural change. It stated that the observed rate at which this population has grown over the last 25 years has been at least 10% per year and that a reduction of just over 1% in this case represents a negligible risk for the population. It concluded that in-combination gannet collisions would result in a slight reduction in the growth rate currently seen at this colony but would not be at a level which would trigger a risk of population decline, and so would not have an AEOI of the SPA. The Applicant also highlighted the precaution in its assessment.

NE [REP7-075] confirmed that the approach to the in-combination assessment had addressed Natural England's methodological concerns. However, it [REP7-075] [REP7-075] highlighted a potential for AEOI from collision risk in-combination with other plans and project and advised consideration of impact mitigation through raised rotor blade heights.

The RSPB [REP7-083] undertook its own calculations presenting Counterfactuals of Population size as percentage reduction in population after 30 years (using the Applicants or RSPBs calculations. It concluded that in-combination mortality has the potential to cause significant declines in the FFC SPA gannet population and that AEOI cannot be excluded as result of predicted in-combination collision mortality with other plans and projects.

f) **In-combination operational displacement** - The Applicant's Deadline 6 assessment of displacement risk for gannet [REP6-021] calculated the total annual in-combination displacement mortality apportioned to the FFC SPA as between 49.1 and 65.5. This would result in an increase in background mortality of the FFC SPA all age class population between 0.64% and 0.85% (designated) and between 0.53% and 0.70% (2017 population). The Applicant concluded there would be no AEOI for the FFC SPA gannet population

due to in-combination displacement mortality. However, NE [REP7-075] advised that further work was required for the in-combination displacement, as it could be affected by the assessment of impacts alone.

g) **Combined operational collision and displacement mortality (from the project alone) -** NE [REP7-075] advised that combined collision mortality and displacement from the project alone would result in up to 36 adult gannet mortalities from the FFC SPA. Using the Hornsea Three PVA, the population of FFC SPA after 30 years would be 3.2-6.4% lower than it would have been in the absence of the additional mortality and the population growth rate would be reduced by 0.1-0.2%. NE advised that once the Applicant had considered the upper and lower 95% confidence intervals of abundance /density it would be able to reach a conclusion as to the level of impact.

h) **Combined operational collision and displacement mortality (in-combination with other plans or projects)** - The Applicant's Deadline 7 assessment [REP7-062] presented the in-combination annual gannet collision and displacement estimates for all projects with potential connectivity to the SPA (including Hornsea Protect Three) to give a combined SPA mortality estimate of 294 to 310; resulting in an increase in background morality of between 16.4-17.3% (designated population) and 13.5-14.3% (2017 count). Using the Hornsea Project Three PVA, the Applicant concluded that the maximum reduction in population growth rate, at an adult mortality of 325, would be 1.5% (density independent). The Applicant considered the gannet population to be in favourable conservation status as gannet breeding numbers have increased in all counts and noted that the relevant conservation objective is to maintain favourable conservation status of the gannet population, subject to natural change. It stated that the observed rate at which this population has grown over the last 25 years has been at least 10% per year. It concluded that in-combination gannet collisions and displacement mortality would result in a slight reduction in the growth rate currently seen at this colony but would not be at a level which would trigger a risk of population decline, and so would not have an AEOI of the SPA. The Applicant also highlighted the precaution in its assessment.

However, NE [REP7-comms by species] stated that with such a reduction in population growth rate, it may not be possible to rule out AEOI in-combination beyond reasonable scientific doubt and recommended that impact mitigation through raising rotor blade heights is considered to reduce the contribution of the NV project to in-combination impacts. It stated that it would provide a conclusion on this once the updated in-combination (collision and displacement combined) assessments are provided by the Applicant. However, NE did not have the opportunity to comment on the Applicant's Deadline 7 material before the RIES was published.

GANNET AND KITTIWAKE

i) <u>Collision mortality</u>

Nocturnal activity factors - For breeding gannet and kittiwake of the FFC SPA, the Applicant's CRM (described in [APP-217]) used nocturnal activity rates derived from tracking studies undertaken by Furness et al. NE [RR-106] did not agree with their use as the studies had not been published nor were publicly available; instead it advocated the use of nocturnal activity factors as per Garthe & Hüppop (2004). RSPB [RR-197][REP1-110] also disagreed with the rates used by the Applicant and considered they would result in inaccurate underestimates of collision risk as they did not consider the potential interaction between survey timing and diurnal behavioural patterns.

With regards to gannet, NE [REP1-088] and the Applicant [REP1-007] noted at Deadline 1 that the Furness et al. paper (2018) had been published; the Applicant noted this recommended slightly higher nocturnal rates than used in its CRM and therefore revised the CRM using nocturnal activity factors in line with the paper (Annex 4 of Appendix 3.2 [REP1-008]). The Applicant explained that kittiwake nocturnal flight activity is an area of ongoing research, however rates are not expected to change from those used in the ES. Nevertheless, it calculated kittiwake collisions using NE recommended rates (25% and 50%) (response to Q3.3(g) [REP1-007] and Annex 4 of Appendix 3.2 [REP1-008]).

The Deadline 1 revised CRM was welcomed by RSPB [REP2-035], however they explained that it increases their concerns about levels of collision and advised that if survey timings are not known, the precautionary rates based on Garthe & Hüppop (2004) and Furness et al., (2013) should be used for gannet as well [REP1-110][REP1-112][REP4-070]. The Applicant provided aerial survey data [REP4-045] to demonstrate the surveys covered a wide range of times throughout the year and advocated the use of the rates presented in Furness et al. (2018) (Q23.82 of [REP4-040]). However, the Applicant also concluded that if using the nocturnal activity rates advised by NE and RSPB, total collisions of birds from FFC SPA would increase; by 17% (from 34 above, to 40) for gannet and by 42% (from 12, to 17) using 50% rate and by 8% (from 12 to 13) using 25% rate for kittiwake. However, it concluded that neither of these changes would materially affect the conclusions of no AEOI for the SPA populations (response to Q23.38 [REP1-007]).

Further to these discussions, the Applicant's Deadline 7 updated CRM [REP7-062] used a nocturnal activity rate of 25% for gannet and 50% for kittiwake.

Regarding gannet, the RSPB [REP7-083] acknowledged that surveys had been spread through daylight hours, however noted that there was very little survey effort at first and last light, thereby likely missing the peak foraging times, and thereby peak mortality risk for several species. Regarding kittiwake, the RSPB stated the peer-reviewed data is extremely limited and patchy and cannot be relied upon. The RSPB did not confirm whether it was content with the values used by the Applicant.

j) **In-combination collision mortality -** NE [REP1-088] advised the in-combination assessment should include Hywind, Kincardine and Moray West offshore wind farms; these were subsequently incorporated into the Applicant's Deadline 6 and Deadline 7 CRM.

GUILLEMOT

k) **Operational phase displacement** - The Applicant's Deadline 6 revised displacement assessment (section 2.8 of [REP6-021]) stated that NV East and NV West are located 205km and 233km respectively from FFC SPA, which is beyond the guillemot mean maximum foraging range of 82.4km. Displacement mortality was apportioned to the SPA on the basis of no connectivity in the breeding season (as the wind farm is located more than four times the mean maximum foraging range of 82.4km for this species) and an even distribution in the non-breeding season.
It concluded that worst case displacement (using NE's preferred 70% displacement and 10% mortality rates) would result in mortality of up to 17 individuals (10 adults); this would increase the background mortality (of 20,438 calculated for all ages assuming 57% adults, Furness 2015) by 0.08% which would not result in an AEOI.

NE [REP7-075] advised that the Applicant's apportionment rate of 5.14% can be considered precautionary, although it advised a rate of 4.4%. It advised that mortality of 17 individuals would equate to 0.34% of baseline mortality of the colony (based on using an adult colony size of 83,214 adults (at designation)) and an adult mortality rate of 6.1%. NE stated that the Applicant still needed to consider the predicted figures based on the upper and lower 95% confidence intervals of the bird abundance/density data in order to consider the uncertainty/variability. (See also footnote (p) of this matrix). Notwithstanding the additional information required, NE concluded [REP7-075] that there would not be an AEOI from operational displacement from the project alone.

l) **In-combination operational phase displacement** - The Applicant's Deadline 6 revised displacement assessment [REP6-021] concluded that the combined displacement mortality of guillemot across the whole year was estimated to be in the range 24 to 561 individuals (283 to 323 adults); this would increase the baseline mortality rate of the population (all ages) by up to 2.7% (using NE's preferred 70% displacement and 10% mortality rates) or 0.2% (using the Applicant's preferred evidence based 50% displacement and 1% mortality rates). The contribution to this from NV was estimated to comprise 3%.

Using the Hornsea Project Three PVA (density independent), the Applicant calculated that the maximum reduction in the population growth rate would be 0.4% which would represent a negligible risk for the population. The Applicant noted the relevant conservation objective is to maintain favourable conservation status of the guillemot population, subject to natural change and that guillemot breeding numbers have shown strong growth over the last 20 years (3.0% between 2000 and 2008 and 4.0% between 2008 and 2017 [REP7-035]) and are therefore in favourable conservation status. It concluded that in-combination guillemot displacement would result in a slight reduction in the growth rate currently seen at this colony but would not be at a level which would trigger a risk of population decline, and so would not have an AEOI of the SPA.

NE [REP7-075] noted that the Applicant had apportioned 100% of birds to the FFC SPA during the breeding season for projects located within the mean-maximum foraging range. It advised the Applicant apportioned 100% for projects within mean maximum foraging range (Teesside, Westermost Rough, Humber Gateway, Triton Knoll), 46.3% for Hornsea One and Two; 35% for Dogger Bank Creyke Beck and Dogger Bank Teesside. It advised a non-breeding season apportionment rate of 4.4%. NE [REP7-075] stated this needed addressing before it can draw conclusions regarding the potential for AEOI.

RAZORBILL

m) **Operational phase displacement** - The Applicant's Deadline 6 revised displacement assessment (section 2.7 of [REP6-021]) concluded that worst case displacement (using NE's preferred 70% displacement and 10% mortality rates) would result in up to 17.8 additional mortalities (10 adults); this would increase the background mortality rate by up to 0.3% which would not result in an AEOI. Displacement mortality was apportioned to the SPA on the basis of no connectivity in the breeding season (as the wind farm is located more than four times the mean maximum foraging range of 48.5km for this species) and an even distribution in the non-breeding season.

NE [REP7-075] advised that data in Appendix A of Furness (2015) should be used for the relevant species BDMPS for each season. It advised that razorbill abundance figures for NV East and NV West were incorrect and that the Applicant should update the assessment using the following apportionment rates before conclusions can be drawn:

- 3.4% for autumn/post-breeding season
- 2.7% for winter/non-breeding season
- 3.4% for spring/pre-breeding season

n) **In-combination operational phase displacement** - The Applicant's Deadline 6 revised displacement assessment [REP6-021] concluded that the combined displacement mortality of razorbills across the whole year (with Hornsea Project Three) was estimated to be in the range 23 to 535 individuals (up to 305 adults) (38 individuals using the Applicant's evidence based rates of 50% displacement and 1% mortality); this would increase the baseline mortality rate of the population (all ages) by 0.35% to 8.3% (using NE's preferred 70% displacement and 10% mortality rates) or 0.6% (using the Applicant's preferred evidence based 50% displacement and 1% mortality rates). Converting this to an adult only estimate gave a worst case (70% displaced, 10% mortality) range of between 230 and 305 (without and with the inclusion of Hornsea Project Three) [REP7-035].

Using the Hornsea Project Three PVA (density independent), the Applicant calculated that the maximum reduction in population growth would be 1.4%; this would still permit population growth at over 5.5% per year. The Applicant noted the relevant conservation objective is to maintain favourable conservation status of the razorbill population, subject to natural change and that razorbill breeding numbers have shown strong growth over the last 20 years and are therefore in favourable conservation status. It

concluded that in-combination razorbill displacement would result in a slight reduction in the growth rate currently seen at this colony but would not be at a level which would trigger a risk of population decline, and so would not have an AEOI of the SPA.

NE [REP7-075] noted that Applicant had apportioned 100% of birds to the FFC SPA during the breading season for projects located within the men-maximum foraging range. It advised the Applicant apportioned 100% for projects within mean maximum foraging range (Westermost Rough), 48.2% for Hornsea One and Two; 30% for Dogger Bank Creyke Beck and Dogger Bank Teesside. It advised the same non-breeding season apportionment rates as for the project alone (noted in footnote (m) of this matrix). NE [REP7-075] stated these issues need addressing before it can draw conclusions regarding the potential for AEOI.

SEABIRD ASSEMBLAGE (INCLUDING PUFFIN)

o) The Applicant's assessment reported on displacement to puffin only. Impacts to the seabird assemblage have not been explicitly addressed within the HRA Report or during the examination.

PUFFIN

p) **Operational phase displacement** - The Applicant's Deadline 6 revised displacement assessment (section 2.6 of [REP6-021]) stated that NV East and NV West are located 205km and 233km respectively from FFC SPA, which is beyond the puffin mean maximum foraging range of 105km. Therefore, it is appropriate to assume there is no breeding season connectivity with NV.

The Applicant's Deadline 6 revised displacement assessment [REP6-021] concluded that of the puffins recorded on NV, 1.7 were apportioned to the FFC SPA population. Using NE's preferred 70% displacement and 10% mortality rates, there would be up to 0.12 additional mortalities (or 0.6% using the Applicant's preferred evidence based rates of 50% displacement within the wind farm, 30% within the 1 km buffer and 0% thereafter, combined with a 1% mortality rate); this would increase the background mortality rate by 0.02% which would not result in an AEOI.

NE [REP7-075] advised that the Applicant's apportionment rate of 1.5% can be considered precautionary, although it advised a rate of 0.41%. NE stated that the Applicant still needed to consider the predicted figures based on the upper and lower 95% confidence intervals of the bird abundance/density data in order to consider the uncertainty/variability. (See also footnote (p) of this matrix). Notwithstanding the additional information required, NE concluded [REP7-075] that there would not be an AEOI from operational displacement from the project alone.

q) **In-combination operational phase displacement** – The Applicant's revised integrity matrices [REP7-035] argued that there is no requirement to undertake an in-combination assessment given the level of mortality attributable to NV. It also noted that the FFC SPA population is almost certainly significantly underestimated due to its inaccessibility and puffin nesting habits.

Nevertheless, the Applicant's Deadline 6 revised displacement assessment [REP6-021] concluded that the number of puffins apportioned to the FFC SPA population at risk of displacement on North Sea wind farms was estimated to be 1,641 in the breeding season (none from NV) and 349 in the non-breeding season (1.7 from NV). Overall, of the 1,989.7 puffins (including Hornsea Project Three) at risk of displacement annually, 0.08% were birds on NV. Without Hornsea Project Three this total is reduced to 1,987.8. The Applicant considered that NV's contribution to any in-combination effect would make no difference and considered that the SPA population could be significantly underestimated due to difficulties to census puffin populations. It concluded no AEOI.
NE [REP7-075] noted that Applicant had apportioned 100% of birds to the FFC SPA during the breading season for projects located within the men-maximum foraging range. It advised the Applicant should apportion:

- 100% for projects within mean maximum foraging range (Humber Gateway, Teesside, Westermost Rough, Triton Knoll), except for Hornsea Project Two where 38% apportioning applied based on proportion of adults in baseline surveys during the breeding season;
- 38% for Hornsea Project One;
- 30% for Dogger Bank Creyke Beck and Dogger Bank Teesside; and
- 50% for Hornsea Project Three

It also advised a non-breeding season apportionment rate of 0.41%. NE [REP7-075] stated these issues need addressing before it can draw conclusions regarding the potential for AEOI.

