

Norfolk Boreas Offshore Wind Farm

Chapter 18

Infrastructure and Other Users

Environmental Statement

Volume 1

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Glossary of Acronyms

BBL	Balgzand Bacton Line
BEIS	Business, Energy and Industrial Strategy
CIGRE	International Council on Large Electric Systems
DCO	Development Consent Order
DCLG	Department for Communities and Local Government
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
ES	Environmental Statement
ESCA	European Subsea Cables Association
HSE	Health and Safety Executive
ICES	International Council for the Exploration of the Sea
ICPC	International Cable Protection Committee
IEC	International Electrotechnical Commission
km	kilometres
MCA	Maritime and Coastguard Agency
MDA	Military Defence Area
MOD	Ministry of Defence
MW	Megawatt
NPS	National Planning Statement
NSIPs	Nationally Significant Infrastructure Projects
O&M	Operations and Maintenance
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Areas
RYA	Royal Yachting Association
SoS	Secretary of State
UKCS	UK continental shelf
UXO	Unexploded Ordnance
VWPL	Vattenfall Wind Power Limited

Glossary of Terminology

Array cables	Cables which link the wind turbine to wind turbine and wind turbine to offshore electrical platform.
Interconnector cables	Offshore cables which link offshore electrical platforms within the Norfolk Boreas site
Landfall	Where the offshore cables come ashore at Happisburgh South
Norfolk Boreas Site	The Norfolk Boreas wind farm boundary. Located offshore, this will contain all the windfarm array.
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.
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 Norfolk Boreas site, containing

	electrical equipment to aggregate the power from the wind turbines and convert it into a suitable form for export to shore.
Offshore export cables	The cables which bring electricity from the offshore electrical platform to the landfall.
Offshore project area	The area including the Norfolk Boreas site, project interconnector cable search area and offshore cable corridor.
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 sites.
Project interconnector search area	The area within which project interconnector cables would be installed.
Safety zones	An area around a vessel which should be avoided during offshore construction
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.
The Applicant	Norfolk Boreas Limited
The Norfolk Vanguard OWF sites	Term used exclusively to refer to the two distinct offshore wind farm areas, Norfolk Vanguard East and Norfolk Vanguard West (also termed NV East and NV West) which will contain the Norfolk Vanguard arrays.
The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.

18 OFFSHORE INFRASTRUCTURE AND OTHER USERS

18.1 Introduction

1. This chapter of the Norfolk Boreas Environmental Statement (ES) describes the existing offshore infrastructure and other human activities (with a marine component) which may be affected by offshore elements of Norfolk Boreas. Other human activities considered include; offshore wind farm projects, oil and gas activity, marine aggregate extraction, and cables and pipelines.
2. This chapter provides an assessment of the potential impacts of Norfolk Boreas on these receptors over the construction, operation and maintenance (O&M) and decommissioning phases, along with proposed mitigation measures, where considered necessary. This chapter has been prepared by Royal HaskoningDHV.
3. Other activities which require individual consideration are covered in Chapter 14 Commercial Fisheries, Chapter 15 Shipping and Navigation and Chapter 16 Aviation and Radar and are not considered further in this chapter. This chapter only considers the offshore environment, onshore infrastructure and other users are considered where appropriate throughout the onshore chapters of this ES.
4. Vattenfall Wind Power Limited (VWPL) (the parent company of Norfolk Boreas Limited) is also developing Norfolk Vanguard, a 'sister project' to Norfolk Boreas. Norfolk Vanguard's development schedule is approximately one year ahead of Norfolk Boreas and as such the Development Consent Order (DCO) application was submitted in June 2018.
5. Norfolk Vanguard may undertake some enabling works for Norfolk Boreas, but these are only relevant to the assessment of impacts onshore. This assessment does however include interconnector cables between Norfolk Boreas and Norfolk Vanguard (herein, 'project interconnector cables'). If Norfolk Vanguard does not proceed then the project interconnector would not be required.

18.2 Legislation, Guidance and Policy

6. The assessment of potential impacts upon infrastructure and other users has been made with specific reference to the relevant National Policy Statements (NPS). These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to the project are:
 - NPS for Renewable Energy Infrastructure (EN-3) (Department of Energy and Climate Change (DECC), 2011).

7. The specific assessment requirements for Infrastructure and Other Users, as detailed in the NPS, are summarised in Table 18.1, together with an indication of the paragraph numbers of the ES chapter where each is addressed.

Table 18.1 NPS assessment requirements

NPS Requirement	NPS EN-3 Reference	ES Reference
'there may be constraints imposed on the siting or design of offshore wind farms because of restrictions resulting from the presence of other offshore infrastructure or activities.'	Section 2.6, paragraph 2.6.35	Chapter 4 Site Selection and Assessment of Alternatives of this ES provides the rationale for the location of the Norfolk Boreas offshore project area, which includes consideration of constraints associated with other offshore infrastructure.
'where a potential offshore wind farm is proposed close to existing operational offshore infrastructure, or has the potential to affect activities for which a licence has been issued by Government, the applicant should undertake an assessment of the potential effect of the proposed development on such existing or permitted infrastructure or activities. The assessment should be undertaken for all stages of the lifespan of the proposed wind farm in accordance with the appropriate policy for offshore wind farm EIAs.'	Section 2.6, paragraph 2.6.179	The potential impacts are assessed in section 18.7
'applicants should engage with interested parties in the potentially affected offshore sectors early in the development phase of the proposed offshore wind farm, with an aim to resolve as many issues as possible prior to the submission of an application to the IPC" (now the Planning Inspectorate).'	Section 2.6, paragraph 2.6.35	Consultation with owners and operators of offshore infrastructure is being undertaken by Norfolk Boreas Limited consultation responses received to date are shown in Table 18.4.

8. In addition to the NPSs there are recommendations provided by the International Cable Protection Committee (ICPC) and European Subsea Cables Association (ESCA) that are of relevance to this Chapter, as outlined in Table 18.2 and Table 18.3, respectively. These are considered throughout the chapter.

Table 18.2 Relevant recommendations of the ICPC (2013, 2014a, b, 2015)

Title	Details
ICPC Recommendation No. 13. Proximity of Wind Farm Developments & Submarine Cables	Section 4 Stakeholder Consultation: "Stakeholder engagement should commence as soon as is practicable following the award of a development zone or project area and continue with all Stakeholders, throughout the process, until the project is fully commissioned."
ICPC Recommendation No.13. Proximity of Wind Farm Developments & Submarine Cables	Section 4 Separation recommendations: this section outlines a method for determining separation distances between wind turbines and existing cables. It also states that "Precise separation distances should be agreed and documented between the parties

Title	Details
	<p>during the planning process. It is also recommended that wind farm developers consult the following ICPC Recommendations:</p> <ul style="list-style-type: none"> • No.1: Management of Redundant and Out of Service Cables; • No.2: Recommended Routing and Reporting Criteria for Cables in Proximity to Others; • No.3: Criteria to be applied to Proposed Crossings between Submarine Telecommunications Cables and Pipelines / Power Cables; • No.4: Recommended co-ordination procedures for repair operations near in service cable systems; • No.7: Procedure To Be Followed Whilst Offshore Civil Engineering Work Is Undertaken In The Vicinity Of Active Submarine Cable Systems;"
ICPC Recommendation No. 5. Standardisation Of Cable Awareness Charts	<p>Section 2.6.6 Safe Working Distance or Cable Buffer Zone Members may wish to designate a "safe working distance" on either side of the cable corridor. Such a zone indicates the recommended distance sea bed users who conduct activity likely to cause damage to a submarine telephone cable shall keep from the cable.</p>
ICPC Recommendation No. 2 Recommended Routing and Reporting Criteria for Cables in Proximity to Others	<p>Provides generalised cable routing and notification criteria that the ICPC recommend be used when undertaking cable route planning activities where the cable to be installed crosses, approaches close to or parallels an existing or planned system.</p>
ICPC Recommendation No. 3 Criteria to be Applied to Proposed Crossings Between Submarine Telecommunications Cables and Pipelines/Power Cables	<p>Describes the basic considerations required and lists issues that should be addressed when pipeline/power cables cross telecommunications.</p>

Table 18.3 Relevant recommendations of the ESCA (2016)

