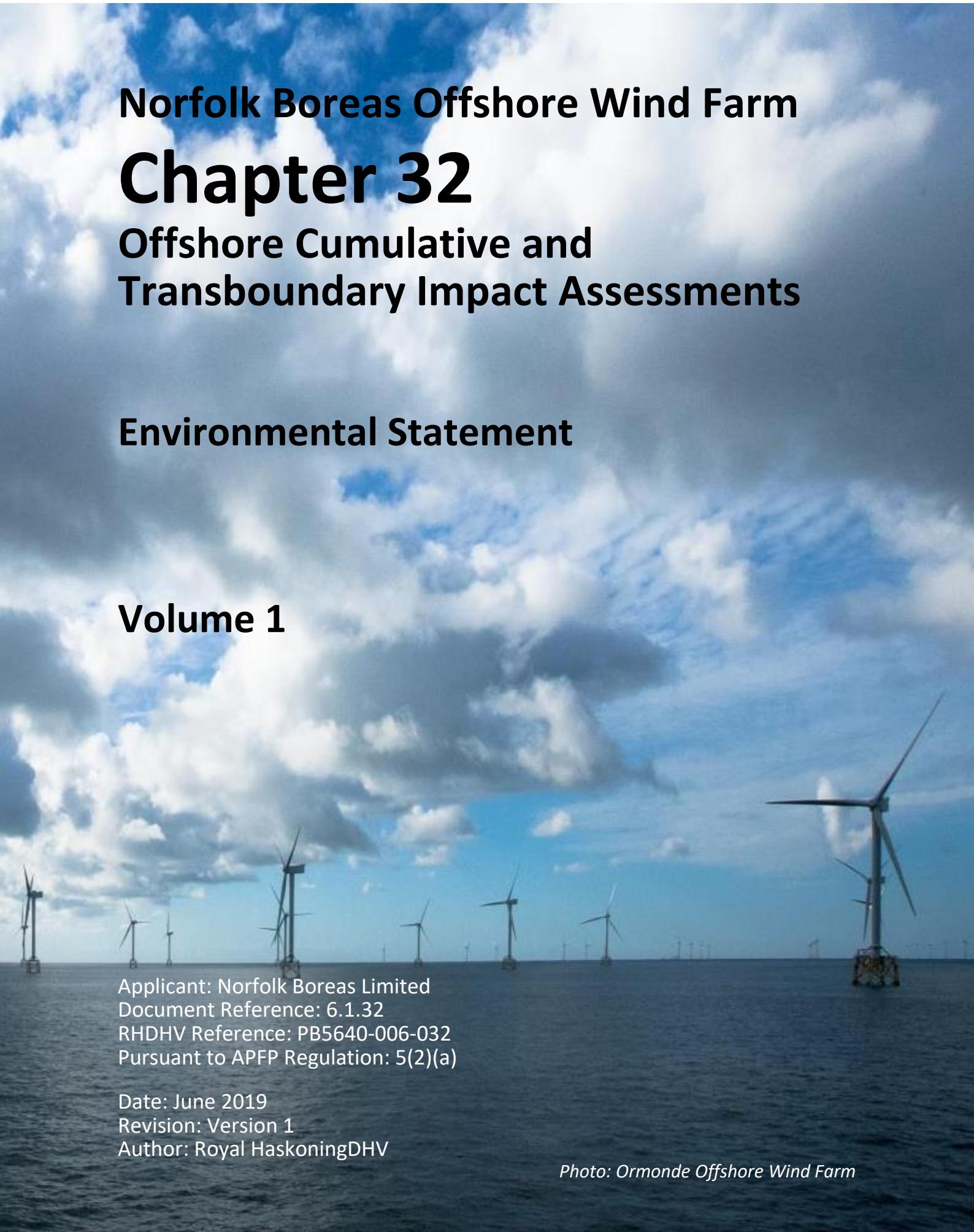
Norfolk Boreas Offshore Wind Farm

Chapter 32

Offshore Cumulative and Transboundary Impact Assessments

Environmental Statement

Volume 1



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Glossary of Acronyms

CIA	Cumulative Impact Assessment
DCO	Development Consent Order
EEA	European Economic Area
EIA	Environmental Impact assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Groups
EU	European Union
FIR	Flight Information Region
HMR	Helicopter Main Route
HRA	Habitat Regulations Assessment
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zone
MS	Member State
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Project
PEIR	Preliminary Environmental Information Report
SNSOWF	Southern North Sea Offshore Wind Forum
SPA	Special Protection Area
TWT	The Wildlife Trust
UNECE	United Nations Economic Commission for Europe
ZEA	Zonal Environmental Appraisal

Glossary of Terminology

Cumulative Impacts	These may occur as a result of the project in conjunction with other existing or planned projects within the study area for each receptor.
Norfolk Boreas site	The Norfolk Boreas wind farm boundary. Located offshore, this will contain all the wind farm array.
Offshore cable corridor	The corridor of seabed from the Norfolk Boreas site to the landfall site within which the offshore export cables will be located.
Offshore electrical platform	A fixed structure located within the wind farm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore. In the HVDC solution the electrical platform steps up the voltage and also converts the power from AC to DC.
Offshore export cables	The cables which transmit electricity from the offshore electrical platform to the landfall.
Offshore service platform	A platform to house workers offshore and/or provide helicopter refuelling facilities. An accommodation vessel may be used as an alternative for housing workers.
Project interconnector cable	Offshore cables which would link either turbines or an offshore electrical platform in the Norfolk Boreas site with an offshore electrical platform in one of the Norfolk Vanguard OWF sites.
Project interconnector	The area within which project interconnector cables would be installed.

search area	
The Applicant	Norfolk Boreas Limited.
The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.

32 OFFSHORE CUMULATIVE AND TRANSBOUNDARY IMPACTS

32.1 Introduction

1. This chapter of the Environmental Statement (ES) provides a summary of the Cumulative Impact Assessment (CIA) and transboundary impact assessment for the offshore topics of the proposed Norfolk Boreas Offshore Wind Farm (herein 'the project'). Whilst each technical assessment chapter within the ES provides its own cumulative impact assessment section in relation to that topic, the purpose of this chapter is to present an overview of all potential offshore cumulative impacts of the project. This chapter is also provided to meet the requirement to consider transboundary impacts required by The Convention on Environmental Impact Assessment in a Transboundary Context, UN treaty No. 34028 (termed the Espoo Convention) which was signed 10 September 1997. The Espoo Convention is implemented by the EIA Directive and transposed into UK law by way of the Environmental Impact Assessment (EIA) Regulations.

2. This chapter describes the requirement for CIA and transboundary impact assessment, the guidance for completing CIA in relation to Nationally Significant Infrastructure Projects (NSIP), and the consultation undertaken to inform the approach that Norfolk Boreas Limited has adopted.

3. It should be noted that an in-combination assessment will be undertaken as part of the Habitats Regulations Assessment (HRA) process. There are elements of the approach to CIA that are mirrored by the in-combination HRA process, in particular the method used to identify other plans, projects and activities that are taken forward in each assessment. Information to Support the HRA Report will be submitted as part of the DCO application, due in June 2019. HRA screening for European sites that will be included within the HRA is provided in Appendix 10.3 of this ES.