GUILLEMOT, RAZORBILL AND PUFFIN

r) **Operational phase displacement -** NE [REP7-075] advised that the operational phase displacement assessments (both alone and in-combination) should be undertaken against baseline mortality for the colony calculated using adult colony sizes and adult mortality rates.

3) GREATER WASH SPA

EU Code: UK9020329												
Distance to NSIP: 0km from the export cable; 36km from the array area												
European site features	**Adverse effect on integrity**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Red throated divers (non-breeding)				**? a**	**? b**					**?** c, **d**	**?** c, **e**	
Little gull (non-breeding)		× f									**?*g***	
Common scoter				**? h**	**? h**						**? *i***	

RED-THROATED DIVERS (RTDs)

a) **<u>Construction phase displacement/disturbance</u>** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] concluded that cable laying operations during construction would disturb birds from the immediate vicinity of (up to two) cable-laying vessels (paragraph 265 of [APP-045]). The assessment indicates that between 34 and 85 red throated divers (RTDs) could be displaced at any one time during cable laying, but only if both vessels are operating within the SPA at the same time (paragraph 267 of [APP-045]). This would lead to a 0.7% increase in diver density in other parts of the SPA based on a highly precautionary maximum mortality rate associated with the displacement of RTD by vessels in the wintering period of 5% (i.e. 5% of displaced individuals suffer mortality as a direct consequence). This leads to a highly precautionary assumption that a single instance of displacement is equivalent to nearly half the total annual adult mortality rate. At this level of additional mortality, a maximum of between 2 and 4 birds would be expected to die across the entire winter period (September to April) as a result of any potential displacement effects from the offshore cable installation activities (paragraph 268 of [APP-045]). However, owing to the Rochdale envelope approach and the nature of the calculations employed, this almost certainly over-estimates the duration of cable laying by a

factor of around 7, since even travelling at the minimum speed of 30m per hour, if a working day lasts for 12 hours the vessel would traverse the SPA in approximately 40 days (assuming the cable route through the SPA is around 15km). Baseline average mortality is 0.228, therefore the estimated natural mortality for the SPA population (1,407), would be 321. The addition of a maximum of 2 to 4 to this total during a single year would increase the mortality rate in that year by approximately 0.6% to 1.2% (paragraph 269 of [APP-045]). However, as this is based on highly precautionary assumptions about the magnitude and impact of displacement and would only be expected to apply during a single non-breeding season (and only then if cable laying by two vessels occurs simultaneously within the SPA during the non-breeding period), the Applicant considered that it is reasonable to conclude that there would be no AEOI of the Greater Wash SPA as a result of RTD displacement due to cable laying for NV alone (paragraph 269 of [APP-045]). This was disputed during the examination, as detailed below.

Displacement and mortality rates - The Applicant's assessment of offshore cable laying disturbance/displacement for Vanguard alone assumed 80% displacement and 5% mortality of RTD. However, NE [RR-106][REP1-088] and RSPB [REP1-112] advised that a worst-case scenario (WCS) of 100% displacement and 10% mortality should be used within 4km of the wind farm boundary, as per SNCB guidelines. NE advised that the 5% mortality rate used by the Applicant was insufficiently precautionary (comments on Appendix 3.1 in [REP3-051][REP4-062]). In response, the Applicant presented a review of published evidence to justify the use of 90% displacement and 1% mortality within 2km of the windfarm boundary (Appendix 3.1 – RTD Displacement note [REP1-008]). Using these rates, the Applicant concluded there would not be an AEOI (Q23.6 of [REP1-007]). The note also presented the precautionary rates recommended by NE.

RSPB [REP2-035] considered that the Applicant had misinterpreted some studies and did not accept the argument to depart from the SNCBs recommended buffer zone or mortality rate. NE (comments on Appendix 3.1 in [REP3-051]) also considered that the Applicant's review did not really appraise the robustness of different methodologies used in the studies they had reviewed and that there was no compelling evidence to warrant a change to NE's recommended rates. NE noted that applying its rates, between 3 and 8.5 birds would die from offshore cable laying, which equates to 0.87-2.46% of baseline mortality; NE considered that this is not insignificant and may result in an AEOI [REP1-088]. For this reason, NE [RR-106][REP1-088] advised that measures, such as avoiding cable laying activities during the non-breeding season/period of peak RTD numbers, should be considered to mitigate disturbance.

The Applicant believed that its assessment was highly precautionary and therefore refuted NE's request to avoid cable laying during the non-breeding season (response to 23.21 [REP1-007]). However, NE [REP2-037] argued that the SPA data is based on visual surveys, which appear to detect lower number of RTDs than digital aerial surveys, therefore the numbers of RTD could be higher. It advised that seasonal restrictions on cable laying has significant potential to reduce impacts.

Deadline 6 revised displacement assessment [REP6-021] - Further to these discussions, the Applicant provided an updated assessment of displacement due to cable installation at Deadline 6 [REP6-021]. Using NE's preferred rates (100% displacement and 10% mortality from 2 vessels), the Applicant stated there would be a maximum of 4 to 8 additional mortalities during a single year which would increase mortality rate by approximately 1.3% to 2.6%. The Applicant considered its assessment was based on highly precautionary assumptions about the magnitude and impact of displacement and would only be expected to apply during a single non-breeding season (and only then if cable laying by two vessels occurs simultaneously within the SPA during the non-breeding period). It concluded no AEOI.

NE [REP7-075] agreed with the Applicant's calculations, however it considered the results to be 'not insignificant'. It also noted the cable route traverses an area of high diver density compared to elsewhere in the Greater Wash SPA and that displacement would mean the loss of habitat in an important area of the SPA for approximately 40 days during a winter/non breeding season. It did not agree to no AEOI. NE continued to advise that a seasonal restriction from January to March inclusive (the period in which disturbance would be more costly and when food supplies might start to become depleted) for cable installation activities within or affecting the red-throated divers of the Greater Wash SPA would allow a conclusion of no AEOI for the project alone and in-combination with other plans and projects.

b) **Operational disturbance/displacement** - NE advised that if mitigation measures such as those agreed for East Anglia THREE could be agreed for fast moving boats, this would remove the likelihood of an AEOI for RTDs (response to Q23.14 of [REP1-088], comments on Appendix 3.1 in [REP3-051] and [REP6-021]). The Applicant updated the outline Project Environmental Management Plan[27] [REP7-022] to include the following mitigation measures to minimise disturbance to red-throated diver:

- avoiding and minimising maintenance vessel traffic, where possible, during the most sensitive time period in January/ February/ March;
- restricting vessel movements where possible to existing navigation routes (to areas where red-throated diver density is likely to be lowest);
- maintaining direct transit routes (to minimise transit distances through areas used by red-throated diver);
- avoidance of over-revving of engines (to minimise noise disturbance); and
- avoiding rafting birds either in-route to array from operational port and/or within the array (dependent on location) and where possible avoid disturbance to areas with consistently high diver density.

[27] Secured through the project environmental management plan which is required under dDCO Schedules 9 and 10 Part 4 Condition 14(1)(d)(vi).

NE [REP7-075] welcomed these commitments however confirmed it would need to see an updated PEMP to be able to conclude whether an AEOI could be ruled out. NE did not have the opportunity to comment on the Applicant's updated PEMP before publication of this RIES.

NOTE: This footnote is also applicable to RTDs of the Outer Thames Estuary SPA.

c) **In-combination displacement/disturbance** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that shipping already affects the distribution of RTDs within the SPA and this represents a background situation following many decades of shipping activity in the area. While any increase in shipping activity would constitute an in-combination impact on divers, the low level of project alone risk and the absence of other developments in the vicinity of the NV offshore cable route indicate that the likelihood of an in-combination disturbance effect is negligible (paragraph 271 of [APP-045]). It stated that the Greater Wash SPA contains several constructed or consented offshore wind farms. RTDs show strong avoidance of offshore wind farms and so the construction or operation of further offshore wind farms would also represent an in-combination impact on divers through foraging habitat loss. However, it is considered unlikely that any future developments would be sited close enough to the coast to directly impact the SPA during the same (short) time frame during which cables would be installed for NV. Therefore, the Applicant initially concluded that there would be no AEOI of the Greater Wash SPA from impacts on RTD due to NV in-combination with other projects (paragraph 272 of [APP-045]). This was disputed during the examination, as noted in footnotes (d) and (e) of this matrix.

d) **In-combination construction phase displacement/disturbance** - NE [RR-106][REP1-088][REP2-036] advised there is potential for the cable installation through the Greater Wash SPA to overlap with that for Hornsea Project Three. The Applicant [REP6-021] considered the risk of construction overlap to be very small. Nevertheless, it calculated the in-combination mortality for NV and Hornsea Project Three to be between 6 and 10 individuals and increasing baseline mortality in that year by approximately 2% to 3.3% using NE's preferred rates; and between 0.6 and 1 individual and increasing baseline mortality by 0.3% using the Applicant's evidence-based rates.

The Applicant noted this in-combination effect would only be expected to occur during a single non-breeding season, if both cable laying vessels planned for NV are present at the same time, and this was also at the same time when those for Hornsea Project Three are present, and furthermore that this combination of events occurs within the SPA during the non-breeding period (which is the least favoured period for such work due to less suitable weather conditions). The Applicant concluded no AEOI.

NE [REP7-075] did not agree the increase in mortality was insignificant and that the DCO/DML does not restrict cable installation to outside of the least favoured period. It reiterated its recommendation to restricting cable laying activities in January-March inclusive.

NE [REP7-075] also noted the Applicant had not considered in-combination disturbance/displacement of cable laying with currently constructed or consented wind farms within the Greater Wash SPA, as it had advised in [RR-106]. However, it advised that a seasonal cable installation restriction would enable an AEOI in-combination to be concluded.

e) **In-combination operational phase displacement/disturbance** - NE [RR-106] advised that in-combination operational displacement should also consider 100% displacement and 10% mortality rates. It did not agree that all wind farms installed before or during 2012 should be considered part of the baseline because the RTD population data pre-date the installations; therefore, the baseline cannot be assumed to include the effects of these wind farms. It also identified several wind farms located within the south-west North Sea RTD BDMPS in Furness (2015) that had not been included in the Applicant's assessment.

In response, the Applicant's RTD displacement note (Appendix 3.1 of [REP1-008]) included estimates of the abundance in the applicable wind farms (where these could be obtained). The cumulative assessment was updated using the rates advised by NE as well as its own preferred rates; it reached the same conclusions regarding the magnitude and significance of predicted impacts. The Applicant (Q23.88 of [REP4-040]) stated that the wind farm projects currently in examination (NV, Hornsea Project Three and Thanet Extension) contribute a very small amount to the predicted cumulative effect, with over 95% of the total effect attributed to existing, operational wind farms.

NE (comments on Appendix 3.1 in [REP3-051][REP4-062]) welcomed the Applicant's inclusion of the OWFs in the south-west North Sea BDMPS. However, it stated it could not reach any conclusion regarding the level of cumulative impact as it considered a better approach would be the same as that taken by the Applicant for auks (i.e. to present the seasonal mean peak abundances and then sum figures across the OWFs and put this through the matrix), or alternatively to use predicted density map and the underlying dataset of the SeaMaST project (Seabird Mapping and Sensitivity Tool) described in Bradbury et al. (2014). It also advised the figures presented in relation to Thanet Extension OWF may not be correct and noted [REP4-062] that Appendix 3.1 and 3.3 did not cover updates to in-combination displacement assessment for RTD at the Greater Wash SPA or Outer Thames Estuary SPA.

The Applicant's Deadline 6 and 7 updated ornithological assessments did not address in-combination disturbance/displacement from the presence of wind turbines to RTDs of the Greater Wash SPA or Outer Thames Estuary SPA.

NOTE: This footnote is also applicable to RTDs of the Outer Thames Estuary SPA.

LITTLE GULL

f) **Collision mortality** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that estimated collision mortality of little gull at the NV site would be 2 individuals (paragraph 257 of [APP-045]). The estimated regional population of little gull is approximately 10,000 to 20,000, of which the Greater Wash SPA population of 1,255 represents 6.3% to 12.6%. Collisions at NV would therefore affect between 0.13 and 0.25 individuals from the Greater Wash SPA (paragraph 258 of [APP-045]). This level of additional mortality due to collisions at NV alone would have an undetectable effect on the population; the Applicant therefore concluded there would not be an AEOI of the Greater Wash SPA (paragraph 259 of [APP-045]).

Deadline 7 revised CRM [REP6-019] and [REP7-062] - Further to discussions during the examination of the Applicant's overall approach to CRM (see section 2.5 of this RIES) the Applicant provided a revised collision risk assessment for little gull at Deadline 7 [REP7-062]. This calculated an annual collision risk of 8.3 little gull mortalities and concluded that maximum of one individual from the Greater Wash SPA population would be at risk (based on a precautionary population estimate). For the SPA population of 1,255, this would increase background mortality rate by 0.4%. The Applicant concluded this additional mortality would be undetectable and there would be no AEOI from the project alone; this conclusion was supported by NE [REP7-075].

g) **In-combination collision mortality** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that given the extremely low level of impacts at the NV site, the Applicant considered that the project would not contribute to an in-combination impact (paragraph 261 of [APP-045]). Thus, the Applicant concluded that the likelihood of an AEOI of the Greater Wash SPA population of little gull can be ruled out for NV in-combination with other projects. However, NE stated that whilst the project alone could result in <1% increase in baseline mortality, this does not mean it should not be added to the in-combination assessment and therefore recommended the in-combination collision risk was revisited once uncertainties around the CRM are resolved. [RR-106][REP2-038][REP3-051][REP4-062][REP5-017].

Deadline 7 revised CRM [REP7-062] – The Applicant [REP7-062] predicted in-combination collision mortality of little gull as 63.3 individuals (using a 99.2% avoidance rate and a population estimate of 10,000); a maximum of 8 of which would be from the Greater Wash SPA population. Using as built or planned designs, this would reduce to 5.2 individuals; and using a wider population of 20,000 this would be reduced to 2.6 individuals. These would give rise to increases in mortality for the SPA population of between 1% (for built projects and the realistic population of 20,000) and 3.2% using the most precautionary combination of consented development predictions and the smallest regional population estimate of 10,000. The Applicant noted a very similar total collision estimate of 7 individuals was accepted by the Secretary of State on the Triton Knoll non-material change application (BEIS 2018). It also noted that taking into account as-built wind farms (rather than consented) and the recently revised design for Triton Knoll (turbine number

reduction from 288 to 90) would reduce the increase in background mortality to 1%. The Applicant concluded an AEOI could be excluded.