Title	Details
Guideline 01 - Fishing Liaison, Issue 6, March 2016	<p>Provides recommendations for cable industry standards and formats relating to how a cable owner should undertake fisheries liaison.</p>
Guideline 02 - UKHO Liaison, Issue 7, March 2016	<p>The UKHO must be informed of route co-ordinates and the progress of the cable laying operations, as well as as-laid coordinates once the cable has been installed and when a cable has been withdrawn from service. This document provides guidance on how best to liaise with UKHO, including timescales, format of information and information stages, to enable adherence to UKHO's submarine cable charting policy.</p>
Guideline 04 - Offshore Liaison, Issue 7, March 2016	<p>Provides recommendations on liaison with other seabed users / stakeholders (i.e. non-fishermen) prior to and during cable installation activities. Also provides advice to third parties and authorities in relation to approval for works adjacent to existing or proposed submarine plant.</p>

Title	Details
Guideline 05 - Inclusion of SCUK Recommendations, Issue 5, March 2016	Summarises the available ESCA and ICPC guidelines for use when drawing up project contracts and undertaking O&M procedures.
Guideline 06 - Proximity of Wind Farms Issue 5 March 2016	Describes the consideration which should be given to separation requirements for cable vessels and offshore wind farms. Guideline 6 provides an overview of relevant guidance in relation to safety zones, discussed further in Chapter 15, Shipping and Navigation.
Guideline 07 - Rock Placement, Issue 5, March 2016	A guide to best practice for rock placement activities based on consultation with the cable, fishing and rock placement industries.
Guideline 08 - Submarine Cable Decommissioning, Issue 5, March 2016	Guidance on industry best practice when decommissioning in relation to safety and risk management, cable recovery and abandonment, licences and permits, liaison activities, cable and plant disposal, and reporting.
Guideline 14 - Power Cable Installation Issue 2 March 2016	Provides guidance on installing subsea power cables, including the sequence of operations, route engineering, quality control, installation methods, vessel and equipment expectations, onboard jointing, and strategic planning and cable repair.
Guideline 15 - Power and Renewable Energy Cable Repair Issue 2 March 2016	High level guidance on cable repair.
Acrobat Guideline 17 - Testing of AC and DC Subsea Power Cables, Issue 2, April 2016	Provides considerations when developing a test plan for subsea power cables, including signposts to other available guidance, e.g. from the International Council on Large Electric Systems (CIGRE) and the International Electrotechnical Commission (IEC).
Guideline 19 - Marine Aggregate Extraction Proximity issue 2 April 2016	Reviews considerations that should be given by all stakeholders in the development of projects requiring proximity agreements between marine aggregate interest and submarine cable projects in UK waters.

9. A number of other specific guidance documents have also been taken into account when completing this assessment. These include:

- DECC – The 31st Round general guidance (Oil and Gas Authority, 2018).
- Department for Communities and Local Government (DCLG) National and Regional Guidelines for Aggregate Provision in England 2005 – 2020, (DCLG, 2009).
- East Inshore and East Offshore Marine Plans (HM Government, 2014).
 - Policies AGG1, AGG2 and AGG3
- Health and Safety Executive (HSE) Offshore Technology Report: Noise and Vibration OTO 2001/068 (HSE, 2001).
- International Council for the Exploration of the Sea (ICES) Guidance for the Management of Marine Sediment Extraction (ICES, 2003).

- Maritime and Coastguard Agency (MCA) Marine Guidance (M+F) Note 543 Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – UK Navigational Practise, Safety an Emergency Response. (MCA, 2016).
- Oil and Gas UK, OP024 - Pipeline Crossing Agreement - Edition 2 and Proximity Agreement - Edition 1 (Oil & Gas UK, 2008).
- Subsea Cables UK (formerly the UK Cable Protection Committee (UKCPC)): ‘Guideline 6 for Proximity of Wind Farm developments and offshore cables’ (UKCPC, 2012).
- The Royal Yachting Association's (RYA) Position on Offshore Renewable Energy Developments: Paper 1 (of 4) – Wind Energy, September 2015 (RYA, 2015);
- The Crown Estate Position Paper: Round 3 Offshore Wind and Oil & Gas – A Critical Interface (The Crown Estate, 2010); and
- The Crown Estate Submarine cables and offshore renewable energy installations Proximity study (The Crown Estate, 2012).

18.3 Consultation

10. Table 18.4 outlines the consultation that has been undertaken in relation to infrastructure and other users and provides a summary of the response to each comment raised. Consultation specific to Commercial Fisheries and Shipping and Navigation is provided in Chapter 14 and Chapter 15, respectively.

Table 18.4 Consultation Responses

Consultee	Date /Document	Comment	Response / where addressed in the ES
Secretary of State	June 2017 Scoping Opinion	It would be useful for figures within the ES (Environmental Statement) to identify the locations of international wind farm developments in addition to those located within UK waters.	The locations of other wind farms are shown on Figure 18.1
Secretary of State	June 2017 Scoping Opinion	The Scoping Report proposes to scope out a number of matters within this topic which the SoS agrees to, as below: <ul style="list-style-type: none"> • Potential interference with other wind farms during all phases of the development - as there is no spatial overlap of wind farm infrastructure and as consideration will be given to crossing of other wind farms’ cables. • Initiation of unexploded ordnance (UXO) during all phases of the development – as detailed geophysical survey and investigations would identify abandoned UXO and this is a health and safety risk which will be carefully mitigated rather than being an environmental issue. The SoS advises that the mitigation proposed 	Noted

Consultee	Date /Document	Comment	Response / where addressed in the ES
		<p>in the event that UXO is found should consider environmental impacts (e.g. on species and habitats) and that the geophysical survey and mitigation is secured by a suitably drafted condition within the draft Deemed Marine Licence.</p> <ul style="list-style-type: none"> • Impacts on Ministry of Defence (MoD) activities during all phases of the development - due to the distance of the site from the nearest Military Practice and Exercise Area (PEXA) (43.5km at its closest point). • Physical impacts on subsea cables and pipelines during operation– as standard industry techniques would be followed for maintenance and/or replacement to ensure that other operators’ cables and pipelines are not impacted. 	
Secretary of State	June 2017 Scoping Opinion	The Scoping Report states that there is no spatial overlap of aggregate licence areas with Norfolk Boreas and therefore there are limited pathways for impacts upon aggregate dredging activities. The SoS agrees potential impacts on aggregate dredging operations can therefore be scoped out. However, the SoS welcomes that if the project programme for the proposed dredging by the Bacton Gas Terminal changes (currently proposed to be in 2017), so that it overlaps with the Norfolk Vanguard construction, impacts will be assessed.	The latest programme for the proposed Bacton to Walcott Coastal Management Scheme is 2019. Therefore, no overlap is predicted with Norfolk Boreas which would commence offshore activities no earlier than 2025.
Secretary of State	June 2017 Scoping Opinion	The Scoping Report proposes to scope out impacts on disposal sites during all phases of the development on the basis that there is no overlap between Norfolk Boreas and disposal sites. The Scoping Report states that the Warren Springs disposal site (HU202), shown on Figure 2.25, is disused and therefore there is no pathway for impact upon it from export cable installation. The ES confirms that consideration of any impacts on water and sediment quality due to interactions between the Proposed Development and Warren springs will be covered in the Marine Water and Sediment Quality chapter of the ES. With this assurance, the SoS agrees impacts on disposal sites can be	Chapter 9 Marine Water and Sediment Quality.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		scoped out of the Infrastructure and Other Users chapter of the ES.	
Secretary of State	June 2017 Scoping Opinion	The Scoping Report proposes to scope out potential interference with oil and gas operations during operation as it is anticipated the assets will have been decommissioned prior to construction of the wind farm. As there are currently no assurances that decommissioning will take place, the SoS does not agree this can be scoped out.	Sections 18.6.3, 18.6.4 and 18.7
Secretary of State	June 2017 Scoping Opinion	The SoS notes that the offshore cable corridor passes through the CON29M Coal and Brine Consultation Areas. The potential for impacts on this area should be considered within the ES and the SoS recommends consultation with the Coal Authority in this regard.	Section 18.6.8
Secretary of State	June 2017 Scoping Opinion	The SoS is pleased to note that the Applicant is in discussion with other infrastructure users and encourages the Applicant to continue with this engagement. In this regard the Applicant's attention is drawn to the comments of BBL Company Limited (see Appendix 3 of this Opinion) regarding the potential interactions of the Proposed Development with the BBL pipeline system. However, it is unclear from the Scoping Report how the potential significance of impacts on other infrastructure users will be assessed. The methodology for the assessment should be detailed within the ES.	Sections 18.4 and 18.6.5
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Our key stakeholder concerns are around issues that may potentially arise from within the designated offshore pipeline corridor, such as: (i) cable crossing protection where the proposed cables will cross the BBL pipeline, (ii) induced scour from cable/pipeline protection that may lead to exposure and/or spanning of the BBL pipeline, thereby compromising integrity, (iii) potential operational impacts of high voltage AC cables that may interfere with the pipeline cathodic protection system and (iv) physical impacts on pipelines during operations, which are currently scoped out	Impacts on cables and pipelines are assessed in section 18.6.5 and section 18.7.5.3 Norfolk Boreas Limited will seek to reach crossing agreements with all cable and pipeline operators that would be affected by the project