4. This chapter draws information from and should be read in conjunction with:

- Chapter 8 Marine Geology, Oceanography and Physical Processes;
- Chapter 9 Marine Water and Sediment Quality;
- Chapter 10 Benthic and Intertidal Ecology;
- Chapter 11 Fish and Shellfish Ecology;
- Chapter 12 Marine Mammals;
- Chapter 13 Offshore Ornithology;
- Chapter 14 Commercial Fisheries;
- Chapter 15 Shipping and Navigation;
- Chapter 16 Aviation and Radar;
- Chapter 17 Offshore and Intertidal Archaeology and Cultural Heritage; and

- Chapter 18 Infrastructure and Other Users;

32.2 Legislation, Guidance and Policy

5. There are numerous pieces of legislation, guidance and policy applicable to CIA and transboundary impacts. The following sections provide detail on key pieces of international and UK legislation, policy and guidance which are relevant to this chapter.

32.2.1 Legislation

6. Norfolk Boreas is subject to EIA under European Union (EU) EIA Directive 85/337/EEC (as amended). The EIA Directive was first transposed into English law for Nationally Significant Infrastructure Projects (NSIPs) by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (the EIA Regulations). In 2011, the original EIA Directive and amendments were translated into EIA Directive 2011/92/EU.

7. Directive 2014/52/EU amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment was published in the European Union's Official Journal in April 2014. The requirements of Directive 2014/52/EU have been formally implemented in England insofar as relevant to NSIPs in the form of a revised set of regulations entitled 'The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017' (the EIA Regulations 2017).

8. Under Article 3(2) of the Directive, transposed by Regulation 37, the EIA Regulations 2017, where an ES is submitted or where a scoping opinion has been sought before 16 May 2017, the project can benefit from transitional provisions to continue under the provisions of the EIA Regulations 2009. However, in order to ensure the EIA is maintained at high quality and in accordance with best practice, Norfolk Boreas Limited has given consideration to, and sought to apply, the new Directive and the EIA Regulations 2017 within this ES.

9. Schedule 4 paragraph 5 of the 2017 EIA Regulations (abridged below) states the need for:

"A description of the likely significant effects of the development on the environment resulting from, inter alia:

(e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources

The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative,

transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development."

10. In line with this requirement, a description of likely significant cumulative and transboundary effects is provided in each technical chapter of the ES and summarised in this chapter.

11. The United Nations Economic Commission for Europe (UNECE) Convention on Environmental Impact Assessment in a Transboundary Context (referred to as the Espoo Convention) requires that assessments are extended across borders between Parties of the Convention when a planned activity may cause significant adverse transboundary impacts.

12. Regulation 32 of the EIA regulations sets out procedures to address issues associated with a development that might have a significant impact on the environment in another European Member State. The procedures involve providing information to the Member State and for the Planning Inspectorate to enter into consultation with that State regarding the significant impacts of the development and the associated mitigation measures. Further advice on transboundary issues, in particular with regard to timing, process and consultation is given in the Planning Inspectorate (2018) Advice Note Twelve.

32.2.2 Guidance

32.2.2.1 Cumulative Impact Assessment guidance

13. Guidance that is applicable to a specific assessment is identified in the relevant chapters of this ES (Chapters 8 – 18).

14. Of relevance to CIA in general, and which has been used to guide the approach taken, are the Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission 1999) and RenewableUK (2013) Cumulative Impact Assessment Guidelines, guiding principles for cumulative impacts assessments in offshore wind farms.

15. Also of relevance to the general approach taken is Advice Note Nine, published by the Planning Inspectorate (2018a). This Advice Note addresses the use of the 'Rochdale Envelope' approach under the Planning Act 2008 (as amended by the Localism Act 2011). Advice Note Seventeen (Planning Inspectorate, 2015) also provides guidance on plans and projects that should be considered in the CIA.

32.2.2.1.1 The Planning Inspectorate Advice Note Nine

16. The Planning Inspectorate's Advice Note Nine: Rochdale Envelope (the Planning Inspectorate, 2018a) recognises that, at the time of submitting an application, offshore wind developers may not know the precise nature and arrangement of

infrastructure that make up the proposed development. This is due to a number of factors such as the evolution of technology, the need for flexibility in key commercial project decisions and the need for further detailed surveys (especially geotechnical surveys) which are required before a final design and layout can be determined. It is therefore important that a design envelope is used to provide flexibility to a developer (see Chapter 5 Project Description. Where necessary, a range of parameters for each aspect of the project has been defined and subsequently, the worst case scenario associated with each parameter and dependent on the receptor has been used in each impact assessment. This provides confidence that the EIA process is robustly considering the likely impact of the project, whilst also allowing the project to be optimised and refined at the time of construction, noting that this may be several years after the DCO application is made. The project design envelope therefore provides the maximum extent of the consent sought (see Chapter 3 Policy and Legislative Context). The detailed design of the project can then be developed, refined and procured within this consented envelope prior to construction.

17. The advice note highlights the importance of identifying and assessing the potential for cumulative impacts against the baseline position (which would include built and operational development) in order to ensure a robust application of the Rochdale Envelope.

18. In line with the advice note, this ES considers the potential for cumulative impacts to arise in the context of the flexibility being sought as part of the consent application. This chapter provides a summary of the assessment that has been undertaken.

32.2.2.1.2 The Planning Inspectorate Advice Note Twelve

19. Advice Note Twelve: Transboundary Impacts and Process (The Planning Inspectorate, 2018b) sets out the procedures for consultation in association with an application for a Development Consent Order (DCO) to the Planning Inspectorate, where such development may have significant transboundary impacts. The Advice Note sets out the roles of the Planning Inspectorate, UK Government departments and developers. Developers are advised to identify the possible significant transboundary effects or alternatively, state why they consider that there would not be any significant effects on another European Economic Area (EEA) State.

32.2.2.1.3 The Planning Inspectorate Advice Note Seventeen

20. Advice Note Seventeen: Cumulative Effects Assessment (The Planning Inspectorate, 2015) outlines the following staged process for the consistent assessment of cumulative impacts:

- Stage 1: Establish the project's zone of influence and identify a long list of other developments within this zone;

- Stage 2: Identify shortlist of other developments by applying inclusion/exclusion criteria to the Stage 1 list for CIA;
- Stage 3: Information Gathering regarding the shortlisted 'other development' to inform the CIA; and
- Stage 4: Assessment.

32.2.3 Policy

21. CIA has been undertaken with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for NSIP, and those relevant to Norfolk Boreas are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC) 2011a); and
- NPS for Renewable Energy Infrastructure (EN-3) (DECC 2011b).

22. The specific requirements of the NPS in relation to CIA and the transboundary impact assessment, relevant to Norfolk Boreas, are summarised in Table 32.1which also includes reference to where they are addressed within this ES.