NE was unable to comment on the Applicant's revised assessment before the publication of this RIES.

COMMON SCOTER

h) **Disturbance/displacement** – The Applicant provided a figure showing Greater Wash SPA common scoter distribution and the offshore cable route, using the data presented in NE and JNCC (2016) [REP2-030]. The Applicant concluded that the offshore cable route does not overlap with any concentrations of common scoter ([REP2-044] and Q23.85 of [REP4-040]) and maintained that a LSE could be excluded. NE stated [REP6-032] that it sought mapping from the Applicant demonstrating the cable laying activities and vessel movements would not interact with common scoter populations, in order to rule out an AEOI; however, it has not explicitly confirmed whether it agrees an AEOI can be excluded.

i) **In-combination disturbance/displacement** – The Applicant concluded no LSE for the project alone and did not consider in-combination effects. However, no agreement has been reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

4) OUTER THAMES ESTUARY SPA and pSPA*

EU Code: UK9020309A												
Distance to NSIP: 21km												
European site features	**Adverse effect on integrity**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Red throated divers (non-breeding)					**? a**						**? b**	

* As noted in the main text of this RIES, the Applicant's updated screening matrices [AS-044] also referred to the Outer Thames Estuary Extension pSPA; this was the first mention of the pSPA within the examination. For the purposes of this RIES, the ExA has applied the same conclusions of the Outer Thames Estuary SPA to the pSPA.

a) **Operational disturbance/displacement** - See footnote (b) of the Greater Wash SPA integrity matrix in this RIES which applies equally to the Outer Thames Estuary SPA.

b) **In-combination operational phase displacement/disturbance** – See footnote (e) of the Greater Wash SPA integrity matrix in this RIES which applies equally to the Outer Thames Estuary SPA.

5) HAISBOROUGH, HAMMOND AND WINTERTON SAC

EU Code: UK0030369															
Distance to NSIP: 0km (cable route intersects the SAC)															
European Site Features	**Adverse effect on integrity**														
	Temporary physical disturbance			Habitat loss			New substrate			Increased suspended sediment and smothering			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Annex I Sandbank slightly covered by seawater all the time	**? a, h**	**? b, h**	**? e, h**		**? f, h**	**? e, g, h**		× c					**? d, h,**	**? d, h**	**? d, e, h**
Annex I Reef (*Sabellaria spinulosa* reefs)	**? h, i**	**? h, j,**	**? e, h**		**? f, h**	**? e, g, h**		**? k, h**		× l		× e	**? h, m**	**? h, n**	**? e, h**

SANDBANKS

a) **Temporary physical disturbance (construction)** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that the maximum area of temporary physical disturbance (9.5km^2) due to cable laying operations equates to 1.4% of the sandbanks and 0.6% of the total area of the SAC (paragraph 353 of [APP-045]). A Sandwave study by ABPmer (Appendix 7.1 of [APP-045]) concluded that as the cable corridor is oriented in most cases transverse to the sand wave crests which require levelling, only a small width of each sand wave would be disturbed with the sand wave continuing to evolve and migrate along most of its length. As a result, the overall form and function of any particular sand wave, or the SAC sandbank system as a whole, would not be disrupted. The cable corridor is in an active and highly dynamic environment, governed by current flow speeds, water depth and

sediment supply, all of which are conducive for the development and maintenance of sandbanks. As sediment would remain within the boundaries of the SAC within the natural limits there would be no significant change to sandbank extent, topography and sediment composition. Once re-deposited on the seabed, the sediment would immediately re-join the local and regional sediment transport system and would not affect the form or function of the sandbanks or the sandbank communities which are adapted to natural disturbance and are therefore likely to be able to recover within a few tidal cycles. As a result, the Applicant concluded there would be no AEOI.

NE's initial representations [RR-106][REP1-049] acknowledged the mobile nature of the sandbank system would make it more likely to recover from changes in structure than less mobile ones. However, it highlighted a lack of empirical data relating to interventions of similar spatial and temporal scale to the proposal to support the Applicant's modelling. NE further highlighted that there was limited survey data within the SAC and as the proposed construction techniques are new, their level of success is uncertain; therefore, the timeframes for any recovery are also uncertain (Q5.10 of [REP2-036]).

At Deadline 5, the Applicant and NE [REP5-007] had agreed that the physical processes of Annex 1 Sandbanks in the HHW SAC has the potential to recover from construction activities, within the range of natural variation; however, it is unclear whether there is agreement that an AEOI to sandbanks from temporary disturbance during construction can be excluded.

The matters discussed relating to disturbance of sandbanks during the examination are detailed below.

Sandwave levelling - NE welcomed the commitment by the Applicant to ensure that the dredged material would be deposited within the SAC to retain sediment within the sandbank system[28] ([REP1-049] and Q23.16 of [REP1-007]). However, it highlighted a lack of evidence for timescales of recovery of sandwaves from sandwave clearance or evidence that the sandbank system would remain undisturbed and it therefore had concerns in relation to the overall impacts to the form and function of the Annex I sandbank sandwave fields and their potential recoverability. NE therefore did not agree to no AEOI from sandwave levelling. [RR-106][REP1-049]. The MMO [RR-186][REP1-044] also did not agree that the SAC would remain undisturbed from sandwave levelling.

The Applicant argued (response to Q5.10 of [REP1-007]) that that sand wave study in Appendix 7.1 of the HRA Report [APP-045] provided a worst case assessment of disposal of sediment from sandwave levelling and confirmed the total volume of sediment in the SAC would not change; the overall area of sandbank habitat would not change; the sea bed composition would not change; and that morphology at the disposal area is likely to be within existing elevation range (sand waves up to 3m high with wavelengths of about 100m). It considered [REP2-031] that its assessment was conservative and sufficiently representative of the project lifecycle.

[28] Secured through the cable specification, installation and monitoring plan, to be agreed with the MMO, which is required under dDCO Schedules 9 and 10 Part 4 Condition 14(1)(g) and Schedules 11 and 12 Part 4 Condition 9(1)(g) and also required through the HHW SAC SIP [REP7-026].

Further to a review of evidence provided for Hornsea Project Three, NE [REP1-088][REP4-062] confirmed it is more confident in the Applicant's conclusions relating to sandwave levelling, although uncertainty around site specific impacts from the actual cable installation remained (see below).

Cable installation - NE [REP1-088] stated that it is likely sediments would recover from cable installation if no protection/sand wave clearance occurs, but advised that further information was required on cable burial operations to conclude no AEOI. It acknowledged that technical detail on cable burial operations would only be available post-consent; therefore, it advised sufficient precaution should be added to the Applicant's assessment to allow for significant, post-consent increases in worst case scenarios. The Applicant [REP2-031] reiterated the conclusion of the HRA Report that sediments would recover and there would be no significant change to the benthos. It also noted that the worst-case scenario had included contingency estimates as requested by NE during the Evidence Plan Process and therefore post-consent increases in worst case scenarios are highly unlikely and would be subject to additional licencing or variation to the DCO. The Applicant [REP2-031] noted the uncertainty regarding impacts from the cable installation but stated that it had drawn upon existing survey data as evidence where possible.

NE (Q5.10 of [REP2-036]) considered the Applicant had not used all relevant information in the supplementary advice on conservation objectives including that relating to form and function. It raised concerns over the potential for repetitive impact to the same area over different installation phases and combined repetitive impact to a feature over these different phases. The Applicant [REP2-003] stated that regardless of whether the project is installed in a single or two-phased scenario, the export cable installation would be undertaken for one cable pair at a time; therefore, the main difference between the scenarios would be the duration between the installation of one HVDC cable pair and the next. It argued that the impact of the bed levelling operations during installation would be comparatively minimal impact to the form and function of the sandwaves and sandbank feature regardless of the phasing scenario. It confirmed (Q23.99 of [REP4-040]) that cables would not be installed at the same location, therefore there would be no repeated disturbance of the same footprint during construction and that sandwave levelling is not expected for cable maintenance.

The Applicant [REP7-039][REP7-035] explained that the Outline HHW SAC Site Integrity Plan (SIP) [REP7-026] shows that the aim of the installation strategy for cables in the SAC would be to bury cables below the mobile sandwaves to avoid or minimise the requirement for routine re-burial of cables during the operational phase and that it will benefit from experience of other wind farm installations to underpin the detailed design and installation methodology with a comprehensive evidence base. It confirmed that the cable installation strategy and the location(s) and methodology for disposal must be agreed with the MMO in consultation with Natural England through the HHW SAC SIP before works can commence. ***Restoration objective*** - NE explained that its (unpublished) condition assessment of the SAC concluded that the sandbank feature is in unfavourable condition and needs to be restored; therefore, the Applicant should demonstrate the risk levels of their operations to the restoration of the extent and distribution of the sandbank (Annex C of [REP1-088]). The Applicant [REP2-031] confirmed it had reviewed NE's conservation advice and noted that the biological communities of the site are relatively species poor, therefore cable installation works and the small scale of cable protection would not significantly alter the community and the site would not be without the biological communities expected from the designated feature.

Dredging - NE ([RR-106] and Q5.10 of [REP2-036]) highlighted the lack of an assessment of the impact of the dredging itself. The Applicant (Q23.99 of [REP4-040]) highlighted its commitment to dispose of sediment arising from within the SAC back into the SAC[29] and explained that levelling and disposal had been considered together. It confirmed that there would be no change to the volume or extent of sandbank and effects to morphology, as assessed in the Sandwave Study (Appendix 7.1 of [APP-045]).

Mitigation - NE [REP1-088] queried what mitigation the Applicant proposed to decrease impact and reduce impedance of recovery and provided examples of mitigation from other activities in SACs designated for similar features (eg reduction of footprint associated with vessel stabilisation through use of alternative work vessels, provision of evidence to quantify footprint of rock armouring potentially needed for works and reuse of existing stabilisation material footprints). The Applicant [REP2-031] argued that these examples would lead to localised reductions of impact, but these differences would be minimal as this represents a temporary and localised effect; nevertheless, it confirmed it would assess the suitability of such options during development of Construction Method Statements.

Update to worst case scenario - The Applicant [REP7-026] confirmed that further to the reduction in the amount of cable protection, the total footprint for temporary disturbance on sandbanks is 2.45km^2.

b) **Temporary physical disturbance (operation)** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that the maximum disturbance area for cable reburial activities within the SAC has been estimated as 0.4km^2 over the life of the project (0.03% of the total area of the SAC or 0.06% of the sandbank area). This is estimated from 4km per cable pair within the SAC, with a disturbance width of 10m. However, if reburial is required, it is likely that this would be for shorter sections (e.g. 1km) at any one time (paragraph 375 of [APP-045]). The Applicant concluded that due to the short term, temporary nature and small scale of any maintenance works (if required) there would be no effect on the form or function of the sandbank systems or on the sandbank communities and therefore no AEOI.

NE [REP1-088] noted there was no discussion of the need for future reburial or cable protection and that it had not seen any evidence that sandwave levelling ensures cables remain buried ([RR-106][REP1-088] and Q5.10 of [REP2-036]). It highlighted that the Race Bank Offshore Wind Farm located in the Wash and North Norfolk Coast SAC had demonstrated cable installation is not a one-off activity [REP4-062]. The Applicant [REP2-031] explained that the worst-case scenario for the operation and maintenance phase is based upon the potential for suboptimal burial in the absence of sandwave levelling; this is considered to be conservative and it is expected that suboptimal burial would be reduced should sandwave levelling be adopted. The Applicant's updated integrity matrix [REP7-035] confirmed that an estimated average of one export cable repair every 10 years within the SAC is included in the Information to Support HRA [APP-045]. It is estimated that 300m sections would be removed and replaced per repair with a disturbance width of 10m and therefore an area of 3,000m^2 (0.003km^2) per repair combined with approximately 150m^2 for any

[29] Secured through the cable specification, installation and monitoring plan, to be agreed with the MMO, which is required under dDCO Schedules 9 and 10 Part 4 Condition 14(1)(g) and Schedules 11 and 12 Part 4 Condition 9(1)(g).

anchor placement associated with repair works (based on 6 anchors per vessel). Due to the short term, temporary nature and small scale of any maintenance works (if required) there would be no effect on the form or function of the sandbank systems or on the sandbank communities and therefore no AEOI.

Temporary physical disturbance to sandbanks from operations and maintenance activities was not discussed further in the examination; it is not clear whether NE agree with the Applicant's conclusion of no AEOI.

c) Introduction of new substrate (operation) - The Applicant's revised integrity matrix [REP7-035] concluded that the extremely small areas associated with the new substrate (0.002% of the total area of SAC and 0.004% of the area of sandbanks within the SAC) would have no significant effect on the governing processes or sandbank communities of the SAC. Therefore, there would be no AEOI.

The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

d) In-combination effects

Temporary physical disturbance during construction, operation and decommissioning – The Applicant's revised integrity matrix [REP7-035] explained that Chapter 8 Marine Geology, Oceanography and Physical Processes of the NV ES (DCO document reference 6.1) states that theoretical bed level changes of up to 2mm are estimated as a result of cumulative effects of NV cable installation and dredging at nearby aggregate sites. This level of effect has no potential to affect the SAC and therefore the only project screened in to the in-combination assessment is Norfolk Boreas (paragraph 391 of [APP-045]). As NV and Norfolk Boreas share an offshore cable corridor there is potential for in-combination effects associated with construction, operation and maintenance, and decommissioning of the projects (paragraph 392 of [APP-045]). It is likely that installation of the Norfolk Boreas export cables would follow the NV export cables with no temporal overlap. The spatial footprint of installation works for both NV and Norfolk Boreas is likely to be double that of NV alone as a worst-case scenario; although some elements of the seabed preparation may overlap and would therefore reduce the overall combined footprint (paragraph 393 of [APP-045]).

The HRA Report [APP-045] stated that there would not be enough time for sand waves levelled for NV to migrate into the area to be levelled for the Norfolk Boreas project. Therefore, there should be no additional impact on the sand waves due to the in-combination effect of both projects. The APBmer report (Appendix 7.1 of [APP-045]) concluded that the likelihood of altering the form and function of the sand wave field and the wider sandbank system is minimal and would not be beyond that described for each individual project.

NE noted uncertainty in the in-combination assessment with Norfolk Boreas ([REP1-088] and Q5.10 of [REP2-036]) and was concerned that the timeframe for impacts could be extended and that the implications of the site being in unfavourable condition for 10+ years should be assessed. The Applicant (Q23.99 of [REP4-040]) argued that each cable installation activity would be spatially and temporally isolated and therefore would not result in the sandbank feature being in unfavourable condition. NE did not comment further on in-combination physical disturbance.

Permanent habitat loss – The Applicant's updated integrity matrix [REP7-035] has not addressed in-combination habitat loss of sandbanks.

SIP – The Applicant's updated integrity matrix [REP7-035] concludes that an AEOI can be excluded on the basis that a SIP would be put in place. See footnote (h) of this matrix for further details.