Consultee	Date /Document	Comment	Response / where addressed in the ES
		of the EIA.	
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Offshore cable installation -para 201 - Crossing protection may induce scour leading to exposure and/or spanning of the BBL offshore pipeline compromising its integrity	Norfolk Boreas Limited will seek to reach a crossing agreement with BBL to ensure that a suitable method is used to cross this asset
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Oil and Gas pipelines and platforms - para 829 - This paragraph should also state that the offshore cable corridor runs adjacent to the BBL offshore pipeline.	Section 18.6 includes information about all assets within and close to the offshore project area.
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Potential impacts during construction - para 844 - Future discussions between the developers of Norfolk Boreas and BBL Company will need to be undertaken as the development progresses.	Norfolk Boreas Limited are/ will shortly be engaging with all asset owners within or close to the offshore project area for Norfolk Boreas.
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Potential impacts during construction - para 844 - It appears that the crossing of the BBL Pipeline would be by offshore export cables and not array cables. Clarification is sought on this point.	Section 18.7.3 and 18.7.5.3 assesses the potential impact of the project on cables and pipelines
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Potential impacts during operation - para 852 - The crossing protection may induce scour leading to exposure and/or spanning of the BBL offshore pipeline, compromising its integrity. High voltage AC cables which cross or are laid in close vicinity to the BBL pipeline may interfere with the operation of its cathodic protection system, compromising its integrity. Hence, the operational impacts should be considered in the EIA.	Has been scoped out as per the Scoping opinion. Discussions between Norfolk Boreas Limited and BBL are on-going will continue throughout application, examination and post consent. A crossing agreement will be sought from BBL and cable monitoring plan will be a condition of the marine licence.
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping	Summary of potential impacts - Table 2.30 - As per comment on para. 852, the physical impacts on subsea cables and pipelines	This was scoped out of the assessment as per the Scoping

Consultee	Date /Document	Comment	Response / where addressed in the ES
	Opinion	during operation should be scoped in.	opinion (see top row of this table) However Norfolk Boreas will commit to producing a cable monitoring plan to be agreed with relevant asset owners, which will ensure that the installation of Norfolk Boreas cables will not compromise other existing assets.
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Offshore project area - para 1515 - Significant infrastructure (i.e. the BBL pipeline) also exists to the south of the offshore project area and along the export cable corridor.	Impacts are assessed in section 18.7.
Atkins (on behalf of BBL Company)	6 th June 2017 Scoping Opinion	Summary of potential offshore environment impacts - para 1637 Table 6.1 - Operation impacts on subsea cables and pipelines should be scoped in due to potential scour and AC effects on CP systems.	Has been scoped out as per the Scoping opinion.
Coal Authority	1 st June 2017 Scoping Opinion	I have reviewed the proposals and confirm that the proposed development would be located outside of the defined coalfield. Accordingly, the Coal Authority has no issues that it would wish to see considered as part of the Environmental Statement for this proposal.	Consultee has been acknowledged in section 18.6.8.
Swift Exploration	17 th April 2018 VWPL consultation	The proposed Norfolk Boreas wind farm is located where we hold licences and the position of the wind farm will most definitely impact the commercial extraction of hydrocarbons. We have identified in excess of 1TCF of methane gas reserves within our licensed and application areas. I have attached a summary map showing the location of our licences, gas fields and opportunities along with the current gas infrastructure, producing and depleted fields.	Sections 18.6.4 and 18.7. Discussions between Norfolk Boreas Limited and Swift Exploration are ongoing will continue throughout application, examination and post consent. An appropriate agreement will be sought from Swift Exploration.

Consultee	Date /Document	Comment	Response / where addressed in the ES
Swift Energy	3 rd December 2018 Section 42 Response	Our main concerns are the preservation of access by helicopters and support vessels including drilling rigs to the seabed areas that we have identified for future development before during and after wind farm construction. It is particularly important that the turbines are located a sufficient distance from the potential drill and platform sites to allow safe access by helicopter.	All helicopter and vessel access routes will be maintained see Chapter 15 Shipping and Navigation and Chapter 16 Aviation and Radar for more details.
Swift Energy	3 rd December 2018 Section 42 Response	Please find updated a map showing the location of our 2 priority areas at Acle and Earlham where we have been working to raise finance to develop these areas for gas production. We have set out our main concern in the earlier document that we have sent you which relate to access to these areas before during and after windfarm construction. We have also identified the location of potential and possible new pipelines in the area. We have sent you this map, timing and project information so it can be part of the PEIR consultation process. Timing of developments in this area are dependent on finance and award of the licence in the Netherlands as shown on the map but have been set out in the attached document along with a brief description of the Earlham/P01-FA joint project.	Noted
Shell	7 th December 2018 Section 42 Response	Of the listed locations below the Corvette is the only Shell location and it's helideck is decommissioned for good mid 2018. For that reason I do not further review and/or comment on your document as per your request below. Please note the Sean locations have been sold some years ago to Oranje Nassau Energy.	Noted. Norfolk Boreas Limited have consulted with Oranje Nassau Energy, who have not provided a response to date.
National Grid Electricity Transmission plc (NGET) and National Grid Gas plc (NGG)	26 th February 2019 Offshore order limits change report response	This is a joint response on behalf of National Grid Electricity Transmission Plc (NGET) and National Grid Gas Plc (NGG). I refer to your letter dated 30th January 2019 in relation to the above proposed application for a Development Consent Order for the proposed Norfolk Boreas Offshore Wind Farm and the Amendment to the offshore Order Limits.	No response required, further detail on the offshore order limits change consultation are provided in the consultation report (document reference 5.1)

Consultee	Date /Document	Comment	Response / where addressed in the ES
		National Grid has no comments on this targeted consultation to add to the Section 42 Consultation Response dated 6th December 2018.	
Swift Energy	28 th February 2019 Email correspondence	Swift confirmed in Feb 2019 that they had relinquished the explorations blocks (49/30b and 50/26a) relevant to Boreas but retain an aspiration of developing their project at a future date.	Noted.
Atkins (on behalf of BBL Company)	5 th April 2019 Section 42 Response	We note that the project includes proposed crossing of the BBL Pipeline by HVDC export cables and potentially other cables. We also note that Vattenfall identifies that a crossing agreement will need to be put in place with BBL Company and that the crossing design will need to be mutually agreed between the two parties.	Discussions between Norfolk Boreas Limited and BBL Company will continue post application and an appropriate pipeline crossing agreement will be reached
Atkins (on behalf of BBL Company)	5 th April 2019 Section 42 Response	The response contained a number of points that will require consideration during the detailed design stage of the Norfolk Boreas project. These included: Locating cables sufficiently distant from the BBL pipeline, minimising the number of crossings and when crossings are required, grouping multiple cables together at as few a crossing points as possible.	The full response will be used to inform the crossing agreements with BBL Company at the detailed design phase.
Atkins (on behalf of BBL Company)	5 th April 2019 Section 42 Response	We note that the offshore order limit change report includes for additional cables which may cross the BBL Pipeline. The observations given on the PEIR above would also apply to any such cable crossings of the BBL Pipeline.	

18.4 Assessment Methodology

18.4.1 Impact Assessment Methodology

11. The generic assessment methodology employed throughout the ES is explained in detail in Chapter 6 EIA Methodology.
12. The assessment of impacts to infrastructure and other users has focused on establishing potential for overlaps, interactions and the consequent potential for conflict between activities in both a geographical and temporal context. This information has been obtained through statements made within publicly available literature (e.g. information in an ES or Scoping Report) or through consultation with

the relevant operator of the activity as discussed in section 18.3 and Chapter 7 Technical Consultation.