Table 32.1 NPS assessment requirements for CIA and transboundary impact assessment

NPS Requirement	NPS reference	ES reference
EN-1 – Overarching NPS for Energy		
Information should be provided on how the effects of the applicant's proposal would combine and interact with the effects of other development (including projects for which consent has been sought or granted, as well as those already in existence).	EN-1, paragraph 4.2.5	This is assessed in all Technical chapters (8 to 30) within this ES.
Any assessment on aviation or other defence interests should also assess the cumulative effects of the project with other relevant projects in relation to aviation and defence.	EN-1, paragraph 4.19.12	Chapter 16 Aviation and Radar
Paragraphs 5.4.10 to 5.4.13 of EN-1 informs that if the proposed development could have an effect on civil and military aviation then the assessment should: • Consult the Ministry of Defence (MoD), the Civil Aviation Authority (CAA) and NATS and any aerodrome – licensed or otherwise – likely to be affected by the proposed development in preparing an assessment of the proposal on aviation or other defence interests; • Any assessment of aviation or other defence interests should include potential impacts of the project upon the operation of Communication, Navigation and Surveillance (CNS) infrastructure, flight patterns (both civil and military), other defence assets and aerodrome operational procedures.	NPS EN-1 Paragraph 5.4.10 to 5.4.13	Chapter 16 Aviation and Radar

NPS Requirement	NPS reference	ES reference
• Assess the cumulative effects of the project with other relevant projects in relation to aviation and defence.		
EN-3 – NPS for Renewable Energy Infrastructure		
Cumulative effects of the development with other relevant proposed, consented and operational wind farms will be considered.	EN-3, paragraph 2.6.169	Chapter 6 EIA Methodology describes the process for assessing cumulative effects and Chapters 8-30 include an assessment of cumulative impacts relevant to each chapter
Where cumulative effects are predicted as a result of multiple export cable routes in the intertidal zone, it may be appropriate for applicants of various schemes to work together to ensure that the number of cable crossings are minimised and installation and decommissioning phases are coordinated in order to reasonably minimise potential disturbance.	EN-3, paragraph 2.6.89	There will be no impact on the intertidal zone due to the use of long HDD as embedded mitigation
Where cumulative effects are predicted as a result of multiple cable routes in the subtidal zone, it may be appropriate for applicants of various schemes to work together to ensure that the number of cable crossings are minimised and installation and decommissioning phases are coordinated in order to reasonably minimise potential disturbance.	EN-3, paragraph 2.6.119	Chapter 10 Benthic and Intertidal Ecology
In some circumstances, transboundary issues may be a consideration as fishermen from other countries may fish in waters within which offshore windfarms are sited.	EN-3, paragraph 2.6.124	Chapter 14 Commercial Fisheries
The assessment of the effects on marine mammals should include the duration of the potentially disturbing activity including cumulative effects with other plans or projects.	EN-3, paragraph 2.6.92	Chapter 14 Marine Mammals
The navigation risk assessment will necessitate cumulative risks associated with the development and other developments (including other wind farms) in the same area of sea.	EN-3, paragraph 2.6.164	Chapter 15 Shipping and Navigation

32.3 Consultation

23. Consultation is an important aspect of the EIA and for this ES and is an ongoing process throughout the lifecycle of the project, from the initial stages through to post-consent. To date, consultation regarding the approach to CIA and transboundary impacts has been conducted through a number of Expert Topic Groups (ETG) through an overarching Norfolk Boreas Evidence Plan Process (EPP), the Scoping Report (Royal HaskoningDHV, 2017) and the Preliminary Environmental Information Report (PEIR) (Norfolk Boreas Limited, 2018). Full details of the project consultation process are presented within Chapter 7 Technical Consultation and the

Consultation Report, which has been submitted as part of the DCO application (document reference 5.1).

24. A summary of the consultation carried out at key stages throughout the project is detailed within relevant chapter assessments and focusses on key issues defined in each assessment. Consultation specifically regarding the CIA and transboundary impacts is set out in Appendix 32.1.

25. Under the Espoo Convention (1991), where a development is likely to cause 'significant adverse transboundary impact', relevant EEA Member States should be notified as early as possible, giving them the opportunity to participate in relevant EIA procedures. On 21st July 2017, following the request for a Scoping Opinion for Norfolk Boreas, the Planning Inspectorate issued a Transboundary Impacts Screening Matrix in accordance with Regulation 24 of the 2009 EIA Regulations. The Planning Inspectorate also published a notification in the London Gazette on 26th July 2017 inviting stakeholders from Belgium, Denmark, France, Germany and The Netherlands to notify the Planning Inspectorate if they wished to be consulted on the proposed development.

26. In addition to this pre-application consultation, statutory transboundary consultation will be undertaken by the Planning Inspectorate in accordance with Regulation 32 of the EIA Regulations, if and when it accepts Norfolk Boreas Limited's application for a DCO.

32.3.1 Southern North Sea Offshore Wind Forum

27. Recognising the importance of developing a consistent framework for the assessment of cumulative and transboundary impacts across other relevant offshore wind farm projects, Norfolk Boreas Limited (through its parent company Vattenfall Wind Power Limited) has also engaged and consulted with the developers of the other UK wind farms in the southern North Sea (referred to as the Southern North Sea Offshore Wind Forum (SNSOWF)).

32.4 Assessment Methodology

28. This section sets out Norfolk Boreas Limited's approach to the assessment of cumulative and transboundary impacts for offshore elements of Norfolk Boreas

32.4.1 Cumulative Impact Assessment

29. The scope of the CIA (in terms of relevant issues and projects) has been established with consultees (including through the Evidence Plan Process (EPP) (section 32.3) and liaison with other developers) as the EIA has progressed, this is also detailed in Chapter 6 EIA Methodology and in each offshore technical chapter (chapters 8-18). Norfolk Boreas Limited has taken advice and guidance (section 32.2.2) from various

sources to inform the CIA. The CIA also draws from findings of earlier studies undertaken to inform the East Anglia Zonal Environmental Appraisal (ZEA) (EAOW, 2012a) which considered cumulative impacts arising from the development of the whole former zone.

30. In addition, Norfolk Boreas Limited has considered experience from other projects located within the former East Anglia Zone through work undertaken for East Anglia ONE (EAOW, 2012b) and East Anglia THREE (EATL, 2015); the wider Southern North Sea; and other UK offshore wind and major marine infrastructure projects.

31. The Planning Inspectorate Advice Note Nine and its complementary guidance in Advice Note Seventeen provides guidance on plans and projects that should be considered in the CIA based on a tiered approach with decreasing levels of likely available detail:

- Projects that are under construction;
- Permitted applications, not yet implemented;
- Submitted applications not yet determined;
- Projects on the Planning Inspectorate's Programme of Projects;
- Development identified in relevant Development Plans, with weight being given as they move closer to adoption and recognising that much information on any relevant proposals will be limited; and
- Sites identified in other policy documents as development reasonably likely to come forward.

32. Where it is helpful to do so 'Tiers' of the development status of other projects' development have been defined, as well as the availability of information to be used within the CIA. This approach is based on the three tier system proposed in the Planning Inspectorate's Advice Note 17. In some offshore chapters, a more refined tiering system based on the guidance issued by JNCC and Natural England in September 2013 is employed and involves six tiers presented below:

- Tier 1: built and operational projects;
- Tier 2: projects under construction plus Tier 1 projects;
- Tier 3: projects that have been consented (but construction has not yet commenced) plus Tiers 1 and 2;
- Tier 4: projects that have an application submitted to the appropriate regulatory body that have not yet been determined, plus Tiers 1-3;
- Tier 5: projects that the regulatory body are expecting to be submitted for determination (e.g. projects listed under the Planning Inspectorate programme of projects), plus Tiers 1-4; and
- Tier 6: projects that have been identified in relevant strategic plans or programmes plus Tiers 1-5.

33. In accordance with Advice Note Seventeen, an initial long list of projects with the potential to interact with Norfolk Boreas has been identified, based on the potential mechanism of interaction. Where it is helpful to do so, the tiered approach may be adopted, based on the availability of information for each project to enable further assessment.

34. Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment have been included in the CIA.

35. Projects which are sufficiently implemented during the site characterisation for the project are considered as part of the baseline for the EIA.

36. Offshore cumulative impacts may arise from interactions with the following activities and industries:

- Other offshore wind farms;
- Wave and tidal projects;
- Aggregate extraction and dredging;
- Licensed disposal sites;
- Sub-sea cables and pipelines;
- Coastal protection schemes;
- Potential port/harbour development; and
- Oil and gas activities.