REEF AND SANDBANKS

e) Decommissioning – The Applicant [APP-045][REP1-010][REP7-035] stated that the potential effects during decommissioning would be no worse than construction (paragraphs 453, 457, 478, and 480 of [APP-045]). The Applicant's updated integrity matrix [REP7-035] concludes that an AEOI can be excluded on the basis that a SIP would be put in place; see footnote (h) of this matrix for further details.

f) Habitat loss (operation)[30] - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that in terms of permanent habitat loss and introduction of new substrate, the worst case total area of cable protection installed within the SAC could be 0.05km^2 which includes cable protection required for crossing existing cables as well as a contingency in the unlikely event that cable burial is not possible (paragraph 380 of [APP-045]). Analysis of geophysical data has shown that the substrate along the entire offshore cable corridor is expected to be suitable for cable burial.

Sandbanks – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that in the unlikely event that cable burial is not possible, this would be a result of encountering areas of the SAC that are hard substrate i.e. not Annex 1 Sandbank (paragraph 381 of [APP-045]). The total footprint of cable protection at crossings equates to less than 0.001% of the total area of the SAC (1,468km^2) and 0.002% of the area of sandbanks within the SAC (678km^2) (paragraph 382 of [APP-045]). The Applicant concluded that due to the very small extent of potential permanent loss of sandbank within the SAC, there would be no change to the physical processes associated with the sandbank form and function and no significant loss of the low abundance and low diversity sandbank communities; as a result, there would be no AEOI.

The Applicant subsequently reduced the amount of cable protection to 5% (see section 2.5 of this RIES); however, did not provide a revised assessment of impacts.

Reefs - The Applicant's HRA Report [APP-045] and integrity matrices [REP7-035] did not address habitat loss of Annex I reef during operation.

Sandbanks and reefs - NE did not agree that there would be no habitat loss from the use of cable protection [REP1-088] and advised against its use (see section 2.5 of this RIES). It stated that the permanent loss of Annex I habitat could be considered as an AEOI [RR-106] and that cable protection would result in permanent habitat loss (Q23.46 of [REP2-036],[REP4-062],[REP6-032]).

[30] The HRA Report [APP-045] explained that the loss of habitat is an on-going impact, therefore it considered habitat loss under operation rather than construction to avoid double counting.

SIP – The Applicant's updated integrity matrix [REP7-035] concludes that an AEOI can be excluded on the basis that a SIP would be put in place. See footnote (h) of this matrix for further details.

g) Habitat loss (decommissioning) – The Applicant's HRA Report [APP-045] and integrity matrix [REP7-035] did not address habitat loss during decommissioning. NE advised that without removal at decommissioning the impacts are likely to persist and depending on the location may hinder the conservation objectives of the designated sites [REP1-088]. However NE also stated [RR-106][REP4-062][REP6-032] that the placement of cable protection is a permanent loss of habitat and that there is no empirical evidence that successful decommissioning where the habitat is returned to its pre-impact state; as a result of recent case law (Sweetman I) this would mean it is not possible to rule out an AEOI. Furthermore, it advised [REP4-062] that it is not appropriate to trade one Annex I habitat for another[31]; therefore, it cannot be considered a benefit to the site if one feature is lost (eg sandbanks) and another is gained (eg reef).

h) Site Integrity Plan (SIP) – Further to discussions over impacts to the HHW SAC Annex I reef and sandbank features, the Applicant acknowledged that the HHW SAC had special environmental status and therefore agreed to secure mitigation associated with the SAC in a single Site Integrity Plan (SIP) and through a separate condition in the DML [REP4-051][32]; this would include the proposed mitigation measures and agreement processes associated with the micro-siting of the cable (Q23.97 of [REP4-040]).

Both NE and the MMO had concerns about deferring the assessment of impacts to post-consent.

The MMO [REP6-030][REP7-071] considered there is a fundamental difference in the need for a SIP between the impact alone within the HHW SAC and for the in-combination noise impact within the Southern North Sea (SNS) SAC (where a SIP was utilised to address the uncertainty of in-combination impacts from other projects). It highlighted concerns regarding a lack of comprehensive descriptions of the worst-case scenario and proposed mitigation possible with different scenarios and considered that uncertainty regarding the approach to avoid all areas of reef was inadequately detailed. The MMO considered this should be addressed pre-consent. Nevertheless, it advised that the SIP should include detailed timescales explaining; when and how cable protection would be placed, timelines of indicative mitigation and how decisions would be made.

NE [REP6-032] considered that a SIP would be a halfway house between an export Cable Installation Plan and a full pre-construction SIP based on further project specific survey data and known contractor requirements. It advised that sufficient information on impacts and scale and conservation objectives is required to rule out AEOI and that the condition as suggested did not alleviate its concerns.

[31] ECJ Briels judgement: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:62012CC0521&from=EN

[32] Schedules 11 and 12, Condition 9(1)(m)

In response, the Applicant [REP7-039] noted that:

- there is significant uncertainty relating to the HHW SAC, particularly for Annex 1 reef features due to its ephemeral nature;
- the detailed installation method, cable crossing and requirement for cable protection would be informed by pre-construction surveys which cannot be undertaken earlier than 12 months prior to cable installation;
- other wind farms which have routed cables through SACs required consent variations; and
- it had provided an assessment of the worst-case scenario;
- the approach of not allowing the project to commence until the MMO, in consultation with NE is satisfied there would be no AEOI has been accepted on the consented East Anglia THREE project.

The Applicant provided a draft Outline SIP to NE and MMO in early April outside of the examination; it then submitted a version at Deadline 7 [REP7-026] which sought to address NE and MMO's comments. The purpose of the SIP was stated to be "*to set out the process for Norfolk Vanguard Limited to agree all works and potential mitigation measures associated with offshore cable installation (including seabed preparation works and cable protection) and maintenance within the HHW SAC, with the MMO in consultation with Natural England, in order to ensure there would be no adverse effect on integrity (AEoI) on the HHW SAC as a result of Norfolk Vanguard".*

The Applicant explained [REP7-064] that if it cannot be agreed with the MMO, in consultation with Natural England, that there is no adverse effect on the integrity of the HHW SAC, the consequences would be:

- construction cannot commence;
- alternatives must be considered;
- if no alternatives can be identified that can be agreed with the MMO, in consultation with Natural England, the Applicant would be required to submit a DCO variation or a Marine Licence application.

The Applicant also provided a note summarising the relevance and appropriateness of the SIP in this context [REP7-058]; explaining that it is not possible to provide detailed method statements for construction prior to consent due to the long lead in times and noting that a SIP had been accepted as an appropriate approach to deliver mitigation for Hornsea Project Two and East Anglia THREE projects.

The Applicant [REP7-064] confirmed that it was engaging in ongoing discussions with NE in relation to the Outline SIP and that it intends to submit a final version at Deadline 8. It considered that the uncertainty associated with the assessment highlights the importance of the SIP framework to allow for further consideration of the effects on the SAC based on the latest available information prior to construction, including pre-construction surveys. It maintained [REP7-059] that the need to appropriately assess the impacts

to the HHW SAC should be dealt with through the SIP and that the interim cable study (see section 2.5 of this RIES), combined with the commitments demonstrated in the Outline HHW SAC SIP and the wording of the DCO (Schedules 11 and 12, Condition 9(1)(m)), allow a conclusion of no AEOI to be made at the pre-consent stage.

The MMO [REP7-071] acknowledged the example of East Anglia Three but advised that there should still be an assessment of the worst-case scenario at this moment in time. It did not welcome delaying the decision process to post-consent. NE and the MMO did not have the opportunity to comment on the Outline SIP prior to publication of this RIES.

REEF

i) Temporary physical disturbance (construction) – The Applicant's HRA Report [APP-045] and updated integrity matrix [RE7-035] concluded that due to the width available for micrositing, it is likely that no physical disturbance would occur in the offshore cable corridor (paragraph 409-410 of [APP-045]). In the unlikely event of disturbance, *S. spinulosa* shows good recoverability to disturbance, depending on the degree of impact and local conditions. Due to the existing presence of *S. spinulosa* reef, local environmental conditions in the area are known to be suitable for *S. spinulosa* growth and therefore recovery (paragraph 411, 416-423 of [APP-045]). Micrositing of cables is secured through DCO, Schedules 9 and 10 Part 4 condition 14(g) and Schedules 11 and 12 Part 4 condition 9(g). In particular, Schedules 11 and 12 Part 4 condition 9(g) (which secures matters in respect of the transmission assets) states that a cable specification, installation and monitoring plan, must be agreed with the MMO. This includes a detailed cable laying plan which gives the MMO and their advisors the opportunity to input to the cable laying plan, including the cable route and potential for micrositing.

NE [RR-106][REP1-088][REP2-037] agreed that where Annex I reef could be avoided, there is a reduced risk of adverse effects from ground preparation and installation activities. However, NE stated that based on the information presented and flawed methods used for assessment, it could not provide an evidence-based opinion on the actual scale of the potential impacts to the *S. spinulosa* reef feature of the SAC. By Deadline 7, disagreement remained between the Applicant and NE whether an AEOI could be excluded; the matters discussed are detailed below.

Baseline - The Applicant established the reef baseline using existing mapping by JNCC, NE, Cefas and the Environment Agency and a site survey. NE [RR-106][REP1-088][REP2-036] raised concerns with the survey timings, mapping and analysis, stating that the extent of reef is difficult to interpret and that complex analyses had been applied to the data.

The Applicant [REP2-031][REP3-004] explained that the survey methodology was agreed with NE and MMO and provided an explanation of its mapping technique. It considered that the ephemeral characteristic of *S. spinulosa* is a key limitation to NE providing an evidence opinion on the scale of impact. It confirmed that pre-construction surveys would be undertaken33 to determine actual reef presence and extent prior to construction and would inform the routing of all cables. The Applicant also confirmed NE had

[33] As required under Conditions 13(2)(a) of the transmission DMLs (Schedules 11 and 12 of the dDCO).

agreed that the Applicant's maps of potential *S. spinulosa* reef identify potential reef areas which are largely consistent with areas NE has identified [REP1-049][REP3-004]. The Applicant [REP2-031] therefore considered its baseline to be sufficient.

Reef avoidance (micrositing) - The HRA Report [APP-045] committed to micrositing where possible and stated that the space available for micrositing within the offshore cable corridor where it overlaps with the SAC is approximately 1.05km along most of the route (2km corridor width), with up to 3.75km available in the 'dog-leg' area (4.7km corridor width). NE and the Applicant agreed [REP1-049] that cable routing/micrositing around the reef could be dealt with in the Cable Specification and Installation Monitoring Plan[34]. However, the parties disagreed on the significance of effects if micrositing is not possible and the reef is temporarily disturbed.

NE [RR-106] advised that all reef within the SAC should be micro-sited around, however considered there to be a high probability that the reef could develop in 'dog leg' area of the offshore cable corridor where this would not be possible. It raised concerns with the Applicant's caveat of micrositing around reef 'where possible' as there are no parameters to assess and agree what is "possible". The Applicant (response to Q5.6 [REP1-007],[REP2-031]) acknowledged that the area available for micrositing could change prior to construction and explained [REP2-031] that 'where possible' is a necessary caveat to the mitigation.

NE also noted that a fisheries byelaw was being considered by the Eastern Inshore Fisheries and Conservation Authority (EIFCA) which would close *S. spinulosa* reef areas to bottom-towed fishing and could therefore result in more extensive reef. NE explained it has advised EIFCA that such a byelaw should protect areas suitable for reef formation rather than solely where reef is present at any given time; it noted that it is highly probable the fisheries byelaw area will straddle the cable route and that the area should be avoided completely. ([RR-106], Annex C of [REP1-088],[REP2-036],[REP4-062],[REP6-032]).

The MMO [REP6-030] and NE [REP6-032] also both referred to a proposed Defra Fisheries Management Area which would overlap with the cable corridor; however, NE noted this would be a wide area which would be difficult to route around. NE [REP6-032] therefore advised that as a minimum, area of high confidence reef should be avoided in its entirety; if the Applicant can demonstrate that it is possible to avoid Annex I reef outside of this area but within the management area boundary, cable laying activities could occur without hindering the conservation objectives of the site or the management measures. NE also advised that cable protection should be excluded within the management area.

NE advised that micrositing is appropriate mitigation but considered that it is the Applicant's duty to demonstrate that this can be achieved in order to rule out an AEOI [REP6-032].

The Applicant [REP7-039] explained that if there is not sufficient space to route cables around reef identified during the pre-construction surveys, the route through reef would be subject to further assessment. It considered that works would be localised and lead to a temporary disturbance to a large reef, however explained that a conclusion of no AEOI would have to be agreed with the

[34] As required under Conditions 9(1)(g) of the transmission DMLs (Schedules 11 and 12 of the dDCO).

MMO in consultation with Natural England. If this could not be agreed, construction could not commence and the onus would be on the Applicant to consider alternative solutions in consultation with Natural England and the MMO. If a solution cannot be agreed, the Applicant would need to consider a DCO variation application or a Marne Licence application. It maintained its position that it is unlikely reef would develop to such an extent that micrositing would not be possible.

Reef recovery - The Applicant concluded that if reef could not be avoided during cable installation, there would be a small proportion of temporary disturbance and reef had high recoverability; therefore, there would be no AEOI ([APP-045] and Q5.6 of [REP1-007]). However, NE [RR-106][REP1-088][REP4-062] raised concerns over the evidence presented to support the ability of reef to recover if impacted through cable installation. It noted that the evidence on recoverability relates only to individuals/abundance, not to reef.

The Applicant argued that it had presented a conservative but proportionate assessment and maintained its conclusion of no AEOI [REP2-031][REP3-004]. It considered that, once the disturbance has ceased (i.e. cable laying or placement of cable protection) *S. spinulosa* could once again settle and form reef aggregations [REP2-031]. It argued that NE's position is disproportionate and inconsistent when NE also feel that micrositing may not be possible due to significant recovery of reef following around 100 years of extensive and repeated commercial fisheries dredging (ie from the implementation of the fisheries byelaw) [REP3-004]. It considered that the same logic would apply to short term and localised cable installation activities and identified evidence referring to reef rather than individuals (Q5.6 of [REP2-004]).

Restore conservation objective – avoiding areas of future reef - NE [RR-106] noted the need to consider the 'restore' conservation objective of the reef features and highlighted the need to make efforts to minimise impacts on areas that have the potential to support reef in the future. NE [REP1-088] considered the reef to be in unfavourable condition and that the applicant should demonstrate that activities would not impede restoration. It also argued that allowing cable installation could slow or temporarily reverse the trajectory of any recovery resulting from the fisheries byelaw [REP4-062].

The Applicant (response to Q5.6 [REP1-007], [REP2-031]) stated that *S. spinulosa* reef is ephemeral and opportunistic so can be expected to recover/recolonise within the range of natural variation; this would not cause adverse effects on the restoration objective for the site – as the magnitude would be low due to the small proportion of temporary disturbance. It considered (Appendix 1 of [REP3-004]) that if reef has recovered to such an extent that it is not possible to route two 30m swathes for NV and a further two for Norfolk Boreas through the 2 to 4km wide offshore cable corridor, then this would be an extremely large reef and the Applicant would propose that this would no longer require a restoration target. The Applicant [REP2-031] also queried how a restoration objective can be measured given the ephemeral and variable nature of the reef and when NE state it is not possible to quantity the total extent or loss of reef.