18.4.1.1 Sensitivity

13. The sensitivity of the receptor for each impact is characterised as one of four levels, high, medium, low or negligible. Examples of definitions for differing levels of sensitivity of infrastructure and other users are provided below in Table 18.5.

Table 18.5 Definitions of Sensitivity Levels for Infrastructure and Other Users

Sensitivity	Definition
High	High value activity or activity fundamental to the operator or infrastructure of an asset that is of international or national economic importance. No redundancy available in event of impact. Therefore the receptor has <u>very limited</u> tolerance of impact. For example, gas pipeline, electrical infrastructure or telecommunication cable supporting UK or European activity or nationally important aggregates area where extraction company has no access to areas of equal quality aggregates.
Medium	Medium value activity. The impact to an asset that would significantly reduce operators' activities but not result in complete failure to continue operations. Limited redundancy available. Asset regionally important. Receptor has <u>limited</u> tolerance of impact. For example, gas pipeline, electrical infrastructure or telecommunication cable supporting the South East of England area, where asset owners have some potential for redundancy planning. Licensed aggregate extraction areas where the extraction company has some, but limited access to equal or better quality aggregate.
Low	Low value activity. Impact to asset would have limited implications on operator/public either due to the availability of redundancy or limited pathway for impact. Receptor has <u>some</u> tolerance of impact. For example, electrical or telecommunication cable with ability to undertake redundancy planning to limit impact. Aggregates area where extraction company has access to large area of equal or better quality aggregate.
Negligible	Low value activity, operators' activities would not be significantly reduced by impact. Receptor <u>generally</u> tolerant of impact. Limited impact to asset owners or local community in case of damage or failure.

18.4.1.2 Magnitude

14. The magnitude of effect has been considered in terms of the spatial extent, duration and timing of the effect in question. Four levels of magnitude (high, medium, low and negligible) are considered with example definitions for a generic receptor provided in Table 18.6.

Table 18.6 Definitions of Magnitude Levels for Infrastructure and Other Users

Magnitude	Definition
High	Loss of resource and / or quality and integrity of receptor; severe damage to key characteristics, features or elements. For example, accidental damage to asset resulting in permanent or long term inoperability or complete loss of access to economically important asset.

Magnitude	Definition
Medium	Loss of resource, but not adversely affecting integrity of resource; partial loss of / damage to key characteristics, features or elements. For example, damage to an asset that results in either short term, complete inoperability or long term reduced functionality. Partial loss of access to economically important asset, or short term complete loss of access.
Low	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements. For example, accidental damage to asset resulting in short term reduction of functionality but not complete loss of function. Short term disruption to access of asset.
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements, and / or slight alteration to activity.

18.4.1.3 Impact significance

15. Following the identification of receptor value and sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix as presented in Table 18.7 is used as a framework to aid understanding of how a judgement has been reached from the narrative of each impact assessment.

Table 18.7 Impact Significance Matrix

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

16. Through use of this matrix, an assessment of the significance of an impact can be made in accordance with the significance definitions shown in Table 18.8.

Table 18.8 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are

Impact Significance	Definition
	unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore no change in receptor condition.

17. Potential impacts identified as major and moderate are considered to be significant in terms of the EIA and where identified would be avoided or reduced through mitigation, where possible. Minor impacts become more important when considering potential, cumulative impacts or interactions.
18. Embedded mitigation is discussed in section 18.7.1, and is referred to throughout the impact assessment. The impact assessment takes into account the embedded mitigation before coming to a conclusion on the potential impact to a receptor.

18.4.2 Cumulative Impact Assessment

19. As per the assessments presented in the PEIR and in accordance with the Scoping Report (Royal HaskoningDHV, 2017) and agreed by the Secretary of State in the Scoping Opinion, cumulative impacts have been scoped out of this chapter of the ES.

18.4.3 Transboundary Impact Assessment

20. As per the assessments presented in the PEIR and in accordance with the Scoping Report (Royal HaskoningDHV, 2017) and agreed by the Secretary of State in the Scoping Opinion, transboundary impacts have been scoped out of this chapter of the ES.

18.5 Scope

18.5.1 Study Area

21. Those marine activities (other than shipping and navigation, aviation and radar and commercial fisheries which are assessed in Chapter 14 Commercial Fisheries, Chapter 15 Shipping and Navigation and Chapter 16 Aviation and Radar) that have the potential to overlap, be influenced by or influence Norfolk Boreas have been identified where possible. For the majority of cases, consideration is given to infrastructure and activities in the southern North Sea. These are displayed in Figures 18.1 to 18.3.

18.5.2 Data Sources

22. The data sources used to inform the offshore infrastructure and other users baseline are listed in Table 18.9.

Table 18.9 Data Sources

Data	Year	Coverage	Confidence	Notes
Offshore Cables	2018	UK	High	KisOrca: http://www.kis-orca.eu/map#.Wrt5gy7wZhF
Wind farms	2018	UK & EU	High	4C offshore: http://www.4coffshore.com/windfarms/windfarms.aspx?windfarmId=UK36 The Crown Estate: https://www.thecrownestate.co.uk/en-gb/resources/maps-and-gis-data/
Oil and gas infrastructure	2019	UK	High	Oil and Gas Authority: https://ogauthority.maps.arcgis.com/apps/webappviewer/index.html?id=adbe5a796f5c41c68fc762ea137a682e
Aggregate sites	2018	UK	High	The Crown Estate: https://www.thecrownestate.co.uk/energy-minerals-and-infrastructure/downloads/marine-aggregate-downloads/
Disposal sites	2018	UK	High	Cefas: http://mapping.cefas.co.uk:8080/geoserver/MDRLive/wfs?request=GetFeature&service=wfs&version=1.0.0&typename=MDRLive:Recordset_9679&outputformat=shape-zip&srsName=EPSG:4326
Coal Mining Reporting Areas/ Coal and Brine Consultation Areas	2017	UK	High	Coal Authority: https://www.gov.uk/government/organisations/the-coal-authority

18.5.3 Assumptions and Limitations

23. Characterisation of the existing environment and the resulting impact assessment is based on publicly available information, purchased data or information gained directly from relevant companies/organisations. There may be elements of uncertainty associated with the locations of some existing infrastructure and this will be discussed with the owners/occupiers during negotiations and/or will be established during pre-construction surveys where necessary.

18.6 Existing Environment

18.6.1 UK Wind Farm and Renewable Energy Developments

24. The UK waters of the southern North Sea are an area of significant offshore wind development activity, having been subject to several phases of offshore wind development under The Crown Estates' Round 1, Round 2, Round 1 and 2 extensions

and Round 3 developments. There are 56 planned or existing offshore wind developments within the southern North Sea.

25. In October 2018, The Crown Estate announced that extension projects to eight Round 3 offshore wind projects would be progressed. If they are fully developed, the extension project could add additional capacity of up to 3.4GW. In addition, in 2019 The Crown Estate and Crown Estate Scotland is expected to commence the auction process for a further significant tranche of offshore wind development sites in UK waters. Whilst these developments represent a significant potential future expansion of the UK offshore wind industry, where the projects remain outside the formal consent process at the time of writing this EIA the new developments cannot be included within the CIA for Norfolk Boreas.
26. Aside from the other developments within the former East Anglia Zone, The Norfolk Boreas offshore project area is over 60km in distance from other existing UK offshore wind farms. The nearest of these developments being Scroby Sands Offshore Wind Farm, a Round 1 project of 60MW situated 68km from the Norfolk Boreas site (Figure 18.1). Hornsea Project One and Dudgeon are the next closest UK wind farm developments, at over 86km and 90km distance from the Norfolk Boreas site. A summary of those within 50km of the Norfolk Boreas offshore project area is provided in Table 18.10.

Table 18.10 Summary of planned and operational offshore wind farms in UK waters within 50km of Norfolk Boreas offshore project area.