37. Norfolk Boreas limited is aware that extensions to many Round 3 offshore wind farm sites have been announced and that preparation for Round 4 sites is underway however, in line with the RenewableUK Cumulative Impact Assessment Guidelines for offshore wind farms (RenewableUK, 2013), the cumulative assessment of other developments has taken an approach that attempts to incorporate an appropriate level of pragmatism. This is demonstrated in the confidence levels applied to various developments, particularly those that are known but currently lack detailed project application documentation, such as those projects that are at the scoping stage only at time of writing (20th March 2019). These projects have been considered for CIA only in those chapters where it is considered that the Scoping Reports contain sufficient detail with which to undertake a meaningful assessment. Due to the lack of specific information in the public domain about these projects, and how and when (or if) they will be built, it is not always possible to undertake a meaningful CIA for these projects and therefore in some chapters they are not considered in the CIA.

38. Table 1.1 in Appendix 32.1 details the full list of plans or projects included in the CIA which has been developed as part of on-going consultation with technical consultees.

32.4.2 Transboundary Impact Assessment

39. As discussed in section 32.3, transboundary stakeholders were invited to notify the Planning Inspectorate if they wished to be consulted on the proposed development.

40. Potential transboundary impacts have been approached in a similar way to other cumulative impacts, with a clear audit trail provided to demonstrate why projects have been included or excluded. In accordance with the advice detailed above, relevant EEA member states have been consulted through targeted consultation including meetings with transboundary commercial fishermen and statutory consultees; and through the consultation on the EIA.

32.5 Cumulative Impact Assessment Methodology

41. The sections below summarises the cumulative impacts identified for each offshore chapter in the ES. The tables below provide the impact, a rationale of how cumulative impacts could occur and a CIA. All mitigation measures and further detail around the CIA are included in each relevant technical chapter.

32.5.1 Marine Geology, Oceanography and Physical Processes

42. Table 32.2 provides a summary of the CIA outcomes for marine geology, oceanography and physical processes. All plans and projects with the potential for cumulative impacts identified for marine geology, oceanography and physical processes are presented in Appendix 32.2.

Table 32.2 Potential cumulative impacts identified for marine geology, oceanography and physical processes

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Construction		
Changes in Suspended Sediment Concentrations due to Seabed Preparation and drill arisings associated with foundations	Where construction windows could overlap for projects adjacent to Norfolk Boreas i.e. Norfolk Vanguard and East Anglia THREE there is potential for cumulative impact.	**Negligible**
Changes in Seabed Level due to Seabed Preparation and drill arisings associated with foundations	Where construction windows could overlap for projects adjacent to Norfolk Boreas i.e. Norfolk Vanguard and East Anglia THREE there is potential for cumulative impact.	**Negligible**
Changes in Suspended Sediment Concentrations during Offshore Export Cable Installation	Norfolk Boreas and Norfolk Vanguard share an offshore cable corridor and therefore there is potential for cumulative impacts. Consideration is also given to Marine Aggregate Dredging.	**Negligible**

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Changes in Seabed Level and interruptions to bed load due to Offshore Export Cable Installation	Norfolk Boreas and Norfolk Vanguard share an offshore cable corridor and therefore there is potential for cumulative impacts. Consideration is also given to Marine Aggregate Dredging.	**Negligible**
Changes in Suspended Sediment Concentrations during array, interconnector and project interconnector cable Installation	Where construction windows could overlap for projects adjacent to Norfolk Boreas i.e. Norfolk Vanguard and East Anglia THREE there is potential for cumulative impact.	**Negligible**
Changes in Seabed Level due to array, interconnector and project interconnector cable Installation	Where construction windows could overlap for projects adjacent to Norfolk Boreas i.e. Norfolk Vanguard and East Anglia THREE there is potential for cumulative impact.	**Negligible**
Operation		
Changes to the Tidal Regime due to the Presence of Wind Turbine Structures	Additive changes to the tidal regime of Norfolk Boreas, Norfolk Vanguard and East Anglia THREE due to their proximity.	**Negligible**
Changes to the Wave Regime due to the Presence of Wind Turbine Structures	Additive changes to the wave regime of Norfolk Boreas, Norfolk Vanguard and East Anglia THREE due to their proximity.	**Negligible**
Changes to Bedload Sediment Transport through the Cumulative and Combined change to the Tidal and Wave Regimes due to the Presence of Wind Turbine Structures	The combined effects of changes to the wave and tide regime as a result of Norfolk Boreas, Norfolk Vanguard and East Anglia THREE due to their proximity.	**Negligible**
Decommissioning		
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.		

32.5.2 Marine Water and Sediment Quality

43. Table 32.3 provides a summary of the CIA outcomes for marine water and sediment quality. All plans and projects with the potential for cumulative impacts identified for marine water and sediment quality are presented in Appendix 32.2.

Table 32.3 Potential cumulative impacts identified for marine water and sediment quality

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Construction		
Deterioration in offshore water quality due to increased suspended sediment concentrations due to sediment plume created by seabed preparation during installation of foundations and drill arisings during installation of piled foundations	Where construction windows could overlap for projects adjacent to Norfolk Boreas i.e. Norfolk Vanguard and East Anglia THREE there is potential for cumulative impact. Norfolk Boreas and Norfolk Vanguard share an offshore cable corridor and therefore there is potential for cumulative impacts. Consideration is also given to Marine Aggregate Dredging. The worst case scenario in relation to water quality effects would be for all wind farm projects identified in Appendix 33.1 to be constructed at the same time since this would provide the greatest opportunity for interaction of any sediment plumes during construction.	**Minor Adverse**
Deterioration in water quality due to increased suspended sediment concentrations during installation of the offshore export cable		
Deterioration in offshore water quality due to increased suspended sediment concentrations during cable installation within the Norfolk Boreas site and project interconnector search area	The worst case scenario is that some interaction could potentially occur between dredging plumes and plumes from Norfolk Boreas cable installation, making the spatial extent of the combined plume slightly greater than for the plumes originating from the offshore cable installation only.	**Minor adverse**
Deterioration in water quality due to works at the offshore export cable landfall		
Operation		
Impacts will be highly localised around the foundations and cables and therefore there will be no cumulative impact.		
Decommissioning		
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.		

32.5.3 Benthic and Intertidal Ecology

44. Table 32.4 provides a summary of the CIA outcomes for benthic and intertidal ecology. All plans and projects with the potential for cumulative impacts identified for benthic and intertidal ecology are presented in Appendix 32.2.