SIP – The Applicant's updated integrity matrix [REP7-035] concludes that an AEOI can be excluded on the basis that a SIP would be put in place. See footnote (h) of this matrix for further details.

j) **Temporary physical disturbance (operation)** – The Applicant's HRA Report [APP-045] stated that the maximum disturbance area for cable reburial activities within the SAC has been estimated as 100,000m^2 per cable over the life of the project (6.8% of the total area of the SAC). It explained that *S. spinulosa* are most frequently found in disturbed conditions and show good recoverability to disturbance and the area affected would be a very small extent of the total area of the SAC. Therefore, the Applicant concluded no AEOI.

However, NE noted that reef could be repeatedly impacted during construction and then again by cable repair/reburial during operation, which would limit the reefs ability to recover due to repeated impacts (Q5.17 of [REP2-036]). It also highlighted the potential for reef to establish across the cable corridor post-installation which could be affected during operation and maintenance cable remediation activities [RR-106]. The Applicant explained that any maintenance works would be agreed with the MMO and NE, would be localised and less than that of construction which the reef would have already been shown to recover from (Q23.99 of [REP4-040]).

However, NE [REP6-032] advised that operation and maintenance activities should either be excluded from within the site (with the option to apply for separate marine licence at later date) or sufficiently restricted as repeated operations and maintenance activities could result in continued disturbance and prevent recovery of Annex I reef. As noted in section 2.5 of this RIES, the Applicant subsequently agreed cable protection cannot be deployed during operation and maintenance, save in relation to cable protection already deployed which may be moved or extended to the extent assessed in the ES [REP7-040].

NE did not have the opportunity to respond to the Applicant's comment before publication of this RIES and it is unclear whether there is agreement between the two parties whether an AEOI to reef from temporary physical disturbance during operation can be excluded.

SIP – The Applicant's updated integrity matrix [REP7-035] concludes that an AEOI can be excluded on the basis that a SIP would be put in place. See footnote (h) of this matrix for further details.

k) **New substrate** – The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that any new substrata created by cable protection may provide a larger area of suitable *S. spinulosa* substrate than was previously present. Therefore, the Applicant concluded no AEOI (paragraph 452 of [APP-045]).

The Applicant considered [REP2-031] that impacts from cable protection would be highly localised and that the cable protection could become colonised by reef; this would therefore not limit the recovery potential of the SAC. Although NE agreed that potential beneficial effects can occur from introduction of hard substrate into a soft substrate system, it advised that within Marine Protected Areas (MPAs) this must be considered secondary to the requirement to recover or maintain the features for which the site is designated; therefore any potential benefits from hard substrate in HHW SAC are contradicted by the impact that the hard substrate would have on the features of the site and the achievement of recovery. It advised that a change of habitat is just as significant as loss of habitat, when that habitat is the designated feature (Annex C of [REP1-088]). NE advised that the deposition of material or other alteration of surface sediment are likely to lead to a persistent change to substrate which is not suitable habitat for mixed

sediment Annex I reef communities [REP1-088]. It did not consider that establishment of *S. spinulosa* on artificial substrate is Annex I reef as designated because it is not replacement for reef on natural site sediment as set out at the time of designations.

The Applicant [REP2-003][REP2-031] confirmed it did not consider cable protection to be a beneficial impact, but did consider that cable protection could become colonised by species associated with the SAC such as *S. spinulosa* reef and keel worms and therefore there would be no Annex I reef habitat loss and recovery potential would not be limited. It cited studies supporting the assertion that cable protection is suitable habitat for Annex I reef communities [REP2-003] and maintained that *S. spinulosa* reef would provide the same benefits in terms of biodiversity, regardless of what it is growing on [REP3-004]. The Applicant also highlighted [REP7-039] [REP7-059] that the large priority area within the DEFRA byelaw area extensively tracks existing pipelines and that *S. spinulosa* is found on an existing pipeline within the SAC. It considered that any reef, regardless of what it is growing on, would have the same effect on biodiversity.

SIP – The Applicant's updated integrity matrix [REP7-035] concluded that an AEOI can be excluded on the basis that a SIP would be put in place. See footnote (h) of this matrix for further details.

l) Increased suspended sediment and smothering (construction) – The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] stated that as part of the embedded mitigation, sediment would not be disposed of within 50m of *S. spinulosa* reef and therefore changes to the extent or structure of the reef due to increased suspended solids and smothering are not anticipated (paragraph 470 of [APP-045]). The location(s) and methodology for disposal (i.e. release near the seabed or water surface) must be agreed with the MMO in consultation with Natural England before works can commence in accordance with the Outline HHW SAC (secured by Condition 9(1)(m) of the Transmission DMLs (Schedules 11 and 12)).

The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

m) In-combination effects (construction phase)

Temporary physical disturbance - The HRA Report [APP-045] stated that the proportion of temporary reef disturbance resulting from NV and Norfolk Boreas would be up to 7.4%. In the context of reef growth that would have occurred relative to the extent of reef recorded in 2016, the conservation objective of maintaining or restoring extent would have been met and exceeded. In addition, there would be approximately 12 months between the two projects which may allow recovery of *S. spinulosa* to occur; *S. spinulosa* shows good recoverability to disturbance, depending on the degree of impact and local conditions and local environmental conditions in the area are thought to be suitable for good *S. spinulosa* recovery.

Increased suspended sediment and smothering - The HRA Report [APP-045] stated that in a worst-case scenario, approximately 1,000,000m^3 of sediment would be deposited into HHW following pre-sweeping of NV and Norfolk Boreas and approximately 2,400,00m^3 would be deposited back into the SAC due to trenching of export cables. Sediment would be kept within the SAC boundaries and would not be disposed of within 50m of *S. spinulosa* reef. Installation works would not be concurrent and *S. spinulosa* is resilient to increased sediment loads.

The Applicant therefore concluded there would be no AEOI. However, no agreement has been reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

n) In-combination effects (operation)

Temporary physical disturbance - The HRA Report [APP-045] stated that the maximum disturbance area would be 3,150m^2 (0.003km^2) for each cable repair, equating to less than 0.001% of the total SAC area at any one time. It is likely that any *S. spinulosa* reef would have recovered from temporary disturbance from one repair before other repairs are required. The area affected is a very small extent of the total area of the SAC and the likelihood of cable repairs being required in an area of reef is relatively low given the small extent of *S. spinulosa* reef compared within the cable corridor area. In addition, *S. spinulosa* shows good recoverability to disturbance in environments that are suitable for *S. spinulosa* growth.

Introduction of new substrate - The HRA Report [APP-045] explained that based on the known cable crossings along the route and the worst case scenario for cable protection, the maximum volume of new substrate would be up to 30,800m^3 and that any new substrata created by cable protection may provide a larger area of suitable reef substrate than was previously present.

The Applicant therefore concluded there would be no AEOI.

Permanent habitat loss – The Applicant's updated integrity matrix [REP7-035] did not address in-combination habitat loss of sandbanks.

No agreement has been reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

6) SOUTHERN NORTH SEA SAC

EU Code: UK0030395																					
Distance to NSIP: 0km																					
European site feature	**Adverse effect on integrity**																				
	Auditory injury			Disturbance from underwater noise			Disturbance from vessels			Collision mortality			Changes to prey resource			Changes to water quality			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Harbour porpoise	**?**a,**c**,k	×d,k	×f,k	**?** b**,c,**k	×d,e,k	×f,k	×g, k	×d, g,k	×f, g,k	×h, k	×d, h,k	×f, h,k	×i,k	×d,i,k	×f,i,k	×j,k		×f,j,k	***?l***	×m	×f

a) **Auditory injury (construction)** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that a Marine Mammal Mitigation Protocol (MMMP)[35] would avoid potential for auditory injury from piling (paragraph 645 of [APP-045]). The MMMP for piling would be agreed with the MMO in consultation with the relevant SNCBs and would be based upon best available information and methodologies. It would detail the proposed mitigation measures to reduce the risk of any physical or permanent auditory injury (Permanent Threshold Shift; PTS) to marine mammals during all piling operations. This would include details of the embedded mitigation, for the soft-start and ramp-up, as well as details of the mitigation zone in order to minimise potential impacts on physical and auditory injury and additional mitigation measures that could be required, for example, the activation of acoustic deterrent devices (ADDs) prior to the soft-start. (Section 8.2.1.2 of [APP-045]).

b) **Disturbance from underwater noise (construction)** – The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] considered that noise disturbance during piling and other construction activities is anticipated to be low, with a worst-case scenario of up to 10% overlap with the Southern North Sea (SNS) SAC winter area or up to 9.4% overlap with the summer SNS SAC area (Table 8.26 of [APP-045]) and a 3% seasonal average for the summer or winter areas ((Table 8.27 of [APP-045]). Therefore, temporary disturbance of harbour porpoise would be less than thresholds recommended by the Joint Nature Conservation Committee

[35] Required under and Schedules 9 and 10 Part 4 condition 14(1)(f) and Schedules 11 and 12 Part 4 condition 9(1)(f), to be based on the draft MMMP submitted with DCO application [APP-037]

(JNCC) and Natural England of 20% of the seasonal component of the SAC area at any one time and less than 10% of the average seasonal component of the SAC area over the duration of that season.

c) Auditory injury and disturbance (construction)

Mitigation measures – The Whale and Dolphin Conservation (WDC) and The Wildlife Trusts (TWT) raised concerns over effectiveness of soft-start piling to reduce potential effects on marine mammals [REP1-123][REP1-124]. NE [RR-106] initially advised that the soft-start noise levels may not be significantly less than the noise generated at maximum hammer energy, however at Deadline 4 confirmed the soft-start protocol would be fit for purpose [REP4-062].

WDC and TWT also had concerns regarding the effectiveness of some of the proposed noise mitigation methods and considered that proven noise reduction measures should be used [RR-013][REP1-123][REP1-061]. WDC [REP1-124][REP4-074] were concerned that the MMMP and SIP (see footnote (l) of this matrix) only included mitigation from the JNCC guidelines, which it noted had not been updated for a number of years and which it considered lack scientific evidence. WDC recommended that the MMMP and SIP include a commitment to using only use proven mitigation measures and recommended the use of bubble curtains. However, it stated that without knowing which methods would be used it is misleading to conclude there would be no AEOI as there is no scientific evidence to back up this claim [REP1-124]. TWT [REP4-072] advised that more evidence is required to give confidence on the effectiveness of mitigation measures and that where evidencing is lacking, monitoring should be put in place, as supported by European Commission Guidance on Article 6[36].

The application dDCO [APP-005] required a MMMP and SIP in the event that driven or part-driven pile foundations are proposed to be used. Further to concerns from WDC [REP4-074] and NE [REP4-062], the dDCO was amended to require production of a SIP and MMMP in the event that piled foundations are used, rather than only in the event of driven or part driven piles; this would allow consideration of any installation method.

Noise thresholds/limits - NE [RR-106] considered that the best available metric to ensure noise generated from piling does not exceed that assessed is to include a maximum hammer energy within the design parameters on the DCO and the DMLs. The maximum hammer energies were incorporated into the dDCO at Deadline 2 [REP2-018]. However, WDC and TWT did not agree with the SNCB guidance on noise management, stating that the area-based thresholds are not underpinned by evidence [REP1-061][REP1-062][REP1-123][REP4-072]; they therefore did not agree with the Applicant's conclusions and considered that the spatial and temporal thresholds would be breached. Both parties requested that limits were placed on noise levels during construction [RR-

[36] http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/Provisions_Art_._nov_2018_endocx.pdf

013][RR-172]; TWT noted that this approach is based on scientific data and is used in Germany, the Netherlands and Belgium and should be applied to ensure consistency across the Southern North Sea [RR-172][REP3-063][REP4-072].

Monitoring - NE [RR-106][REP1-088] and the MMO [RR-186][REP3-046][REP4-059] both recommended that the Applicant should cease piling if monitoring shows significantly different impacts to those assessed, until appropriate increased mitigation and/or monitoring can be agreed and implemented [RR-106][REP2-037]; this was supported by the MMO [REP4-059]. WDC similarly advised that development should be halted if monitoring identifies negative impacts [REP1-124]. This concern was addressed by the Applicant with a revision to Condition 19(3) of the generation assets DMLs (Schedules 9 and 10) and Condition 14 of the transmission DMLs (Schedules 11 and 12) [REP4-027].

d) Operation and maintenance impacts – The Applicant's HRA Report [APP-045] and integrity matrix [REP7-035] stated that operational and maintenance impacts are likely to be localised around the project infrastructure, and any maintenance impacts would be intermittent and temporary, therefore the Applicant concluded no AEOI would occur. (paragraphs 790; 792; 793; 798; 800; 801; 806; 808; 809; 830; 832; 833; 834 of [APP-045]). The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

e) Disturbance from underwater noise (operation) – The Applicant's HRA Report stated that currently available data suggests that there is no lasting disturbance or exclusion of harbour porpoise around wind farm sites during operation. It concluded that any disturbance of harbour porpoise as a result of underwater noise from operational turbines at NV (alone) would not exceed 20% of the seasonal component of the SAC at any one time and would not on average exceed 10% of the seasonal component of the Southern North Sea SAC. Therefore, there would be no AEOI. (Paragraphs 785-790 of [APP-045])

The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

f) Decommissioning impacts – The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] stated that the activity levels and potential effects during decommissioning would be no worse than construction (with no pile driving) (paragraphs 839; 840; 841; 842; 843 of [APP-045]). The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

g) Disturbance from vessels - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] stated that the NV West area (295km2) is approximately 1% of the summer SNS SAC area and the NV East area (297km2) is also approximately 1% of the summer SAC area. The total offshore cable corridor area (237km2) is less than 1% of the summer SAC area and less than 2% of the winter SAC area. It is unlikely that vessels would cause disturbance from the whole project areas and therefore this provides a conservative assessment. Disturbance from vessels is likely to be localised to areas of activity, thus there would be no exceedance of the 20% seasonal component at any one time or 10% of the average seasonal component thresholds and therefore the Applicant concluded there would be no AEOI. (paragraphs 734; 739 of [APP-045]). The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

h) Collision mortality – The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] stated that approximately 1,180 vessel movements are estimated over the two to four year indicative offshore construction window, an average of approximately two vessel movements per day (paragraphs 742; 743 of [APP-045]). It is expected that harbour porpoise would be able to detect the presence of vessels and, given that they are highly mobile, would be able to largely avoid vessel collision (paragraph 747 of [APP-045]), therefore the Applicant concluded there would be no AEOI. The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

i) Changes to prey resource - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] stated that potential effects on fish species include physical disturbance, loss or changes of habitat, increased suspended sediment concentrations, and underwater noise. It is anticipated that as a worst-case scenario effects from the NV West area (295km2) would impact approximately 1% of the summer Southern North Sea SAC area, and for the NV East area (297km2), approximately 1% of the summer SAC area, and/or for the total offshore cable corridor area (237km2), less than 1% of the summer SAC area and less than 2% of the winter SAC area (paragraph 760 of [APP-045]). However, it is more likely that effects would be restricted to an area around the working sites, therefore the Applicant concluded there would be no AEOI. The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

j) Changes to water quality - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] stated that the NV West area (295km^2) is approximately 1% of the summer Southern North Sea SAC area, the NV East area (297km2) is also approximately 1% of the summer SAC area. The total offshore cable corridor area (237km2) is less than 1% of the summer SAC area and less than 2% of the winter SAC area. It is highly unlikely that any changes in water quality (suspended sediment) could occur over the entire offshore development area during construction therefore this is a highly conservative assessment (paragraph 770 of [APP-045]). It is more likely that effects would be restricted to an area around the working sites, therefore there would be no exceedance of the 20% seasonal component at any one time or 10% of the average seasonal component thresholds and therefore the Applicant concluded there would be no AEOI. The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

k) Impacts from the project alone - The Applicant and NE agreed there would be no AEOI from the project alone [RR-106][REP1-049][REP3-051].

l) In-combination effects (construction)

Site Integrity Plan - The HRA Report [APP-045] identified the potential for more than 20% of the SAC summer and winter areas to be affected based on the maximum potential overlap for single and concurrent piling; or for more than 20% of the SNS SAC winter area to be affected. However, the Applicant considered it unlikely that concurrent piling would occur at all five sites assessed at the same time. The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] stated that impacts of underwater noise

from construction and decommissioning would be mitigated through the Site Integrity Plan (SIP)[37]. The SIP would set out the approach for the Applicant to deliver any project mitigation or management measures in relation to the SNS SAC in agreement with the MMO and relevant SNCBs to an extent whereby no AEOI is expected (paragraph 882 of [APP-045]).