Site	Status	Developer	Nearest Distance from Norfolk Boreas (km)		
			NB	Project interconnector	Offshore cable corridor
Norfolk Vanguard East	Application submitted	VWPL	1	0	0
Norfolk Vanguard West	Application submitted	VWPL	13	0	3
East Anglia THREE	Consented	ScottishPower Renewables	13	5	5
East Anglia ONE North	Pre-planning Application	ScottishPower Renewables	51	38	33
Scroby Sands	In operation	E.ON Climate and Renewables UK	68	45	14
East Anglia ONE	Under construction	ScottishPower Renewables	62	49	47
Sheringham Shoal	In operation	SCIRA Offshore Energy Ltd	103	83	38
Dudgeon	Under Construction	Dudgeon Offshore Wind Ltd	90	74	43
East Anglia Two	Pre-planning Application	ScottishPower Renewables	73	56	44

18.6.2 European Offshore Wind Farm Developments in the Southern North Sea

27. The closest commissioned international wind farm developments are the Princes Amalia windpark, Eneco Luchterduinen and the Egmond aan Zee offshore wind farms which are situated 80km, 88km and 89km away from the Norfolk Boreas site, respectively. A list of planned and operational European offshore windfarms with 100km of the Norfolk Boreas offshore project area in Table 18.11.

Table 18.11 Summary of planned and operational offshore wind farms outside of UK waters within 100km of Norfolk Boreas offshore project area

Site	Country	Status	Developer	Nearest Distance from Norfolk Boreas (km)		
				Norfolk Boreas site	Project interconnector search area	Offshore cable corridor
Hollandse Kust Noord Holland I and II (Tender 2019)	Netherlands	Concept/Early Planning	Ministerie van Economische Zaken	75	83	94
Prinses Amaliawindpark	Netherlands	Fully Commissioned	Eneco Wind B.V	80	88	98
Hollandse Kust Zuid Holland I and II (Tender 2017)	Netherlands	Consented	Chinook C.V. a subsidiary of Nuon/VWPL	82	84	92
Egmond aan Zee	Netherlands	Fully Commissioned	NoordzeeWind	88	97	108
Eneco Luchterduinen	Netherlands	Fully Commissioned	Eneco Wind B.V	89	93	102
Hollandse Kust Zuid Holland III and IV (Tender 2018)	Netherlands	Concept/Early Planning	Ministerie van Economische Zaken	91	93	101

18.6.3 Oil and Gas Infrastructure

28. The southern North Sea has over 1,100 oil and gas wells and platforms according to a review of available data; however, some of this infrastructure is now undergoing decommissioning.
29. The Norfolk Boreas offshore project area boundary has been developed with the aim of avoiding interaction this infrastructure as far as possible. However, due to other limitations within the northern part of the former East Anglia zone it has not been possible to avoid all existing oil and gas infrastructure (see chapter 4 Site Selection and Alternatives).
30. There are active oil and gas infrastructures within the Norfolk Boreas site. In the Davy gas field there is an active platform and seven active subsurface infrastructures (four within Orwell, two in Davy and one in Davy East gas fields). These subsurface infrastructures range from wellheads to debris and subsea protection, they are owned mostly by Perenco. There are also eight completed¹ wells within the offshore project area, owned by Perenco and Tullow. Infrastructure within 5km of the offshore project area are shown in Table 18.12 and displayed in Figure 18.2.

Table 18.12 Oil or gas platforms/wells within 5km of Norfolk Boreas offshore project area

Type of infrastructure	Name	Status	Developer	Nearest Distance from Norfolk Boreas (km)		
				Norfolk Boreas site	Project interconnector search area	Offshore cable corridor
Wells	49/25b-11	Completed	Oranje-Nassau	0	29	31
	53/05b- 7	Completed	Perenco	0	8	17
	49/30a-A5Y	Completed	Perenco	0	12	15
	49/30a-A5Z	Completed	Perenco	0	12	15
	49/30a-A1	Completed	Perenco	0	12	15
	49/30a-A2	Completed	Perenco	0	12	15
	49/30a-A3	Completed	Perenco	0	12	15
	49/30a-A4	Completed	Perenco	0	12	15
	49/30a- 7A	Completed	Perenco	0	21	21
	50/26a-D3	Completed	Tullow	0	26	33
	53/04d- 11	Completed	Tullow	1	0	0
	49/25a-P7	Completed	Shell	3	32	33
	49/25a-P5	Completed	Shell	3	32	33
	49/25a-P6Z	Completed	Shell	3	32	33
	49/25a-P3	Completed	Shell	3	32	33
	49/25a-P8	Completed	Shell	3	32	33
	49/25a-P1	Completed	Shell	3	32	33
	49/25a-P9Z	Completed	Shell	3	32	33
	49/25a-P4	Completed	Shell	3	32	33
49/25a-P2	Completed	Shell	3	32	33	

¹ Installation of permanent wellhead equipment for oil and gas production.

Type of infrastructure	Name	Status	Developer	Nearest Distance from Norfolk Boreas (km)		
				Norfolk Boreas site	Project interconnector search area	Offshore cable corridor
	49/25a-P10	Completed	Onebv	5	34	35
Surface	Davy A	Active	Perenco	0	13	15
	Sean PP	Active	Oranje-Nassau	3	32	33
	Sean PD	Active	Oranje-Nassau	3	32	33
	Surface Mooring Buoy 2	Active	Oranje-Nassau	4	32	32
	Surface Mooring Buoy 1	Active	Oranje-Nassau	4	34	34
Subsurface	Davy East	Active	Perenco	0	8	17
	Debris: Epona Well - KFB 12/2007	Active	Unknown	0	8	11
	N Davy 49/30A-7A	Active	Perenco	0	21	21
	Orwell	Active	Perenco	0	26	33
	Orwell D1	Active	Perenco	0	26	33
	Orwell D2	Active	Perenco	0	26	33
	Orwell D3	Active	Perenco	0	26	33
	Wissey 53/4D	Abandoned	Tullow	0	0	0
	Export Line SSIV Spool	Active	Oranje-Nassau	2	32	32
	Sean PP SSIV	Active	Shell	3	32	32
	Potential Snags Protruding 3.5M Off Seabed KFB:08/2017	Active	Seafish	11	2	10
	Handrails KFB:25/2016	Active	Seafish	11	2	10
	PL24.3	Active	Perenco	58	34	5
	PL24.2	Active	Perenco	58	34	5

31. No potential contaminants from oil and gas infrastructure were identified during seabed contaminant surveys (Chapter 9 Marine Water and Sediment Quality).
32. There is regular helicopter traffic that transports crew between North Sea oil and gas platforms and the mainland. Some of this traffic currently travels through or close to the Norfolk Boreas site as discussed in Chapter 16 Aviation and Radar. There is also shipping traffic associated with oil and gas infrastructure in the surrounding area, as discussed in Chapter 15 Shipping and Navigation.

18.6.4 Oil and Gas Licence Areas

33. For the purpose of oil and gas licensing, the UK continental shelf (UKCS) is divided into quadrants and blocks. Different types of licence for particular blocks, or part

blocks, are issued by Business, Energy and Industrial Strategy (BEIS) through competitive annual Seaward Licensing Rounds under the Petroleum Act 1998 (as amended).

34. The most recent was the 31st Offshore Licensing Round published in July 2018; license blocks on offer from this round are predominantly north of the southern North Sea and do not overlap with the project areas, therefore are not displayed in Figure 18.2. The decisions of the 30th round were announced 23rd May 2018 with no new licensed blocks within the offshore project area as shown in Figure 18.2. Table 18.13 shows current licenced blocks that overlap with Norfolk Boreas offshore project area.

Table 18.13 Current licence blocks overlapping or within 5km of Norfolk Boreas offshore project area

Quadrat Block	Operator	Nearest Distance from Norfolk Boreas (km)		
		Norfolk Boreas site	Project interconnector search area	Offshore cable corridor
53/4d	Tullow UK	0	0	0
53/5c	Eni UK Limited	0	0	2
53/5b	Perenco Oil & Gas	0	6	15
49/30c	Perenco Oil & Gas	0	10	15
49/29a	Oranje-Nassau Energie	0	24	24
49/25a	Oranje-Nassau Energie	0	29	30
53/5a	Perenco Oil & Gas	0	5	12
49/29c	Swift Exploration Limited*	0	18	18
49/30g	Perenco Oil & Gas	0	18	18
49/30d	Perenco Oil & Gas	0	11	12
49/30a	Oranje-Nassau Energie	0	27	28
49/25b	Oranje-Nassau Energie	0	29	31
49/30e	Oranje-Nassau Energie	0	23	24
49/30a	Perenco Oil & Gas	0	27	28
49/24e	Oranje-Nassau Energie	3	29	29
54/1b	Eni UK Limited	5	2	15
53/10a	Eni UK Limited	7	0	11
54/6a	Eni UK Limited	9	3	15
53/9a	Eni UK Limited*	15	4	4
53/8a	Eni UK Limited*	19	4	3
53/4b	Tullow UK	9	2	7
53/3c	Tullow UK	11	0	10
53/2b	Perenco Oil & Gas	29	5	12
53/1b	Independent Oil and Gas	38	14	4

*This is the administration organisation as no operator has been listed.