Table 32.4 Potential cumulative impacts identified for benthic and intertidal ecology

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Construction		
Temporary habitat loss/ disturbance associated with the Norfolk Boreas site	Additive habitat loss/disturbance of Norfolk Vanguard sharing the same offshore cable corridor as Norfolk Boreas.	**Negligible**
Temporary habitat loss/disturbance associated with offshore cable corridor	Additive habitat loss/disturbance of Norfolk Vanguard sharing the same offshore cable corridor as Norfolk Boreas.	**Negligible**
Temporary habitat loss/ disturbance in the project interconnector search area	Additive habitat loss/disturbance of the project interconnector search area overlapping the Norfolk Vanguard site.	**Minor adverse**
Temporary increases in suspended sediment concentrations and associated sediment deposition in the Norfolk Boreas site	Norfolk Vanguard East and East Anglia THREE are 1km from Boreas. There is therefore potential for cumulative impacts associated with suspended sediments and deposition towards the perimeter of each wind farm if construction is undertaken at the same time.	**Negligible**
Temporary increases in suspended sediment concentrations and associated sediment deposition in the offshore cable corridor	Consideration is given to cumulative impacts of suspended sediment from Norfolk Vanguard sharing the same offshore cable corridor, as well as impacts from aggregate dredging.	**Negligible**
Operation		
Permanent loss of seabed habitat in the Norfolk Boreas site	Additive habitat loss/disturbance across the region	**Negligible**
Permanent loss of seabed habitat in the offshore cable corridor	Additive habitat loss/disturbance of Norfolk Vanguard sharing the same offshore cable corridor as Norfolk Boreas.	**Minor adverse**
Temporary seabed disturbances from maintenance operations in the Norfolk Boreas site	Additive habitat loss/disturbance across the region	**Negligible**
Temporary seabed disturbances from maintenance operations in the offshore cable corridor	Additive habitat loss/disturbance of Norfolk Vanguard sharing the same offshore cable corridor as Norfolk Boreas.	**Negligible**
Temporary seabed disturbances from maintenance operations in the project interconnector search area	Additive habitat loss/disturbance of the project interconnector search area overlapping the Norfolk Vanguard site.	**Minor adverse**

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Decommissioning		
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.		

32.5.4 Fish and Shellfish Ecology

45. Table 32.5 provides a summary of the CIA outcomes for fish and shellfish ecology. All plans and projects with the potential for cumulative impacts identified for fish and shellfish ecology are presented in Appendix 33.2.

Table 32.5 Potential cumulative impacts identified for fish and shellfish ecology

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Construction		
Physical disturbance and temporary loss of area	There could be potential for construction works at other projects to result in additional disturbance and temporary habitat loss to fish and shellfish receptors to that identified for the project alone where construction schedules significantly overlap. The fish and shellfish species included for assessment have wide overall distribution ranges (including the extent of spawning and nursery grounds for relevant species) in the context of the discrete areas which may be affected at a given time. The sensitivity of fish and shellfish species in general is therefore considered to be low. In the case of species which depend on specific substrates and species or life stages of reduced mobility, considering the potential increased area of their habitat affected and their reduced ability to relocate to other areas, the sensitivity is considered to be medium.	**Minor adverse**
Increase in Suspended Sediment Concentration (SSCs) and sediment re-deposition	There may be potential for increased SSCs and sediment re-deposition associated with other projects to cumulatively add to the impact identified for Norfolk Boreas alone, if construction schedules coincide.	**Minor adverse**
Underwater noise associated with pile driving	There is potential for noise generated during piling activity in Norfolk Boreas and other wind farm projects to result in cumulative impacts on fish species. This would be a result of either increased spatial or temporal effects resulting from concurrent or sequential piling at different offshore wind farms, or a combination of both. Of particular concern in this regard is the potential for behavioural impacts to occur on	**Minor adverse**

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
	species which use the area for spawning, however consideration has also been given to other fish species.	
Noise from other construction activities	There may be other activities associated with construction works at other projects that could result in potential disturbance to fish and shellfish (i.e. vessel transit, cable laying, rock placement, dredging).	**Minor adverse**
Noise from UXO clearance	The detonation of UXO associated with other offshore wind farm developments, would also result in injury and disturbance to fish species in the vicinity of the detonation. Physical injury / trauma would occur in close proximity to the detonation with TTS and behavioural effects occurring at greater distance.	**Minor adverse**
Operation		
Permanent loss of seabed habitat	The introduction of infrastructure associated with Norfolk Boreas together with that associated with other wind farm projects could result in cumulative impacts on fish and shellfish species in terms of loss of seabed habitat.	**Minor adverse**
Introduction of hard substrate	The introduction of hard substrate as part of the project together with that introduced as a result of other wind farm projects could result in cumulative impacts on fish and shellfish species in terms of changes to the species assemblage.	**Minor adverse**
Operation noise	During the operational phase there may be potential for operational noise from Norfolk Boreas to add cumulatively to operational noise from other offshore wind farm projects.	**Minor adverse**
EMFs	EMFs associated with cables at Norfolk Boreas and other offshore wind farm projects could result in a cumulative impact on sensitive fish and shellfish species (particularly elasmobranchs).	**Minor adverse**
Changes to fishing activity	The presence of infrastructure associated with offshore wind farms during the operation phase could result in changes to fishing activity within wind farm arrays but also in the wider area (i.e. due to displacement of fishing activity into other areas). This could in turn result in changes in the status of commercially targeted fish stocks.	**Minor adverse**

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Decommissioning		
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.		

32.5.5 Marine Mammals

46. Table 32.6 provides a summary of the CIA outcomes for marine mammals. The CIA considered the three types of impact (underwater noise, indirect impacts and direct interaction) from all stages of any plan or project where there is the potential to overlap with Norfolk Boreas. Each type of potential cumulative impact has been assessed, where relevant, for harbour porpoise, grey seal and harbour seal.

47. Appendix 12.3 details the plans and projects which were considered for the Marine Mammal CIA.

Table 32.6 Potential cumulative impacts identified for marine mammals

Potential Impact	Rationale for Cumulative Impact	Receptor	Cumulative Impact Significance
Underwater noise during piling	Cumulative increase in underwater noise from piling during construction at offshore developments has the potential to cause disturbance to marine mammals. Included in the CIA: • Projects with overlapping construction phases with Norfolk Boreas, resulting in maximum potential for underwater piling noise to interact cumulatively in the regional marine mammal reference population boundaries. Worst case temporal adverse scenario considers the longest duration of the piling phase for each of the projects. This may include projects whose construction phases do not overlap with Norfolk Boreas but which occur immediately prior to or after and therefore increase the overall duration of sequential piling within the marine mammal reference population boundaries. Maximum spatial adverse scenario considers the maximum area of which marine mammal could be disturbed as a result of offshore piling.	Harbour porpoise	**Minor adverse**
		Grey Seal	**Minor adverse**
		Harbour seal	**Minor adverse**

Potential Impact	Rationale for Cumulative Impact	Receptor	Cumulative Impact Significance
Underwater noise for all other noise sources	Cumulative increase in noise for activities other than piling and vessels arising from construction, operation and maintenance and decommissioning of offshore developments may result in increased noise disturbance to marine mammals. Included in the CIA: • Projects with overlapping construction phases with Norfolk Boreas, resulting in maximum potential impacts on marine mammals. Projects that could have the potential to disturb marine mammals due to operational and maintenance or decommissioning activities.	Harbour porpoise	**Minor adverse**
		Grey Seal	**Minor adverse**
		Harbour seal	**Minor adverse**
Changes to prey availability	Cumulative changes in fish abundance and distribution resulting from construction, operation and maintenance, and decommissioning of offshore developments may lead to a loss or changes in prey resources for marine mammals.	Harbour porpoise	**Minor adverse**
		Grey Seal	**Minor adverse**
		Harbour seal	**Minor adverse**
Collision risk – vessels and tidal devices	Cumulative increase in vessel traffic arising from construction, operation and maintenance, and decommissioning of offshore developments may result in increased collision risk to marine mammals. Included in the CIA: • Projects with overlapping construction phases with Norfolk Boreas, resulting in maximum increase in number of vessel movements. Projects that could contribute to increased vessel traffic due to operational and maintenance or decommissioning activities.	Harbour porpoise	**Minor adverse**
		Grey Seal	**Minor adverse**
		Harbour seal	**Minor adverse**
Decommissioning			
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.			