NE [REP1-049] agreed that the draft SIP provided an appropriate framework to agree mitigation measures and that the scope of the measures within the In Principle SIP [APP-041] were appropriate; although noted that there has not yet been a need to adopt these measures, therefore they have not been proven to be deliverable [REP1-088]. It also considered there (Q23.11 of [REP2-036]) remained a lack of clarity on how SIP conditions would ensure that mitigation would be put in place to prevent exceedance of the SNCB thresholds for disturbance and that a mechanism would need to be developed by the regulators to ensure continuing adherence to the SNCB thresholds as multiple SIPs are developed over time. NE [RR-106] advised that it was unable to complete any in-combination assessment until the Review of Consents process[38] has concluded and a mechanism is in place to ensure that disturbance can be limited to an acceptable level.

The MMO (Q23.11 of [REP1-084] and Q23.101 of [REP4-059]) considered a SIP could be used to demonstrate how in-combination underwater noise impacts would be mitigated to ensure that it would not cause an adverse effect. However, it stressed that this would require accurate project timetables and noted that there is currently no mechanism in place for a regulator to control the scheduling of piling operations (Q23.22 of [REP1-084]). At Deadline 7, it confirmed [REP7-071] that the SNS SAC regulation group had laid out terms of reference and advised that there would be stakeholder consultation on the proposed mechanism in quarter 3 2019, with an intention to provide the response in quarter 4 2019. The MMO also explained [REP4-059] that it has enforcement powers to issue a stop notice or to vary, suspend or revoke a licence. It envisages that construction plans would be assessed by the Applicant in-combination with other projects to ensure there would be no breach of proposed thresholds prior to submission to the MMO. It advised [REP6-030][REP7-071] that if the consent decision occurs prior to a mechanism being defined, it could vary the DML; however, the current SIP requirement is likely to be sufficient to allow any mechanism to be fully incorporated without need for variation.

The WDC and TWT agreed with the principle of a SIP, but did not consider the Applicant's In Principle SIP [APP-041] contained enough information to give certainty of no adverse effect/beyond reasonable scientific doubt; rather, they considered the SIP and the MMMP (see footnote (c) of this matrix) were little more than a commitment to use mitigation methods [RR-172][REP1-061][REP4-074]. TWT [REP1-123] advised that more evidence is required to detail how effective the mitigation outlined in the In Principle SIP

[37] Required under Schedules 9 and 10 Part 4 condition 14(m) and Schedules 11 and 12 Part 4 condition 9(l)

[38] Regarding the Southern North Sea SAC, required under regulation 33 of the Conservation of Offshore Marine Habitats and Species Regulations 2017

would be, and that noise modelling should be undertaken to demonstrate the degree of noise reduction which could be achieved through mitigation. NE supported this position [REP2-036].

The Applicant stated that the In Principle SIP format follows that agreed for other consented projects and is based on information currently available, however it confirmed that the final SIP would be updated based on final design and taking into account best scientific evidence at the time [REP1-004][REP2-003][REP2-004]. Construction would not commence until the MMO is satisfied there would be no AEOI. It noted [REP4-038] that the Review of Consents has identified a SIP as the most appropriate mechanism to manage the mitigation of potential AEOI of the Southern North Sea SAC and provided an explanation of the options to manage in-combination effects and mitigation for harbour porpoise ([REP4-038] and Q23.102 of [REP4-040]).

Further to the clarifications from MMO over the timeframes for the regulator group, NE, WDC and TWT have not confirmed whether they agree an AEOI can be excluded for in-combination impacts.

m) In-combination effects (operation) – The Applicant's integrity matrix stated that current data suggests that there is no lasting disturbance or exclusion of harbour porpoise around wind farm sites during operation and therefore the Applicant concluded there would be no AEOI. The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

7) PASTON GREAT BARN SAC

EU Code: UK0030235

Distance to NSIP: 2.9km

European site features	**Adverse effect on integrity**																										
	Direct effects (e.g. habitat loss) on land within the SAC boundary			Direct effects on ex-situ habitats functionally connected to the SAC			Impacts from alterations to geology and land contamination			Disturbance due to groundwater / hydrology changes			Impacts from noise disturbance			Impacts from changing air quality			Impacts from light disturbance			Impacts from visual disturbance			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Barbastelle bats				**?** **a**	**?** **a**	**?** **a**				× b	× b	× b	× c	× c	× c				× d	× d	× d				**?** **e**	**?** **e**	**?** **e**

a) **<u>Direct effects on ex-situ habitats functionally connected to the SAC</u>** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] explained that hedgerow removal would be minimised by reducing the cable corridor working width to 20m at perpendicular crossings with the cable and a maximum of 25m where the cable crosses at a diagonal (paragraph 1184 of [APP-045]). The hedgerow would be removed in advance of construction phase works at each important barbastelle feature, and the land would remain open during the construction phase works at each location (for approximately one week, with the exception of Dilham Canal and land east of Dilham Canal, where works would take place over up to eight weeks due to trenchless drilling techniques at this location) (paragraph 1185 of [APP-045]). Hedgerows would be replanted following works at each location. To minimise the potential effect upon commuting and foraging barbastelle arising from this temporary loss of habitat, several mitigation measures outlined in the Outline Landscape and Ecological Management Strategy (OLEMS) [APP-031] would be implemented[39] and NV would seek to avoid mature trees within hedgerows through the micro-siting of individual cables where possible (paragraph 1186

[39] Secured through Requirement 24 (Ecological Management Plan) of the dDCO

of [APP-045]). Once replanted hedgerows have reached maturity (expected to be 3-7 years following planting on completion of construction), they would provide an improved commuting and foraging habitat for bats (paragraph 1185 of [APP-045]). Across the five important barbastelle habitat features potentially present within the onshore project area, a total of approximately 11ha of habitat used by barbastelles of the Paston Great Barn maternity colony is anticipated to be isolated by hedgerow removal during the project construction phase. This represents approximately 0.6% of the home range of the Paston Great Barn maternity colony (paragraph 1192 of [APP-045]). The Applicant concluded that following mitigation, these small-scale, temporary effects would not result in an AEOI.

However, NE [RR-106][REP1-088][REP2-037] considered that there was insufficient information to assess the significance of the loss and severance of foraging and commuting habitat for Barbastelle bats over a construction period of at least seven years. It considered that the HRA Report did not recognise the heterogeneity of hedgerows and how they may be used by Barbastelle bats [REP1-049]. It requested more information about each hedgerow to be removed and woodland to be fragmented, plus an estimate of recovery timescales; and advised that a mitigation plan should be agreed with NE prior to the removal of hedgerows [RR-106].

NE also suggested a requirement for a mitigation plan prior to hedgerow removal and that hedgerows should be monitored for seven years or until they have reached the same or better quality than before they were removed (Q23.60 of [REP2-036] and [REP6-032]).

The Applicant provided a clarification note (Appendix 3 of the SoCG with NE [REP1-049]) which confirmed that 130m of hedgerow within 5km of Paston Great Barn SAC would be temporarily removed during construction; 82m of which support foraging barbastelle bats. The Applicant reiterated that detailed bat and hedgerow mitigation measures are captured within the OLEMS [APP-031] and secured through Requirement 24 of the draft DCO (Ecological Management Plan), which would require consultation with Natural England prior to discharge.

Nevertheless, NE (Q24.1 of [REP2-036]) advised that the development has the potential to affect the conservation objective to "*Maintain the presence, structure and quality of any linear landscape features which function as flight lines*".

The Applicant submitted an updated version of the clarification note (Appendix 1 of [REP6-013]) which included additional information regarding the extent of available alternative foraging habitat, the location of habitat potentially temporarily fragmented from construction and the location of hedgerows temporarily affected during construction. Further to a review of the note, NE [REP6-032] confirmed that it had withdrawn its concerns, although it still advised that an OLEMS/EMP should include the improvement of hedgerows either side of the section to be removed and that the mitigation plan should be in place for 7 years or until hedgerow has fully recovered. This was addressed by the Applicant at Deadline 7 in section 7.3.3 of the updated OLEMS [REP7-008].

NE did not have the opportunity to comment on the updated OLEMS prior to the publication of this RIES and has not confirmed whether it agrees an AEOI can be excluded.

b) <u>Disturbance due to groundwater / hydrology changes</u> - The Applicant's matrices [AS-06][REP7-035] explained that the proposed trenching of watercourses identified as core foraging areas would involve ground excavation, and therefore would have a small, localised effect upon surface water flows. However, due to the removal of hedgerows, commuting and foraging habitats would not be present in these locations during the construction phase, and therefore the habitat within this location would not be affected. Furthermore, a pre-construction drainage plan would also be developed and implemented to minimise water within the cable trench and ensure ongoing drainage of surrounding land (paragraph 1198 of [APP-045]).[40]

The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

c) **<u>Impacts from noise disturbance</u>** - As noted in section 3.3 of this RIES, the Applicant's HRA Report [APP-045] explained that construction noise effects would be restricted to project working hours of 7am-7pm Monday-Friday and therefore have been screened out. The Applicant considered this restriction to be an inherent feature of the Proposed Development (Q23.15 of [REP1-007]); however, NE advised it would consider this as mitigation (Q23.15 of [REP1-088]). On the basis on the Sweetman judgement, the ExA has therefore progressed this impact to the integrity matrix.

No matters relating to noise disturbance on Barbastelle bats of the SAC from noise disturbance have been discussed during the examination.

d) **<u>Impacts from light disturbance</u>** - The Applicant's HRA Report [APP-045] and integrity matrix [REP7-035] explained that construction phase lighting for cable duct installation would be used between 7am-7pm, only if required (i.e. in low light conditions). Lighting would not be used overnight, except at trenchless crossing locations. In these instances, lighting may be needed for eight weeks at Dilham Canal and land east of Dilham Canal. Any lighting used would be directional i.e. angled downwards and a cowl provided for the light to minimise light spill (paragraph1199 of [APP-045]).[41] There would be no lighting required during the operational phase of NV (paragraph 1201 of [APP-045]).

The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

e) <u>In-combination effects</u> - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that the in-combination assessment for the onshore elements of this assessment for potential for AEOI has adopted the following principle: in order for NV to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project itself. If a potential for AEOI was not determined with respect to a site due to NV, there is no real prospect of an in-combination effect occurring with another plan or project. The Applicant

[40] As detailed in the outline CoCP [APP-025] and to be secured via the final CoCP under Requirement 20 of the draft DCO.
[41] As detailed in the OLEMS [APP-031] and to be secured via the Ecological Management Plan (EMP) under Requirement 24 of the draft DCO.

concluded that as there is no effect from NV alone, there is no potential for in-combination effects (paragraph 1209; 1210 of [APP-045]).

Although the Applicant's conclusion had not been explicitly disputed by any Interested Parties (by Deadline 7 of the examination) no agreement has been reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

8) RIVER WENSUM SAC

EU Code: UK0012647

Distance to NSIP: 0km

European site features	**Adverse effect on integrity**																									
	Direct effects (e.g. habitat loss) on land within the SAC boundary			Direct effects on ex-situ habitats functionally connected to the SAC			Impacts from alterations to geology and land contamination			Disturbance due to groundwater / hydrology changes			Impacts from noise disturbance			Impacts from changing air quality			Impacts from light disturbance			Impacts from visual disturbance			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	× a			× b			× b	? c d	? c d	? c d	? c d	? c d	? c d													? e	? e	? e
Desmoulin's whorl snail	× a			× b			× b	? c d	? c d	? c d	? c d	? c d	? c d													? e	? e	? e

a) **Direct effects on land within the SAC boundary –** As noted in section 3.3 of this RIES, the Applicant considered trenchless crossings to screen out direct effects at the River Wensum SAC to be an inherent feature of the Proposed Development (Q23.15 of [REP1-007]); however NE advised it would consider this to be mitigation (Q23.15 of [REP1-088]). On the basis on the Sweetman judgement, the ExA has therefore progressed this impact to the integrity matrix.

No matters relating to direct effects upon qualifying features of the SAC from trenchless crossing have been discussed during the examination.

b) <u>Direct effects on ex-situ habitats</u> - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that features are not present within the drains and ditches of the floodplain habitats of the River Wensum on the right-hand (southern) bank of the river (paragraph 1158; 1170 of [APP-045]). The drain on the left-hand (northern) bank of the river is located outside of the proposed trenchless crossing technique zone (paragraph 1159; 1171 of [APP-045]). Therefore, potential direct effects upon this habitat have been avoided at this location. Additionally, given the absence of these features from the other ex-situ habitats located within the onshore project area, it is considered unlikely that habitat is present within this drain.

The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

c) <u>Indirect effects</u> - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that there are no springs or seepages located within the floodplain habitats on the right-hand bank of the River Wensum (paragraph 1162 of [APP-045]). The floodplain on the left-hand bank would be avoided by trenchless crossing techniques, however a narrow section of the floodplain below ground in this location would be affected by the trenchless crossing. A pre-construction survey on the left-hand floodplain habitat would be conducted to identify any springs or seepages and, if identified, these would be avoided through micro-siting (paragraph 1162 of [APP-045])[42]. As such, works in this area would not result in direct changes to any springs directly connected to the River Wensum. Introduction of cable ducts is not anticipated to have any effect upon groundwater flows for the River Wensum (paragraph 1162 of [APP-045]). Furthermore, for a river crossing, trenchless crossing ducts would be installed 5-15m below the floodplain, and at least 2m below the river bed. As a result, the buried ducts would have no effect upon surface water flows.