35. Discussions with license holders are ongoing (where known) to understand results of early exploratory works and the resulting likelihood and extent of activity in these areas.

18.6.5 Sub-sea Cables and Pipelines

36. The southern North Sea has a significant number of cables; primarily telecommunication connections between the UK and continental Europe (see Figure 18.2). The UK-Netherlands 14 telecommunications cable runs from Winterton-on-Sea to Egmond in the Netherlands and intersects the eastern section of the project interconnector search area and the offshore cable corridor. The Tampnet (formerly known as North Sea Com 1 fibre optic) cable runs from Lowestoft north through the offshore cable corridor. All other cables intersecting the Norfolk Boreas offshore project area are inactive.
37. The offshore cable corridor will intersect the Bacton-Zeebrugge gas pipeline and the BBL Balgzand-Bacton gas pipeline. Selection of the Norfolk Boreas offshore project area boundary has been designed to minimise interaction with both pipelines (see Chapter 4 Site Selection and Assessment of Alternatives). The Bacton-Zeebrugge gas pipeline runs east-west, parallel with the inshore section of the cable corridor, and then tracks south, crossing the cable corridor approximately 90°. The BBL Balgzand-Bacton gas pipeline also runs east to west to the north of the cable corridor, adjacent to the southern boundary west of the project interconnector search area and then to the northern boundary east of the project interconnector search area.
38. Table 18.14 presents all known sub-sea cables and gas pipelines that pass through the Norfolk Boreas offshore project area.

Table 18.14 Summary of operational offshore oil and gas pipelines and offshore cables which intersect the Norfolk Boreas offshore project area (as shown in Figure 18.2).

Asset Name	Asset type	Operator	General Trajectory	Crossings / Intersects		
				Norfolk Boreas site	Project interconnector search area	Offshore cable corridor
Pipelines						
Davy A to Tristan NW*	Gas	Verus Petroleum	East/West	Yes	No	No
Davy Host to Davy East Gas	Gas	Perenco	West/East	Yes	No	No
Davy Host to Davy East UMB	Chemical	Perenco	West/East	Yes	No	No
Davy to North Davy		Perenco	South/North	Yes	No	No
North Davy to Davy	Gas	Perenco	North/South	Yes	No	No
Davy to Inde AT	Gas	Perenco	South/North	Yes	No	No
Orwell to Thames RA*	Gas	Tullow	East/West	Yes	No	No
Thames RA to Orwell MEG*	Other fluid	Tullow	West/East	Yes	No	No

Asset Name	Asset type	Operator	General Trajectory	Crossings / Intersects		
				Norfolk Boreas site	Project interconnector search area	Offshore cable corridor
Thames RA to Orwell Control Umbilical*	Other fluid	Tullow	West/East	Yes	No	No
Bacton to Zeebrugge	Gas	Interconnector	North/South	No	No	Yes
BBL Balgzand to Bacton	Gas	BBL	East/West	No	No	Yes
Cables						
UK-Germany 5*	Telecommunication	BT	West/East	Yes	No	Yes
UK-Netherlands 14	Telecommunication	Vodafone	East/West	No	Yes	Yes
Tampnet	Telecommunication	Tampnet	West/East	No	No	Yes

*Not in use

39. Crossing and proximity agreements with the asset owners would be finalised prior to construction commencing.
40. Shipping traffic associated with sub-sea cables and pipelines is covered in Chapter 15 Shipping and Navigation.

18.6.6 Marine Aggregate Dredging

41. There are no aggregate dredging licenced or application areas within the Norfolk Boreas offshore project area. There are aggregate dredging licences and exploration agreements approximately 5km south west of the offshore cable corridor and 27km south west of the project interconnector search area; these are shown in Figure 18.3. The offshore cable corridor runs through an area of high potential aggregate resource, shown in Figure 18.3. These areas are covered by Policy AGG3 in the East Inshore and East Offshore Marine Plans (2014).
42. Shipping traffic associated with marine aggregate dredging is covered in Chapter 15 Shipping and Navigation.

18.6.7 Disposal Sites

43. There is one disused marine disposal site HU202 (BBL Pipeline disposal site) that runs through offshore project area. There are two closed marine disposal sites, HU146 and HU148 within 2km of the Norfolk Boreas landfall site and two closed marine disposal sites approximately 25km north of the project interconnector search area, as shown in Figure 18.3. The largest marine disposal site in the surrounding area is TH075 (Warren Springs). This site is located 26km south of the offshore cable corridor and has been closed since 1995.

44. HU202 was a temporary disposal site that received deposits during the pre-sweep works prior to the BBL Pipeline being laid. Material from the pre-sweeping was temporarily deposited to HU202 and then re-deposited to its original location on the seabed (EMU, 2010).
45. The closest open marine disposal site to the offshore project area is HU212, located 4km south of the project interconnector search area. This site would be used to dispose of marine sediment which has been dredged from the seabed during construction of the East Anglia THREE offshore windfarm, which is expected in 2022.

18.6.8 Coal Authority

46. The offshore cable corridor overlaps with a Coal and Brine Consultation Area (also known as a Coal Mining Reporting Area). Consultation with the Coal Authority has confirmed that it is not required to be considered as part of the assessment.

18.6.9 Ministry of Defence Activities

47. No military practice and exercise areas (PEXAs) overlap with the offshore project area. The closest PEXA is the Southern Military Defence Area (MDA); 34km from the Norfolk Boreas site, and the distance to the closest point of the offshore cable corridor is 63km. The closest military base is RAF Trimingham (see Chapter 16 Aviation and Radar).

18.6.10 Unexploded Ordnance

48. The offshore project area and surrounding area was important during both World Wars due to its proximity to the ports of Felixstowe, Harwich, Lowestoft and Great Yarmouth. This means there is potential for munitions to remain within the offshore project area. Magnetometer surveys were completed across the provisional offshore cable corridor in 2016 and further surveys were conducted across the Norfolk Boreas site in 2017 to identify potential UXO within the offshore project area. A detailed UXO survey and if required a detonation programme will be carried out prior to construction of Norfolk Boreas.
49. There are two Ministry of Defence (MOD) identified explosives dumping grounds approximately 64km and 107km to the south west of the offshore project area. At this distance they are not relevant to this assessment.

18.7 Potential Impacts

50. This section identifies and assesses potential impact to infrastructure and other users. Due to the level of existing accurate data on installed assets and the fact that Norfolk Boreas limited have and will continue to be in direct contact with asset and licence owners the level of confidence in the assessments below is high.

18.7.1 Embedded Mitigation

51. The location of the Norfolk Boreas offshore project area has been selected to minimise potential interaction with neighbouring infrastructure. The project is:
 - Located outside any areas licensed for dredging and aggregate extraction;
 - Located outside any known MOD danger areas; and
 - Located outside any known PEXA.
52. Norfolk Boreas has been located to avoid existing pipelines, telecommunication and transmission cables as far as possible given other constraints.
53. Owners and operators of infrastructure (including oil and gas developers, other wind farm developers, and electrical and telecommunication cable operators) are, and will continue to be, consulted by Norfolk Boreas Limited and commercial and technical agreements will be put in place where required. Crossing and proximity agreements will be agreed post-consent with the relevant asset owners.

18.7.2 Worst Case

54. In relation to infrastructure and other users, the worst case parameters are those that have the greatest potential impact upon existing and planned infrastructure and other users of the sea during construction, operation and decommissioning.
55. Norfolk Boreas may be constructed as a single phase or two phases with a total capacity of up to 1800MW. This may affect the construction programmes intending to start in 2026 and be complete by early 2030 (further details in Chapter 5 Project Description). However, the infrastructure requirements are the same for each phase and therefore the phasing scenarios may have an effect on surrounding existing infrastructure and other users.
56. The full construction window is expected to be up to approximately four years, although this may include periods when there is no on site construction activity.
57. Norfolk Boreas infrastructure consists of wind turbines, offshore electrical platform, offshore service platform, metmasts, LiDAR, array cables, interconnector cables or project interconnector cables and export cables.
58. The layout of the wind turbines will be defined post-consent but a range of 10MW to 20MW wind turbines is included in the project design envelope in order to future proof the DCO to accommodate foreseeable advances in wind turbine technology. For 1,800MW there could be between 90 and 180 turbines ranging from 10MW to 20MW (or any other configuration within this range).