32.5.6 Offshore Ornithology

48. Table 32.7 provides a summary of the CIA outcomes for offshore ornithology. A cumulative assessment of operation displacement risk was undertaken for Red-throated diver, Gannet, Auks, Razorbill and Guillemot and a cumulative assessment of collision risk was undertaken for Gannet, Kittiwake, Lesser black-backed gull and

Great black-backed gall. Detail on the assessment for each species can be found in Chapter 13 Offshore Ornithology. Appendix 32.2 details the plans and projects which were considered for the offshore ornithology CIA.

Table 32.7 Potential cumulative impacts identified for offshore ornithology

Potential Impact	Rationale for Cumulative Impact	Receptor	Cumulative Impact Significance
Construction			
No cumulative impacts identified during the construction stage.			
Operation			
Disturbance and displacement	There is a sufficient likelihood of a cumulative impact to justify a detailed, quantitative cumulative impact assessment. Note that data confidence is lower for older wind farms due to variations in the level of detail reported. There is greater confidence in assessments for more recent wind farms which have typically followed a standard approach to assessment and reporting.	Red-throated diver	**Minor adverse**
		Gannet	**Negligible**
		Razorbill	**Minor adverse**
		Guillemot	**Minor adverse**
Collision risk	There is a sufficient likelihood of a cumulative impact to justify a detailed, quantitative cumulative impact assessment.	Gannet	**Minor adverse**
		Kittiwake	**Minor adverse**
		Herring Gull	**Minor adverse**
		Lesser black-backed gull	**Minor adverse**
		Great black-backed gull	**Minor adverse**
Decommissioning			
The likelihood that there would be a cumulative impact on disturbance and displacement and through effects on habitats and prey species is low because the contribution from the proposed project is small and it is dependent on a temporal and spatial co-incidence of disturbance / displacement from other plans or proposed projects.			

32.5.7 Commercial Fisheries

49. Table 32.8 provides a summary of the CIA outcomes for commercial fisheries. All plans and projects with the potential for cumulative impacts identified for commercial fisheries are presented in Appendix 32.2.

Table 32.8 Potential cumulative impacts identified for commercial fisheries

Potential Impact	Rationale for Cumulative Impact	Receptor	Cumulative Impact Significance
Construction, Operation and Decommissioning			
Potential impacts on commercially exploited Fish and Shellfish Populations	There is the potential for Norfolk Boreas in combination with other projects to result in cumulative impacts on commercially exploited fish and shellfish species. This could in turn indirectly affect the productivity of the fisheries them.	All commercial fishing vessels	**Minor adverse**
Loss or Restricted Access to Traditional Fishing Grounds	The potential cumulative impact of Norfolk Boreas with other projects, activities and conservation measures on commercial fisheries is assessed by individual fleet. In respect of other offshore wind farm projects, it is taken that fishing will be able to resume in operational offshore wind farms with the exception of projects in countries where fishing within them is prohibited	Dutch beam trawling	**Moderate adverse**
		Dutch seine netting	**Moderate adverse**
		Belgian beam trawling	**Moderate adverse**
		Belgian demersal otter trawling and seine netting	**Negligible**
		UK Local inshore vessels	**Minor adverse**
		UK beam trawlers (Anglo-Dutch)	**Moderate adverse**
		UK beam trawlers (south-west ports)	**Negligible**
		UK demersal trawlers	**Negligible**
		French demersal and pelagic trawlers	**Minor adverse**
		Danish industrial sandeel and pelagic trawlers	**Negligible**

Potential Impact	Rationale for Cumulative Impact	Receptor	Cumulative Impact Significance
		German fishing vessels	**Negligible**
Displacement of Fishing Activity into Other Areas	Given the limited operational range of local static gear fisheries and the localised and short term duration of export cable installation activities, considering construction/decommissioning activities in other projects, there would be limited potential for displacement to result in increased levels of competition between local static gear vessels. Similarly, there would also be little potential for cumulative displacement to result in conflicts between towed and static gear vessels. Fishing activity by the main fleets that would be subject to potential cumulative	Static gear vessels	**Minor adverse**
		Towed gear vessels	**Negligible to Minor adverse**
Increased Steaming Times to Fishing Grounds	The implementation of advisory safety zones at Norfolk Boreas and other projects could result in some short term increases in steaming distances and times, and therefore higher operational costs for fishing vessels	All commercial fishing fleets	**Negligible**
Interference with Fishing Activities	There could be potential for construction and operation and maintenance activities at Norfolk Boreas and other projects, particularly other offshore wind farms, to result in interference with fishing activities as a result of increased construction/operation vessel transits.	Static Gear fleets	**Minor adverse**
		Mobile gear fleets	**Negligible**
Safety Issues for Fishing Vessels	It is recognised that in addition to the project, other projects and activities included for assessment of cumulative impacts, particularly other offshore wind farms, could result in additional safety issues and seabed obstacles for fishing vessels. It should be noted, however, that the same factors and obligations with regards to safety and seabed obstacles applied to the project would also apply to other projects/activities.	All commercial fishing vessels	**Within acceptable limits**
Obstacles on the seabed			

32.5.8 Shipping and Navigation

50. Table 32.9 provides a summary of the CIA outcomes for shipping and navigation. All plans and projects with the potential for cumulative impacts identified for shipping and navigation are presented in Appendix 32.2.

Table 32.9 Potential cumulative impacts identified for shipping and navigation

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Construction, Operation and Maintenance, Decommissioning		
Vessel Displacement	These were raised as key points to be considered during consultation.	**Tolerable with mitigation**
Restriction of Adverse Weather Routes		**Tolerable**
Increased vessel to vessel collision risk		**Tolerable with mitigation**
Increased vessel to structure allision risk	Only with projects located within the former East Anglia Zone (Norfolk Vanguard, Norfolk Boreas, East Anglia Three, East Anglia One, East Anglia Two and East Anglia One North)	**Tolerable with mitigation**
Effects on emergency response resources	Increase in activity cumulatively within the southern North Sea area must be considered.	**Tolerable with mitigation**

32.5.9 Aviation and Radar

51. Table 32.10 provides a summary of the CIA outcomes for aviation and radar. All plans and projects with the potential for cumulative impacts identified for aviation and radar are presented in Appendix 32.1.

Table 32.10 Potential cumulative impacts identified for aviation and radar

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Operation		
Wind turbines causing permanent interference on civil and military radar	The proposed project is approximately 1km (Norfolk Vanguard East) to 51km (East Anglia ONE North), from proposed offshore wind farm developments that will be located in the southern North Sea. Other developments are at a sufficient distance in ATS terms that they would not create cumulative impacts on aviation operations in the area of Norfolk Boreas. With respect to onshore wind farm sites, these would all be of a sufficient distance from the proposed project that there would be no cumulative effects on aviation operations that arise from any combined adverse impacts. Adjacent offshore wind farms have the potential to create a cumulative effect on radar systems similarly impacted by the development of Norfolk Boreas. Norfolk Vanguard is being developed by the same applicant as Norfolk Boreas and it is	**Not significant**

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
	assumed that mitigation for Norfolk Boreas will be equally suitable for the effects Norfolk Vanguard will create to identified radar systems. Similarly, it is assumed that operational wind farms and those proposed are mitigated against effect to aviation radar; therefore, any potential for a cumulative effect will be removed once mitigation is in place for current and future wind farms.	