Mitigation measures (included in the Outline Code of Construction Practice (CoCP) [APP-025] and secured through DCO Schedule 1 Part 3 Requirement 20) would be put in place to minimise the risk of sediment or pollutant release into the watercourses which are functionally connected to the River Wensum (paragraph 1164; 1165 of [APP-045]). The Applicant considered these to be suitable for minimising the risk of sediment / pollutant release into watercourses functionally connected with the River Wensum to a negligible level.

Sediment management and restoration/reinstatement - NE [RR-106][REP1-088] raised concerns about the level of detail within the CoCP regarding measures to safeguard the designated sites in relation to sediment control and reinstatement of all work areas. Whilst NE welcomed that a programme for each watercourse crossing, diversion and reinstatement would be produced[43] to include site specific details of the sediment management measures, it expected to see the mitigation presented at this stage [REP2-036]. It advised [RR-106] that works to facilitate the trenchless crossing of the River Wensum within the floodplain north of Penny

[42] As detailed in the Outline Landscape and Ecological Management Strategy (OLEMS) [APP-031] and to be secured via the Ecological Management Plan (EMP) under Requirement 24 of the draft DCO.

[43] Secured through Requirement 25 (Watercourse crossings) of the dDCO

Spot Beck, should be avoided as it is part of a Countryside Stewardship agreement to improve the site integrity of the River Wensum SAC. It was content with the mitigation proposed if this location had to be used, i.e. works would take place outside of the winter period (October – February inclusive), however it advised that restoration of this site should be undertaken sensitively: deep turf stripping and reinstatement is more appropriate than natural regeneration or reseeding.

The Applicant submitted a clarification note (Appendix 1 of [REP6-013]) to clarify its approach to onshore construction works within functional floodplains and identify mitigation measures to minimise the risk of sediment or pollutant release in the River Wensum and Penny Spot Beck.

NE subsequently ([REP5-017] and Appendix 2 of [REP6-013]) confirmed the note addressed most of its concerns and provided sufficient details with regards to sediment control. It welcomed the commitment within the functional floodplain to topsoil strip using a turf cutter, to store removed topsoil and turn outside the functional floodplain and to retain and reinstate turf rolls. However, it noted that in areas outside of the functional floodplain areas of removed surface vegetation (with the exception of arable crops) would be reseeded to prevent future runoff; it considered that reseeding would only be effective when carried out in suitable growing conditions, otherwise it risks extended periods of bare ground, liable to erosion and that there was the potential to affect water quality within the River Wensum SAC. NE also noted that the clarification note did not provide details on how any damage to ground conditions from vehicle tracking would be rectified prior to the reinstatement of topsoil/turf.

At Deadline 7, NE [REP7-075] confirmed that restoration of habitats within the River Wensum catchment would be captured within the detailed scheme and programme of watercourse crossings to be produced by the Applicant post-consent[44]. Nevertheless, it clarified its approach to grassland reinstatement within the functional floodplain would be implemented for all grassland habitats located within 10m of any watercourse within the River Wensum catchment. The Applicant also confirmed it would follow Defra's Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009) during all land reinstatement; including measures related to the relief of soil compaction. The Applicant updated the outline CoCP [REP7-006][45] to include these commitments and, in light of the negligible risk of the proposed works affecting local groundwater and hydrology conditions following implementation of the mitigation measures, concluded no AEOI.

NE [REP7-075] welcomed the provision of further clarification and the commitment to update the CoCP, however was unable to comment on the updated CoCP prior to publication of this RIES.

d) ***Pollution control –*** NE [REP1-088] advised that detailed management and monitoring procedures should be provided in the CoCP in case of 'breakout' of drilling fluid. The Applicant's clarification note (Appendix 1 of [REP6-013]) provided a brief overview of the

[44] Secured through Requirement 25 (Watercourse Crossings) of the dDCO

[45] Secured through Requirement 20 (Code of Construction Practice) of the dDCO

break-out contingency plan. NE confirmed this addressed its concerns (Appendix 2 of [REP6-013]). An updated CoCP was provided at Deadline 7, which incorporated the information set out in the Applicant's clarification note.

e) **In-combination effects** - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that the in-combination assessment for the onshore elements of the assessment for potential for AEOI has adopted the following principle: in order for NV to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project alone. If a potential for AEOI is not determined with respect to a site due to NV alone, there is no real prospect of an in-combination effect occurring with another plan or project. The Applicant considered that as there is no effect from NV alone, there is no potential for in-combination effects (paragraph 1177 of [APP-045]).

The Applicant's conclusion had not been explicitly disputed by any Interested Parties (by Deadline 7 of the examination), However, an agreement has yet to be reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

9) NORFOLK VALLEY FENS SAC

EU Code: UK0012892

Distance to NSIP: 0.6-5km (5 sites within 5km)

European site features	**Adverse effect on integrity**																										
	Direct effects (e.g. habitat loss) on land within 5km			Impacts on features outside 5km of the onshore project area			Impacts on ex-situ habitats functionally connected to the SAC			Disturbance due to ground-water / hydrology changes within 5km			Effects from noise disturbance within 5km			Effects from changing air quality within 5km			Effects from light disturbance within 5km			Effects from visual disturbance within 5km			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Northern Atlantic wet heaths with *Erica tetralix*										× a, b, c	× a, b, c	× a, b, c				× d									× e	× e	× e
European dry heaths										× a, b, c	× a, b, c	× a, b, c				× d									× e	× e	× e
Semi-natural dry grassland and scrubland facies on calcareous substrates (*Festuco-Brometalia*)	× f	× f	×f	× f	×f	×f	×f	×f	×f	×f	×f	×f	×f	× f	×f	×f	× f	×f	×f	×f	×f	×f	×f	×f	×f	×f	×f
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)										× a, b, c	× a, b, c	× a, b, c				× d									× e	× e	× e

Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*										× a, b, c	× a, b, c	× a, b, c				× d									× e	× e	× e
Alkaline fens										× a, b, c	× a, b, c	× a, b, c				× d									× e	× e	× e
Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*)										× a, b, c	× a, b, c	× a, b, c				× d									× e	× e	× e
Narrow-mouthed whorl snail	× f	× f	×f	× f	×f	×f	×f	×f	×f	×f	×f	×f	×f	× f	×f	×f	× f	×f	×f	×f	×f	×f	×f	×f	×f	×f	×f
Desmoulin's whorl snail	× f	× f	×f	× f	×f	×f	×f	×f	×f	×f	×f	×f	×f	× f	×f	×f	× f	×f	×f	×f	×f	×f	×f	×f	×f	×f	×f

NORTHERN ATLANTIC WET HEATHS WITH *ERICA TETRALIX,* EUROPEAN DRY HEATHS, MOLINIA MEADOWS ON CALCAREOUS, PEATY OR CLAYEY-SILT-LADEN SOILS (*MOLINION CAERULEAE*), CALCAREOUS FENS WITH *CLADIUM MARISCUS* AND SPECIES OF THE *CARICION DAVALLIANAE,* ALKALINE FENS AND ALLUVIAL FORESTS WITH *ALNUS GLUTINOSA* AND FRAXINUS EXCELSIOR (*ALNO-PADION, ALNION INCANAE, SALICION ALBAE*)

a) **Groundwater/hydrology effects** - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that out of the five component SSSIs, only one (Booton Common SSSI) has a functional connection to the onshore project area. Where the onshore cable route crosses two tributaries of the Blackwater Drain, trenched crossing techniques are proposed (paragraph 1221 of [APP-045]). Following construction at these locations, reinstatement of the trench would be conducted to the pre-construction depth of the watercourse and the dams removed. As water flow would be maintained and given the distance of these sites from Booton Common, effects from trenching works at these locations upon the Blackwater Drain would be minimal (paragraph 1223; 1224 of [APP-045]).

Changes to groundwater flow - NE [RR-106] noted that the qualifying features present at Booton Common are water sensitive habitats reliant on the groundwater supply and considered that there was insufficient evidence to assess impacts of changes in groundwater flow. It advised that further information be obtained from the Environment Agency (eg WetMec data showing water

supply mechanisms for all the component sites and/or EA's groundwater modelling) to undertake a detailed appraisal of groundwater effects at both Norfolk Valley Fens SAC and The Broads SAC.

The Applicant provided a clarification note regarding groundwater dependent designated sites (Appendix 2 of [REP1-049]) which confirmed that the Norfolk Valley Fens SAC and The Broads SAC are predominantly surface water fed, but also partly groundwater fed from the underlying chalk aquifer. It concluded that there is no direct pathway between construction works and the underlying chalk aquifer; therefore a detailed groundwater assessment was not considered necessary (Q23.52 of [REP1-007]). However, NE (Annex D of [REP1-088], Q23.56 of [REP1-088] and Q23.52 of [REP2-036]) noted WetMec data had not been provided and considered that there remained insufficient information to provide a substantive response.

The Applicant submitted a revised version of the water dependent designated sites clarification note which included a conceptual model of groundwater flows using WetMecs data with respect to Norfolk Valley Fens SAC (Booton Common SSSI component) and The Broads SAC (Broad Fen, Dilham component SSSI), to provide further clarity regarding groundwater flows for the site (Appendix 1 of [REP6-013]). The note explained that that the onshore cable trenching and HDD activities associated with the onshore project construction phase would remain at least 7m above the Chalk aquifer at any point and would be separated from the chalk aquifer by the boulder clay aquiclude. As such, there is no pathway between the onshore project area and any of the designated sites. In response to the note, NE withdrew its concerns [REP6-032] and confirmed it agreed with the conclusions of no AEOI to Norfolk Valley Fens SAC ([REP5-017] and Appendix 2 of [REP6-013]).

b) ***Sediment management and reinstatement/restoration -*** NE raised concerns about the level of detail within the CoCP regarding measures to safeguard the designated sites in relation to sediment control and reinstatement of all work areas; noting that the concern related to the River Wensum SAC, Norfolk Valley Fens SAC and The Broads SAC [RR-106][REP1-088]. As noted in footnote (b) of the River Wensum SAC integrity matrix in this RIES, the Applicant produced a clarification note (Appendix 1 of [REP6-013]) to clarify its approach to sediment management at the River Wensum crossing. The note did not explicitly address the Norfolk Valley Fens SAC and The Broads SAC. Nevertheless, the OLEMS was updated at Deadline 7 to confirm that a scheme and programme for each watercourse crossing, diversion and reinstatement would act as additional mitigation for the Norfolk Valley Fens SAC[46] and as noted in footnote (a) of this matrix, NE confirmed it agreed with the conclusions of no AEOI to Norfolk Valley Fens SAC [REP5-017].

c) ***Pollution control –*** See footnote (d) of the River Wensum SAC integrity matrix in this RIES which applies equally to the Norfolk Valley Fens SAC.

[46] Secured through Requirement 25 (Watercourse Crossings) of the DCO.

d) **Effects from changing air quality** - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that an air quality impact assessment in line with IAQM guidance (IAQM, 2014) has been conducted for NV to understand the potential effects of dust and fine particle emissions. Booton Common is located approximately 1.4km south of the nearest access route for construction vehicles for the proposed project and is located 600m from the onshore project area. As such, following IAQM guidance, it is considered to be outside the potential zone of influence of the project in terms of air quality emissions (paragraph 1226 of [APP-045]). The Applicant's conclusion has not been disputed by any Interested Parties (by Deadline 7 of the examination).

e) **In-combination effects** - The Applicant's HRA Report [APP-045] and initial integrity matrix [REP1-010] explained that the in-combination assessment for the onshore elements of this assessment for potential for AEOI has adopted the following principle: in order for NV to be considered to have the potential to contribute to in-combination effects, there must be sufficient cause to consider that a relevant habitat or species is sensitive to effects due to the project itself. If a potential for AEOI was not determined with respect to a site due to NV, there is no real prospect of an in-combination effect occurring with another plan or project. Therefore, as there is no effect from NV alone, there is no potential for in-combination effects (paragraph 1228 of [APP-045]).

However, NE [RR-106][REP1-088] noted that the Hornsea Project Three cable route passes about 360m to east of Booton Common and that construction periods may overlap. As such, it suggested that the in-combination assessment for Norfolk Valley Fens SAC be revisited. The Applicant did not consider that an in-combination assessment with Hornsea Project Three is required as no pathway to give rise to potential effects for NV alone has been identified (Q23.52 of [REP1-007] and (Q24.106 of [REP4-040]); this was confirmed in the water dependent designated sites clarification note (Appendix 1 of [REP6-013]).

NE confirmed it agreed with the conclusions of no AEOI to Norfolk Valley Fens SAC [REP5-017].

SEMI-NATURAL DRY GRASSLANDS AND SCRUBLAND FACIES ON CALCAREOUS SUBSTRATES, NARROW MOUTHED WHORL SNAIL and DESMOULIN'S WHORL SNAIL

f) As noted in the screening matrix within this RIES, NE identified these as features for which concerns remain, however did not provide further details. Nevertheless, as noted in footnote (a) of this matrix, NE confirmed it agreed with the conclusions of no AEOI to Norfolk Valley Fens SAC [REP5-017].

10) THE BROADS SAC

EU Code: UK0013577												
Distance to NSIP: 3.6km												
European site features	**Adverse effect on integrity**											
	Direct effects upon ex-situ habitats which may support the qualifying feature otter, due to suitable ex-situ habitats for this feature being present			Indirect effects upon habitats and species within the SAC boundary arising from changes in local groundwater / hydrology conditions			Indirect effects upon ex-situ habitats which may support the qualifying feature otter, arising from changes in groundwater / hydrology conditions			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
Hard oligo-mesotrophic waters with benthic vegetation of Chara spp				**? a, b,** c						**? d**		
Natural eutrophic lakes with Magnopotamion or Hydrocharition – type vegetation				**? a, b,** c						**? d**		
Transition mires and quaking bogs				**? a, b,** c						**? d**		
Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae				**? a, b,** c						**? d**		
Alkaline fens				**? a, b,** c						**? d**		

Alluvial forests with Alnus glutinosa and Fraxinus excelsior				**? a, b,** c						**? d**		
Molinia meadows on calcareous, peaty or clayey-silt-laden soils				**? a, b,** c						**? d**		
Desmoulin's whorl snail				**? a, b,** c						**? d**		
Fen orchid				**? a, b,** c						**? d**		
Ramshorn snail				**? a, b,** c						**? d**		
Otter	× e	× e	× e				× e	× e	× e	**? d**		

a) **Indirect effects** - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that as part of the project's embedded mitigation (listed as part of the detailed design and secured through DCO Schedule 1 Part 3 Requirement 16(17)(e)), the North Walsham and Dilham Canal would be crossed using a trenchless crossing technique (e.g. HDD). This means that the North Walsham and Dilham Canal would be avoided, and no works would take place within this watercourse (paragraph 1241 of [APP-045]). The East Ruston Stream is proposed to be crossed using a trenching methodology, however, given the distance to The Broads SAC (4.6km), the risk of groundwater pollution of The Broads SAC is low. Good practice pollution prevention measures would also be employed. For watercourses which are shallower than 1.5m, temporary damming and diverting of the watercourse may be employed during trenching works (paragraph 1243 of [APP-045]). The suitability of this method would be advised at detailed design. Several mitigation measures would be employed, and the trench would be reinstated to the pre-construction depth of the watercourse. Where culverts may be required, additional mitigation measures (captured within the Outline CoCP [APP-025] and secured through DCO Schedule 1 Part 3 Requirement 20) would be employed (paragraph 1245 of [APP-045]). In addition, no stage of the onshore transmission works involving the crossing, diversion and subsequent reinstatement of any designated main river or ordinary watercourse may commence until a scheme and programme for any such crossing, diversion and reinstatement in that stage has been submitted to and, approved by the relevant planning authority in consultation with NE (as secured through DCO Schedule 1 Part 3 Requirement 25).