59. The worst case assumptions for infrastructure and other users are outlined in Table 18.15 (further details on the parameters in this table are provided in Chapter 5 Project Description).

Table 18.15 Worst Case Assumptions

Impact	Parameter	Notes
Construction		
Direct impacts with oil and gas operations	Installation of between 90 and 180 turbines ranging from 10MW to 20MW.	Discussions with owners and operators of the infrastructure within and adjacent to the Norfolk Boreas site has indicated that the assets within the site will have been decommissioned by 2023, i.e. prior to construction of the wind farm. Proximity agreements will be agreed post-consent with the relevant asset owners.
	Installation of other infrastructure: <ul style="list-style-type: none"> • 2 x offshore electrical platforms; • Offshore service platform; • 2 x LiDARs; • 2 x met masts; and • 2 x wavebuoys. 	
	Installation of offshore cabling: Two pairs of offshore export cables (totalling 250km of trenching), up to 60km of interconnector cable trenches and up to 600km of array cables. within the Norfolk Boreas site and up to 92km of project interconnector cable trenching within project interconnector search area.	
	Increased vessel activity including jack ups and anchors.	
Impacts on oil and gas licence areas	Installation of between 90 and 180 turbines ranging from 10MW to 20MW.	Discussions with licence owners that overlap and/or within Norfolk Boreas site will be on going throughout the project life. Proximity agreements will be agreed post-consent with the relevant licence owners.
	Installation of ancillary infrastructure: <ul style="list-style-type: none"> • 2 x offshore electrical platforms; • Service platform; • 2 x LiDARs; • 2 x met masts; and • 2 x wavebuoys. 	
	Installation of offshore cabling: Two pairs of offshore export cables (totalling 250km of trenching), up to 60km of interconnector cable trenches and up to 600km of array cables. within the Norfolk Boreas site and up to 92km of project interconnector cable trenching within project interconnector search area.	
	Increased vessel activity including jack ups and anchors.	
Physical impacts on subsea cables and	Seabed preparation	Each Norfolk Boreas export cable pair will cross a maximum of 11 existing cables and two pipelines (i.e. a
	Installation of between 90 and 180	

Impact	Parameter	Notes
pipelines ²	turbines ranging from 10MW to 20MW.	<p>maximum of 26 individual crossings).</p> <p>There will be up to 10 crossings within the project interconnector search area.</p> <p>The array cables will make 10 cable crossings within the wind farm site.</p> <p>Disused cables may be partially removed.</p> <p>Crossing and proximity agreements will be agreed post-consent with the relevant asset owners.</p>
	Installation of ancillary infrastructure: <ul style="list-style-type: none"> • 2 x offshore electrical platforms; • Service platform; • 2 x LiDARs; • 2 x met masts; and • 2 x wavebuoys. 	
	Installation of offshore cabling: Two pairs of offshore export cables (totalling 250km of trenching), up to 60km of interconnector cable trenches and up to 600km of array cables. within the Norfolk Boreas site and up to 92km of project interconnector cable trenching within the project interconnector search area.	
	Seabed contact by legs of jack-up vessels and / or anchors (installation).	
	Removal of disused cables	
Operation		
Direct impacts with oil and gas operations	The presence of wind turbine and platform foundations, scour protection, array cables, inter-connector cables, and cable protection	Subject to discussions with developers
	Increased vessel traffic during maintenance.	
Impacts on oil and gas licence areas	Limited access for oil and gas exploration	Subject to discussions with developers
	Reduced/limited space to install future oil and gas infrastructure.	
Physical impacts on subsea cables and pipelines ²	Scoped out (see Royal HaskoningDHV, 2017 and the Planning Inspectorate, 2017)	
Decommissioning		
Direct impacts with oil and gas operations	Some or all of the export cables, array cables and interconnector cables may be removed. Cable protection would	Subject to discussions with developers and decommissioning plan.
Impacts on oil and gas		

² Data provided by KisOrca (shown in Table 18.14 and Figure 18.2) indicates that there are two in service cables and 1 disused cable that cross the offshore cable corridor, this data also concurs with that supplied by The Crown Estate. However, data provided by Global Marine indicate that there could be a further eight out of service cables that cross the offshore cable corridor. There is very little confidence in Global Marine data as it is older (2010) and not verified by any other data set. However, it has been included here to capture the worst case scenario.

Impact	Parameter	Notes
licence areas	likely be left in-situ.	
Impacts on subsea cables and pipelines		

18.7.3 Potential Impacts during Construction

18.7.3.1 Impact 1: Interference with oil and gas operations

60. As detailed in section 18.6.3 and Figure 18.2, there is oil and gas infrastructure (wells, subsurface and surface) within the offshore project area. Such infrastructure will be avoided (if still in existence) when planning the siting of foundations. However, it will be necessary to continue discussions with the relevant owners and develop proximity agreements for relevant infrastructure.
61. Construction activities, such as seabed preparation, installation of turbines, trenching and installation of offshore export cables, interconnector or project interconnector and array cable installation, vessel anchoring and debris cleaning operations have the potential to interfere with existing operations.
62. Damage to platforms, wells or any other surface / subsurface infrastructure caused during the construction of Norfolk Boreas has the potential to cause major disruption to oil and gas operations and associated potential environmental impacts; therefore the sensitivity of the receptor is high. However, proactive proximity agreements with operators will be finalised prior to construction with the aim of removing the risk of impact as part of embedded mitigation (see section 18.7.1). This reduces the sensitivity of the impact to low and the magnitude of the impact would be negligible, therefore the impact significance would be **no change**.
63. In addition discussions with owners and operators of the infrastructure within and adjacent to the Norfolk Boreas site have indicated that the assets within the site will have been decommissioned by 2024, (i.e. prior to commencement of construction of the wind farm). Discussions will continue to verify this.
64. Any conflicts with vessel and/or aviation activities, including increased vessel activity and helicopter operations associated with the oil and gas industry are addressed in Chapters 15 Shipping and Navigation and Chapter 16 Aviation and Radar respectively.

18.7.3.2 Impact 2: Impacts on oil and gas exploration

65. There is potential for oil and gas exploration within the existing licence blocks that overlap the offshore project area (section 18.6.4).
66. Norfolk Boreas Limited will continue to engage with the relevant oil and gas developers who currently have permissions regarding licence blocks overlapping the

offshore project area. Through this engagement any impacts that may arise from Norfolk Boreas may be mitigated as necessary. This will ensure that through effective planning and engagement, disruption due to construction will be avoided.

67. The oil and gas industry as a receptor is an industry of national importance, but in this case there is no guarantee of future exploration activity, therefore the sensitivity is considered to be medium. It is difficult to predict the level of impact that Norfolk Boreas would have on future oil and gas activity, however the continued consultation with licensees of the oil and gas licence blocks should ensure that the magnitude of the impact would be negligible. Therefore, any impacts are considered to be **minor adverse** assuming they cannot be avoided completely.

18.7.3.3 Impact 3: Impacts on subsea cables and pipelines

68. Operational cables and pipelines within the Norfolk Boreas site will be avoided when siting the foundations. However, it may be necessary for cables from Norfolk Boreas to cross the existing subsea cables / pipelines and therefore crossing agreements with the operators of these will be sought. Where existing cables are disused these may be removed, subject to agreement with the owner.
69. As detailed in sections 18.6.5, Table 18.14 and shown in Figure 18.2, the latest available data indicates that the offshore project area will intersect:
- Nine pipelines and one cable within the Norfolk Boreas site;
 - Two pipelines and three cables within the offshore cable corridor (note the caveat in Table 18.15); and
 - One cable and pipeline within the project interconnector search area.
70. Construction activities, such as for offshore export, project interconnector, interconnector and array cable installation as well as vessel anchoring and debris cleaning or UXO detonating operations have the potential to interfere with submarine cables and gas pipelines.
71. Damage to offshore cables and pipelines caused during the installation of Norfolk Boreas cables has the potential to cause disruption to gas and power distribution and telecommunications, therefore the sensitivity of the receptor is high. Where an existing cable or pipeline requires crossing by a Norfolk Boreas cable a cable crossing methodology would be designed by Norfolk Boreas Limited and then agreed with the asset owner. The design of the crossing are as yet unknown but could involve firstly derating the existing cable, installing protective material for example: rock, armouring or concrete mattresses, then laying the Norfolk Boreas cables over the protective material. Protective material would then be laid over the Norfolk Boreas cable. The design of the cable crossing would aim to minimise the requirement for derating of the existing cable as well as minimising the amount of cable protection required.