32.5.10 Offshore Intertidal Archaeology and Cultural Heritage

52. Table 32.11 provides a summary of the CIA outcomes for offshore archaeology. The cumulative impact assessment includes known consented and planned projects within 100km of Norfolk Boreas, while developments beyond 100km are scoped out for the purposes of direct impacts. The COWRIE guidance (Oxford Archaeology, 2008) states that establishing a geographical boundary for cumulative impact assessment needs to be considered on a case-by-case basis. A 100km boundary has been selected for this project in order to facilitate a clear understanding of the types of projects in the 'region' that may affect not only the heritage assets themselves but also their settings and the perceptual values associated with the historic seascape character.

53. The cumulative impact assessment for marine physical processes is set out in section 8.8 of Chapter 8 Marine Geology, Oceanography and Physical processes. The assessment in Table 32.11 takes account of the results of this assessment in identifying the potential for indirect cumulative impact to heritage assets from the effect of marine physical processes and from sediment plumes and deposition.

54. There are a large number of constructed/consented and planned offshore wind farms, aggregate dredging licence areas, oil and gas licences and licensed disposal sites within 100km (for example) of Norfolk Boreas. Of these, only Norfolk Vanguard overlaps with Norfolk Boreas in terms of footprint and, as Norfolk Vanguard is subject to the same embedded mitigation as Norfolk Boreas, comprising the avoidance of known heritage assets wherever possible, then there is no pathway for cumulative direct impacts on the known heritage assets identified in section 17.6 of Chapter 17 Offshore and Intertidal Archaeology and Cultural Heritage.

55. With respect to unavoidable impacts to potential heritage assets, and to the settings of heritage assets and the historic character of the study area, cumulative impacts are possible. However, as the extent of these potential heritage assets which could be subject to cumulative impact are unknown, it is not possible to identify which constructed/consented or planned projects would have the potential to have a

cumulative impact with Norfolk Boreas. Therefore, a definitive list of projects assessed as part of this chapter is not provided as part of this CIA. Rather the potential for cumulative impact is discussed as a board narrative in sections 17.8.1 and 17.8.2 of Chapter 17 Offshore and intertidal Archaeology and Cultural Heritage. It is acknowledged that strategic analysis in relation to the cumulative impact of multiple planned offshore arrays and overall numbers of turbines would facilitate greater understanding of the cumulative effect of offshore wind development within the North Sea, although this is considered beyond the scope of assessment for an individual project.

Table 32.11 Potential cumulative impacts identified for offshore archaeology and cultural heritage

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Construction		
Direct impact to potential heritage assets	Although the effect of unavoidable impacts will be mitigated by agreed measures as part of the consenting process for each of the constructed and planned projects, the impacts will still have occurred and permanent damage or destruction will have taken place. The assessment of cumulative impacts, therefore, needs to consider the effect of multiple unavoidable impacts from multiple projects upon the archaeological resource. This is discussed further in section 17.8.1 of Chapter 17 Offshore and Intertidal Archaeology and Cultural Heritage	**Minor adverse (plus positive benefit from accumulation of data)**
Impacts to the setting of heritage assets and historic seascape character	Across the region, changes to the setting of heritage assets and historic seascape character will occur cumulatively as a result of the presence of multiple constructed projects.	
Operation		
Direct impact to potential heritage assets	There is potential for multiple unavoidable impacts associated with operations and maintenance activities (e.g. cable repairs and vessel anchors/jack up legs) during the operation phases of multiple projects.	**Minor adverse (plus positive benefit from accumulation of data)**
Impacts to the setting of heritage assets and historic seascape character	Across the region, changes to the setting of heritage assets and historic seascape character will occur cumulatively as a result of the construction of multiple projects.	
Decommissioning		

Potential Impact	Rationale for Cumulative Impact	Cumulative Impact Significance
Direct impact to potential heritage assets	There is potential for multiple unavoidable impacts associated with decommissioning considered cumulatively with activities associated with other projects.	**Minor adverse (plus positive benefit from accumulation of data)**
Impacts to the setting of heritage assets and historic seascape character	Changes to the setting of heritage assets and historic seascape character will occur cumulatively although the nature of this change will depend upon the decommissioning plans for multiple projects.	

32.5.11 Infrastructure and Other Users

56. In accordance with the Scoping Report (Royal HaskoningDHV, 2017) and agreed by the Secretary of State (SoS) in the Scoping Opinion, cumulative impacts have been scoped out of the infrastructure and other users chapter.

32.6 Transboundary Impact Assessment Summary

57. This section presents a summary of the potential impacts on transboundary receptors for each topic within the ES. Where transboundary impacts are scoped out, this is also noted.

32.6.1 Marine Geology, Oceanography and Physical Processes

58. Transboundary impacts are assessed through consideration of the extent of influence of changes or effects and their potential to impact upon marine physical processes receptor groups that are located within other European Union (EU) member states.

59. Transboundary impacts were considered in the Scoping Report for this topic and it was concluded that “transboundary impacts are unlikely to occur or would be insignificant.” (Royal HaskoningDHV, 2017). This statement is supported by the assessments that have been completed for the East Anglia ZEA (ABPmer, 2012a), the ES of Norfolk Vanguard (Norfolk Vanguard Limited, 2018), the ES of East Anglia THREE (EATL, 2015), and the ES of East Anglia ONE (EAOW, 2012b), as well as this document. Therefore, transboundary impacts are scoped out and will not be considered further in this chapter. This approach was confirmed during the scoping process (Royal HaskoningDHV, 2017; Planning Inspectorate, 2017) and Evidence Plan Process.

32.6.2 Marine Water and Sediment Quality

60. The localised nature of the potential impacts on marine water and sediment quality mean that significant transboundary impacts are unlikely. In accordance with the

EIA Scoping Report (Royal HaskoningDHV, 2017) and in agreement with the EPP, transboundary impacts have been scoped out of the EIA.

32.6.3 Benthic and Intertidal Ecology

61. The localised nature of the potential impacts on the benthos means that significant transboundary impacts are unlikely. In accordance with the Scoping Report (Royal HaskoningDHV, 2017) and Scoping Opinion (the Planning Inspectorate, 2017), transboundary impacts have been scoped out of the EIA for this topic.

32.6.4 Fish and Shellfish Ecology

62. The distribution of fish and shellfish species is independent of national geographical boundaries. The impact assessment has therefore been undertaken taking account of the distribution of fish stocks and populations irrespective of political limits. As a result, it is considered that a specific assessment of transboundary effects have been scoped out of the EIA.

32.6.5 Marine Mammals

63. The potential for transboundary impacts has been addressed by considering the reference populations and potential linkages to non-UK sites as identified through telemetry studies.

64. The assessment of the effect on the integrity of the transboundary European sites as a result of impacts on the designated marine mammal populations will be undertaken and presented in the Report to inform the HRA, which has been submitted as part of the DCO application (document reference 5.3).

65. The highly mobile nature of marine mammals species considered in this assessment means that there are potential transboundary impacts for each receptor. These transboundary impacts are already considered in the main assessment, as the impacts for all species have been based on the relevant Management Units and reference populations.

66. For harbour porpoise the extent of the reference population includes UK, Dutch, German, French, Belgian, Danish and Swedish waters. For harbour seal the extent of the reference population includes UK, Dutch, German, Belgian and French waters. For grey seal the extent of the reference population includes UK, Dutch, German, Belgian, Danish and French waters.

32.6.6 Offshore Ornithology

67. The transboundary impact assessment methodology applied in Chapter 13 is based on that described in Chapter 6 EIA Methodology, adapted to make it applicable to ornithology receptors.