Changes to groundwater flow – see footnote (a) of the Norfolk Valley Fens SAC integrity matrix. However, NE has not explicitly confirmed whether the Applicant's clarification note addresses it's concerns in relation to The Broads SAC.

b) ***Sediment management and reinstatement/restoration*** – NE raised concerns about the level of detail within the CoCP regarding measures to safeguard the designated sites in relation to sediment control and reinstatement of all work areas; noting that the

concern related to the River Wensum SAC, Norfolk Valley Fens SAC and The Broads SAC [RR-106][REP1-088]. As noted in footnote (b) of the River Wensum SAC integrity matrix in this RIES, the Applicant produced a clarification note (Appendix 1 of [REP6-013]) to clarify its approach to sediment management at the River Wensum crossing. The note did not explicitly address the Norfolk Valley Fens SAC and The Broads SAC. It is unclear whether the Applicant's clarification note addresses it's concerns in relation to The Broads SAC.

c) ***Pollution control –*** See footnote (d) of the River Wensum SAC integrity matrix in this RIES which applies equally to The Broads SAC.

d) **In-combination effects** – The footnotes of the Applicant's updated integrity matrix [REP7-035] did not explicitly address in-combination effects. However, the Applicant's HRA Report [APP-045] concluded that as the assessment did not identify any potential for AEOI from the project alone, therefore there is no potential for AEOI in-combination with other projects. The Applicant's conclusion has not been explicitly disputed by any Interested Parties (by Deadline 7 of the examination); however, no agreement has been reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

OTTER

e) **Direct and indirect effects** - The Applicant's HRA Report [APP-045] and updated integrity matrix [REP7-035] explained that a review of the desk-based records obtained from Norfolk Biodiversity Information Service (NBIS) in July 2016 indicated that there are no records of otter on the Hundred Stream. There is one record of an otter spraint on the North Walsham and Dilham Canal, recorded in 2015 and located at TG28863183. This is located approximately 700m upstream of the onshore project area. The absence of records of otter on the Hundred Stream is not conclusive proof of the absence of this species from the watercourse (paragraph 1235 of [APP-045]). However, water depths are likely to be too shallow to form part of an otter's home range, especially given the superior habitat available downstream on other parts of the river network connected to The Broads SAC. In light of this it is considered unlikely that otter are present within the reaches of the Hundred Stream in which the onshore project area is located (paragraph 1235 of [APP-045]).

The Applicant's integrity matrix [REP7-035] further explained that it is considered that otters may be commuting along the North Walsham and Dilham Canal within the onshore project area, but that they are not resting or making other use of bankside habitat in these locations (paragraph 1236 of [APP-045]). As part of the project's embedded mitigation, the North Walsham and Dilham Canal would be crossed using a trenchless crossing technique (e.g. HDD), to minimise impacts to the watercourse at this location. This means that the North Walsham and Dilham Canal and its immediate bankside habitat would be avoided, and no works would take place within these habitats (paragraph 1237 of [APP-045]). As a precaution, while works would be taking place within 100m of North Walsham and Dilham Canal, all excavations would be either covered overnight of left with escape ramps to allow otters to escape if

they enter, and all vehicles wheels / tracks would be checked in the morning for the presence of sleeping otter (paragraph 1239 of [APP-045]).[47]

NE [RR-106] confirmed that it was satisfied there is unlikely to be an AEOI of The Broads SAC in relation to the conservation objectives for otter.

[47] As detailed in the Outline Landscape and Ecological Management Strategy (OLEMS) [APP-031] and to be secured via the Ecological Management Plan (EMP) under Requirement 24 of the draft DCO.

11) BROADLAND SPA AND RAMSAR SITE

EU Code: SPA - UK9009253; Ramsar – UK11010																
Distance to NSIP: 53km (offshore project area); 3.6km (onshore project area)																
European site features	**Adverse effect on integrity**															
	Collision mortality			*Displacement/ disturbance*			*Barrier effects*			*Impacts to habitats*			*In-combination*		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
SPA qualifying features															
Great bittern (breeding)		× a								**? b**			**? c**	× a	
Bewick's swan (non-breeding)		× a								**? b**			**? c**	× a	
Whooper swan (non-breeding)		× a								**? b**			**? c**	× a	
Eurasian wigeon (non-breeding)		× a								**? b**			**? c**	× a	
Gadwall (non-breeding)		× a								**? b**			**? c**	× a	
Northern shoveler (non-breeding)		× a								**? b**			**? c**	× a	
Eurasian marsh harrier (breeding)		× a								**? b**			**? c**	× a	
Hen harrier (non-breeding)		× a								**? b**			**? c**	× a	
Ruff (non-breeding)		× a								**? b**			**? c**	× a	
Ramsar criterion															
Ramsar criterion 2: rare species and habitats within the															

biogeographical zone context															
Ramsar criterion 6: species/populations occurring at levels of international importance (tundra swan, Eurasian wigeon, gadwall, Northern shoveler, pink-footed goose and greylag goose)		× d		× d	× d	× d	× d	× d	× d	× d			× d	× d	× d

ALL SPA FEATURES

a) **<u>Collision mortality (alone and in-combination)</u> -** As noted in the screening matrix within this RIES, the Applicant provided collision estimates for the NV project alone and cumulatively with the adjacent East Anglia THREE Offshore Wind Farm for non-seabird migrants in [REP3-038]. NE [REP4-062] provided comments on the CRM, specifically:

- migration periods/routes – requesting consideration be given to different estimates for each migration season for some species;
- the source of the SPA population sizes; and
- CRM input parameters – including clarification as to the source of the proportion at potential collision height values for each species, nocturnal activity factors and bird biometrics data;

It also disagreed with the avoidance rates used by the Applicant for Bewick's swan (99.5%) and advised 98.9% was used (resulting in 1.5 annual collisions). However, it acknowledged that this this would not alter the Applicant's conclusion for the assessment of impacts from Vanguard alone.

The Applicant provided revised CRM for non-seabird migrants at Deadline 6 [REP6-022] to address NE's concerns; this included further information on migration routes and migrant population sizes. It predicted collision mortality of no more than 1 individual per year and that background mortality would not increase by more than 1% and would therefore be undetectable against natural variation. The Applicant therefore concluded no AEOI of the SPA populations of Breydon Water SPA, Broadland SPA or North Norfolk Coast SPA from the project alone, or in-combination with East Anglia THREE.

NE [REP7-075] welcomed the assessment and confirmed it was content with the total migrant population sizes used. It continued to argue that a 99.5% avoidance rate for Bewick's swan was not appropriately precautionary and advised a 98% avoidance rate. Nevertheless, it advised the resultant increase in annual collision predicted (which it calculated to be 1.4 rather than 1 or fewer stated by the Applicant in [REP6-022]) would not alter the Applicant's conclusions for the assessment of impact from NV alone.

NE noted that none of the predicted impacts (using the avoidance rates it considered to be appropriate) equated to 1% or more of baseline mortality for either the most recent 5 year mean site figures from WeBS or the citation figures (for the project alone or in-combination with East Anglia Three); it therefore agreed an AEOI can be excluded from collision risk from NV alone for all relevant non-seabird migrant qualifying features for both the project alone and in-combination.

NOTE: This footnote is also applicable to Breydon Water SPA and North Norfolk Coast SPA.

b) **Direct and indirect impacts to ex-situ habitats** - As noted in the screening matrix within this RIES, NE queried the importance of the ex-situ habitats used by SPA and Ramsar bird species that could be affected by construction. It reiterated the need for an assessment of cropping rotation and how this may impact bird species present across several years in order to confirm whether the low numbers of birds in the Applicant's survey was due to the cropping regime of that particular year or genuinely represents low usage of those areas. NE advised that mitigation would be required in terms of crop rotations that would be in place at the time of construction and until this is addressed, it would not be able to rule out an AEOI of Broadland SPA and Ramsar. [REP5-017][REP6-032]

The Applicant noted that mitigation measures had been proposed to account for changes in cropping patterns and for wintering birds to use different habitats for foraging and resting on an interannual basis in the OLEMS[48] [APP-031] (including no winter works in any one area in consecutive years) ([REP1-007] and Appendix 1 of [REP6-013]).

The Applicant subsequently committed to undertake a second year of wintering bird surveys post consent. If this demonstrates that qualifying birds are present in significant numbers then the Applicant has committed to working in only one of the two areas of the Broadland SPA and Ramsar site that overlap with the onshore works footprint[49] during the winter period (November to January inclusive); this would ensure the potential extent of foraging habitat subject to disturbance effects during construction would be limited to at most a 1.7km length of the onshore cable route [REP7-064]. This commitment was incorporated into section 10.3 of the updated OLEMS [REP7-008].

Should qualifying features be recorded during the second year of surveys, the Applicant stated that the mitigation described above would result in the ex-situ habitats only being rendered as sub-optimal foraging habitat for a maximum of one winter in every two. As effects would be extremely localised, reversible and indirect, the Applicant concluded there would be no AEOI on the Broadland SPA and Ramsar site in relation to the conservation objectives. [REP7-064]

[48] Secured through DCO Schedule 1 Part 3 Requirement 24 (Ecological Management Plan)

[49] Depicted on Figure 1 of [REP7-064]

NE [REP7-075] welcomed the measures. However, it advised that the survey area should be informed by the area of functionally linked land and therefore should be extended from 5km to 20km from the Broadland SPA/Ramsar and that appropriate Ramsar species be included.

c) **In-combination effects to ex-situ habitats –** In-combination effects to ex-situ habitats have not been explicitly addressed during the examination. No agreement reached with NE regarding effects from the project alone and the affect this has on the conclusion reached in the in-combination assessment is unclear.

RAMSAR CRITERION 6

d) **Collision mortality, displacement/disturbance and barrier effects** to Ramsar criterion 6 species has not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044]. However, NE's Deadline 7 response [REP7-075] agreed an AEOI can be excluded from collision risk from NV alone for all relevant non-seabird migrant qualifying features.

12) BREYDON WATER SPA AND RAMSAR SITE

EU Code: SPA - UK9009181; Ramsar – UK11008												
Distance to NSIP: 53km												
European site features	**Adverse effect on integrity**											
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination		
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*
SPA qualifying features												
Avocet (non-breeding)		× a									× a	
Bewick's swan (non-breeding)		× a									× a	
Golden plover (non-breeding)		× a									× a	
Assemblage qualification		× a									× a	
Ramsar criterion												
Ramsar criterion 5: assemblages of international importance		× b									× b	
Ramsar criterion 6: species/populations occurring at levels of international importance (including tundra swan, northern lapwing, and identified for possible future consideration: pink-footed goose, Eurasian wigeon, northern shoveler, European golden plover and black-tailed godwit)		× b									× b	

ALL SPA FEATURES

a) **Collision mortality (alone and in-combination) -** See footnote (a) of the Broadland SPA and Ramsar site integrity matrix.

RAMSAR CRITERION 5 and 6

b) **Collision mortality, displacement/disturbance and barrier effects** to Ramsar criterion 5 and 6 species has not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044]. However, NE's Deadline 7 response [REP7-075] agreed an AEOI can be excluded from collision risk from NV alone for all relevant non-seabird migrant qualifying features.

13) NORTH NORFOLK COAST SPA AND RAMSAR SITE

EU Code: SPA - UK9009031; Ramsar – UK11048													
Distance to NSIP: 80km													
European site features	**Adverse effect on integrity**												
	Collision mortality			Displacement/ disturbance			Barrier effect			In-combination			
	C	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	*C*	*O*	*D*	
Great bittern (breeding)		× a									× a		
Pink-footed goose (non-breeding)		× a									× a		
Dark-bellied brent goose (non-breeding)		× a									× a		
Eurasian wigeon (non-breeding)		× a									× a		
Eurasian marsh harrier (breeding)		× a									× a		
Montagu's harrier (breeding)		× b		× b	× b	× b		× b		× b	× b	× b	
Pied avocet (breeding)		× a									× a		
Red knot (non-breeding)		× a									× a		
Sandwich tern (breeding)		× a									× a		
Common tern (breeding)		× a									× a		
Little tern (breeding)		× a									× a		
Ramsar criterion													
Ramsar criterion 1													

Ramsar criterion 2												
Ramsar criterion 5: assemblages of international importance		× C		× C	× C	× C		× C		× C	× C	× C
Ramsar criterion 6: species/populations occurring at levels of international importance (including sandwich tern, common tern, little tern, red knot, pink-footed goose, dark-bellied brent goose, Eurasian wigeon, northern pintail, and identified for possible future consideration: ringed plover, sanderling, bar-tailed godwit)		× C		× C	× C	× C		× C		× C	× C	× C

ALL SPA FEATURES

a) **Collision mortality (alone and in-combination) –** See footnote (a) of the Broadland SPA and Ramsar site integrity matrix.

In addition, NE advised [REP4-062][REP7-075] that it did not agree with avoidance rate used by the Applicant for dark-bellied brent goose (99.8%) and advised that 99% should be used (and a range of rates (eg 95-99.8% be presented). However, it advised the resultant increase in annual collision predicted (4.4 rather than 1 or fewer stated by the Applicant in [REP6-022]) would not alter the Applicant's conclusions for the assessment of impact from NV alone.

MONTAGU'S HARRIER

b) Montagu's harrier was not included in the Applicants integrity matrix [REP7-035] and was not assessed by the Applicant in [APP-045] or [REP3-038]; however, it is present on the Natural England Conservation Objectives for the site[50]. However, NE's Deadline 7 response [REP7-075] agreed an AEOI can be excluded from collision risk from NV alone for all relevant non-seabird migrant qualifying features.

[50] http://publications.naturalengland.org.uk/publication/4732349359063040 (Accessed 15 April 2019)

RAMSAR CRITERION 5 and 6

c) **Collision mortality, displacement/disturbance and barrier effects** to Ramsar criterion 5 and 6 species has not been explicitly addressed in the Applicant's HRA Report [APP-045] or screening matrices [AS-044]. However, NE's Deadline 7 response [REP7-075] agreed an AEOI can be excluded from collision risk from NV alone for all relevant non-seabird migrant qualifying features.