72. Norfolk Boreas Limited has designed the project to minimise the number of cable crossings through the site selection process (Chapter 4 Site Selection and Assessment of Alternatives). Cable and pipeline crossing agreements with operators would be sought prior to construction with the aim of reducing the risk of impact as part of embedded mitigation (see section 18.7.1) and therefore the magnitude of the impact would be negligible. Given the high receptor sensitivity and negligible magnitude, the impact would be of **minor adverse** significance.

18.7.4 Potential Impacts during Operation

18.7.4.1 Impact 1: Interference with oil and gas operations

73. As considered in construction Impact 1 (section 18.7.3.1), there is existing oil and gas infrastructure within the offshore project area. To ensure all parties are able to operate efficiently, continued engagement with the relevant owners throughout the operation of Norfolk Boreas will be necessary.
74. Operation and maintenance activities have the potential to interfere with existing operations. With exclusion zones around wind farm infrastructure and increased vessel traffic (transiting crew, monitoring surveys and maintenance vessels), access oil and gas infrastructure may be compromised (see Chapter 15 Shipping and Navigation section 15.7.6). Therefore, the sensitivity of the receptor is high.
75. As indicated in section 18.7.3.1, it is likely that the existing gas infrastructure within and adjacent to the offshore project area would have been decommissioned by 2024, if this is the case there would be no impacts. However, if the decommissioning were delayed and overlapped with the operation of Norfolk Boreas agreements would ensure that the magnitude of the impact would be negligible and therefore would be of **minor adverse** significance.
76. Associated oil and gas industry vessel and/or aviation activities is addressed in Chapters 15 Shipping and Navigation and Chapter 16 Aviation and Radar respectively.

18.7.4.2 Impact 2: Impacts on oil and gas exploration

77. As discussed in construction Impact 2 (section 18.7.3.2) there are planned oil and gas exploration in licensed blocks overlapping with the offshore project area. Norfolk Boreas Limited would continue to engage with any relevant oil and gas developers during operation of Norfolk Boreas to ensure that by necessary planning and engagement, disruption would be avoided.
78. The magnitude of the impact would depend on the level of development that occurs within the site. If this were to be on a large scale in terms of the area affected the magnitude of the impact could be minor, however if no further development occurs during the operation of Norfolk Boreas there would be no impact. The receptor is

considered to be of national importance however given the continued engagement with oil and gas developers and the commitment to proximity arrangements this receptor is afforded medium sensitivity. Given the range of possible outcomes the impact is predicted to range between **minor adverse** significance and **no change**.

18.7.5 Potential Impacts during Decommissioning

79. Impacts upon infrastructure and other users during decommissioning are anticipated to be similar to those assessed during construction of the wind farm, with an incremental reduction of impact as individual wind turbines are removed from the site.
80. Decommissioning works would be determined by the relevant legislation and guidance at the time of decommissioning and would most likely involve the accessible installed components. Offshore, this is likely to include removal of all of the wind turbine components, part of the foundations (those above seabed level), removal of some or all of the array cables, interconnector or project interconnector cables, and offshore export cables. Scour and cable protection would likely be left in-situ. This section provides an overview of the potential impacts.

18.7.5.1 Impact 1: Interference with oil and gas operations

81. To minimise environmental impacts, the offshore export, project interconnector and array cables may be disconnected and left in-situ along with associated cable protection measures and sub-sea structures. If this is not the case and they were removed agreements will be reached with owners of existing (and potentially future) infrastructure prior to the removal.
82. Wind turbine and offshore platform foundations would be removed from the Norfolk Boreas site to the level of the seabed, but these would have been located to avoid any impact upon existing infrastructure during construction.
83. The sensitivity and magnitude of effects would be comparable to those identified for the construction phase. Therefore, the impact significance would be **no change** upon oil and gas operations.

18.7.5.2 Impact 2: Impacts on oil and gas exploration

84. Wind turbine and offshore platform foundations would be removed from the Norfolk Boreas site. To minimise environmental impacts, the offshore export, project interconnector and array cables would be disconnected and left in-situ along with associated cable protection measures and sub-sea structures. If this is not the case and they were removed, agreements would be sought with licence block owners.

85. The sensitivity and magnitude of effects would be comparable to those identified for the construction phase. Therefore, the impact significance would be **minor adverse**.

18.7.5.3 Impact 3: Interference and damage on subsea cables and pipelines

86. To minimise environmental impacts, the offshore export, project interconnector and array cables would be disconnected and left in-situ along with associated cable protection measures and sub-sea structures. This will be agreed with owners of existing cables in relation to cable crossings.
87. Wind turbine and offshore platform foundations would be removed from the Norfolk Boreas site, but these would have been located to avoid any impact upon cables and pipelines during construction. The sensitivity and magnitude of effects would be comparable to those identified for the construction phase. Therefore, the impact significance would be **minor adverse**.

18.8 Cumulative Impacts

88. As per the assessments presented in the PEIR and in accordance with the Scoping Report (Royal HaskoningDHV, 2017), cumulative impacts have been scoped out of the EIA.

18.9 Transboundary Impacts

89. As per the assessments presented in the PEIR and in accordance with the Scoping Report (Royal HaskoningDHV, 2017), transboundary impacts have been scoped out of the EIA.

18.10 Inter-relationships

90. Table 18.16 illustrates the inter-relationship between impacts discussed in this chapter and those discussed in other chapters.
91. As the majority of existing offshore infrastructure is outside the boundary of Norfolk Boreas, the main potential for impact is associated with interactions between traffic associated with Norfolk Boreas and the other infrastructure which is assessed in Chapter 15 Shipping and Navigation and Chapter 16 Aviation and Radar.

Table 18.16 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter
Helicopter traffic associated with oil and gas platforms	Chapter 16 Aviation and Radar	Section 18.6.3
Shipping traffic associated with other offshore wind farms	Chapter 15 Shipping and Navigation	Section 18.6.1
Shipping traffic associated with oil and gas industry	Chapter 15 Shipping and	Section 18.6.3

Topic and description	Related Chapter	Where addressed in this Chapter
	Navigation	
Shipping traffic associated with sub-sea cables	Chapter 15 Shipping and Navigation	Section 18.6.5
Shipping traffic associated with marine aggregate dredging	Chapter 15 Shipping and Navigation	Section 18.6.6

18.11 Interactions

92. There is no potential for interactions between impacts on the different infrastructure and other users described in this chapter as these are all separate, non-related receptors.

18.12 Summary

93. Table 18.17 summarises the predicted impacts to infrastructure of Norfolk Boreas through the construction, operation and decommissioning phases.

Table 18.17 Potential Impacts Identified for Infrastructure and other users

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction						
Impacts on oil and gas operations	Infrastructure	Low	Negligible	No change	Agreements with operators would be put in place as embedded mitigation.	No change
Impacts on oil and gas exploration	Infrastructure	Medium	Negligible	Minor adverse	Ongoing consultation with developers	Minor
Physical impacts on subsea cables and pipelines	Infrastructure	High	Negligible	Minor adverse	Agreements with operators would be put in place as embedded mitigation.	Minor
Operation						
Impacts with oil and gas operations	Infrastructure	High	Negligible	Minor adverse	Agreements with operators would be put in place as embedded mitigation.	Minor
Impacts on oil	Infrastructure	Medium	Negligible	Negligible	Ongoing	No

Potential Impact	Receptor	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
and gas exploration					consultation with developers	change
Decommissioning						
Impacts on oil and gas operations	Infrastructure	Low	Negligible	No change	Agreements with operators would be put in place as embedded mitigation.	No change
Impacts on oil and gas exploration	Infrastructure	Medium	Negligible	Minor adverse	Ongoing consultation with developers	Minor
Physical impacts on subsea cables and pipelines	Infrastructure	High	Negligible	Minor adverse	Agreements with operators would be put in place as embedded mitigation.	Minor

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