68. A summary of consultations conducted with other EU Member States (MS) surrounding the North Sea basin is provided in Tabl3 13.3. The only MS which provided a response to the PEIR was Rijkswaterstaat (RWS) in the Netherlands, who noted that consideration should be given to proposed wind farm developments in the Netherlands with respect to displacement impacts. The response also noted that this would require an international cumulative approach, which has not been developed to date. Owing to the different approaches to impact assessment adopted by each MS it is not currently clear how this could be undertaken quantitatively.

69. Protected sites in countries beyond the UK that may have connectivity with Norfolk Boreas are listed in Table 13.9 of Chapter 13 Offshore Ornithology.

70. To inform this assessment, consideration has been given to the consultation response received for Norfolk Boreas which raised a potential concern over transboundary impacts on ornithology receptors. This was provided by Rijkswaterstaat (RWS) in the Netherlands and noted that non-UK wind farms in the southern North Sea had not been included in the cumulative assessment of displacement.

71. With regards to the potential for transboundary cumulative impacts, there is clearly potential for collisions and displacement at wind farms outside UK territorial waters. However, the operational offshore wind farms in Belgium, the Netherlands and Germany are comparatively small (in combination these projects are of a similar size to no more than one to two of the more recent UK wind farms, such as East Anglia ONE). Since the spatial scale and hence seabird population sizes for a transboundary assessment would be much larger (e.g. assessments would necessarily be with reference to the biogeographic populations which are much larger: for example, for guillemot the biogeographic population is approximately three times the BDMPS, for gannet the difference is between two and four times, and for kittiwake it is more than five times), it is apparent that the comparative scale of wind farm development relative to the seabird populations would be much smaller (perhaps 1.5 times as much in the way of wind farm development). Therefore, the inclusion of non-UK wind farms would be very unlikely to alter the conclusions of the existing cumulative assessment, and any if there were any change it is likely that estimated impacts at population levels would be reduced if calculated at larger spatial scales.

32.6.7 Commercial Fisheries

72. The impact assessment provided within Chapter 14 takes account of the potential impacts of Norfolk Boreas on international fleets which are known to operate in the study area. Therefore, the assessment of potential transboundary impacts is integrated within the impact assessment carried out throughout that chapter.

32.6.8 Shipping and Navigation

73. Transboundary impacts relate to impacts that may occur from an activity within one European Economic Area (EEA) state on the environment or interests of another.

74. Assessment of vessel routeing has identified that there was potential for significant transboundary effects with regard to shipping and navigation from the project upon the interests of other EEA states; however due to the international nature of shipping and navigation this has been considered within the baseline (section 15.6) and cumulative assessments (section15.8).

75. It was identified that transboundary impacts could arise from the project having an effect upon commercial shipping routes transiting between the UK and other EEA ports. This could also include impacts upon international ports, shipping routes and / or routes affected by other international offshore renewable energy developments. The potentially affected areas include ports within the southern North Sea. The development of the project could affect routes operating between the UK and ports located in the Netherlands, Denmark, Belgium and Germany (noting that regular routes to the Netherlands and Germany were identified in the marine traffic survey data). The results of the vessel deviation assessments in the NRA identified some deviations for routes; however, the deviations identified were found to have no perceptible impacts (no impact) on ports following consideration of the cumulative routeing scenarios. It is noted that the project is located centrally within the southern North Sea and that levels of displacement for cumulative vessel routeing were considered tolerable as per Section 15.8.1.

76. It is considered that there are no additional transboundary impacts beyond those included in the cumulative assessment, noting that as per Table 15.13, transboundary projects were considered.

77. All European Union (EU) member states are consulted as part of the formal phases of consultation. Dialogue with these authorities will continue to take place throughout the development of the project in relation to transboundary impacts. Given that Dutch sector wind farms will have a notable cumulative effect when considered with Norfolk Boreas, consultation with Rijkswaterstaat has been undertaken on vessel routeing and will be ongoing.

32.6.9 Aviation and Radar

78. Other EU member states that could be impacted by the proposed project are detailed in Table 32.12.

Table 32.12 List of other EU Member States retained in the transboundary impact assessment in relation to the topic

EU member state	Commentary
Netherlands	Norfolk Boreas would be located adjacent to the London / Amsterdam Flight Information Region (FIR). Consultation with Dutch civil and military aviation stakeholders has been completed for Norfolk Boreas with confirmation that there will be no impact to operations conducted by Dutch aviation authorities. Dutch Helicopter Main Routes (HMRs) located in the Amsterdam FIR continue into the UK and vice-versa however from the consultation response received from helicopter operators no impact is predicted.

79. The strategies applied to mitigate any impact to offshore helicopter operations and the provision of ATS should be equally effective in the Netherlands as aviation operations are regulated by international criteria. Consultation with helicopter operators based in the UK, Netherlands and Belgium has been undertaken with limited response from the operators and therefore based on the outcome of consultation transboundary impacts are assessed as **not significant**.

80. Table 32.13 provides a summary of the potential transboundary impacts identified for aviation and radar.

Table 32.13 Potential transboundary impacts identified for aviation and radar

Potential Impact	Receptor	Significance	Mitigation	Residual Impact
Impacts to aircraft operators between the London and Amsterdam FIRs	Helicopters using HMR which transit the proposed project	Not Significant	N/A	**N/A**
Impacts on Dutch Primary Surveillance Radar	Luchtverkeersleiding Nederland and Ministerie Van Defensie	Not significant	N/A	**N/A**

32.6.10 Offshore and Intertidal Archaeology and Cultural Heritage

81. Transboundary impacts stemming from changes to marine physical processes have been scoped out (see Chapter 8 Marine Geology, Oceanography and Physical Processes). Tidal ellipses show that all movement is in a north south direction and so will not cross the international boundary.

82. Transboundary archaeological impacts may occur if wrecks or aircraft of non-British, European nationality are subject to impact from development. Such wrecks may fall

within the jurisdiction of another country, and may include, for example, foreign warships lost in UK waters. As the implementation archaeological exclusion zones will prevent direct impacts to known archaeological receptors, transboundary impacts to known wrecks and aircraft are not expected to occur. Table 32.14 provides a summary of the transboundary impacts for offshore and intertidal archaeology.

Table 32.14 Potential transboundary impacts identified for offshore and intertidal archaeology and cultural heritage

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Direct impact to known heritage assets	Wrecks or aircraft of non-British origin	High	High	Major adverse	Avoidance	**No impact**
Direct impact to potential heritage assets	Wrecks or aircraft of non-British origin	High	High	Major adverse	Further assessment/ reporting protocol/ consideration of legal status in country of origin	**Minor adverse**
	Prehistoric, maritime and aviation archaeological resource (across national boundaries)	Medium to High	High	Major adverse	Further assessment/ reporting protocol	**Minor adverse** (plus positive benefit from accumulation of data)
Indirect impact to heritage assets from changes to physical processes	Tidal ellipses show that all movement is in a north south direction so will not cross the international boundary and transboundary impacts will not occur.					

32.6.11 Infrastructure and Other Users

83. In accordance with the Scoping Report (Royal HaskoningDHV, 2017) and agreed by the SoS in the Scoping Opinion, transboundary impacts have been scoped out of Chapter 18 of the ES.

32.7 Summary

84. This chapter of the ES provides a summary of the CIA and transboundary impact assessment for the offshore topics considered in the EIA for the Norfolk Boreas Project. Full details of the CIAs for each offshore topic are presented in the relevant chapters 8 to 18.

32.8 References

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