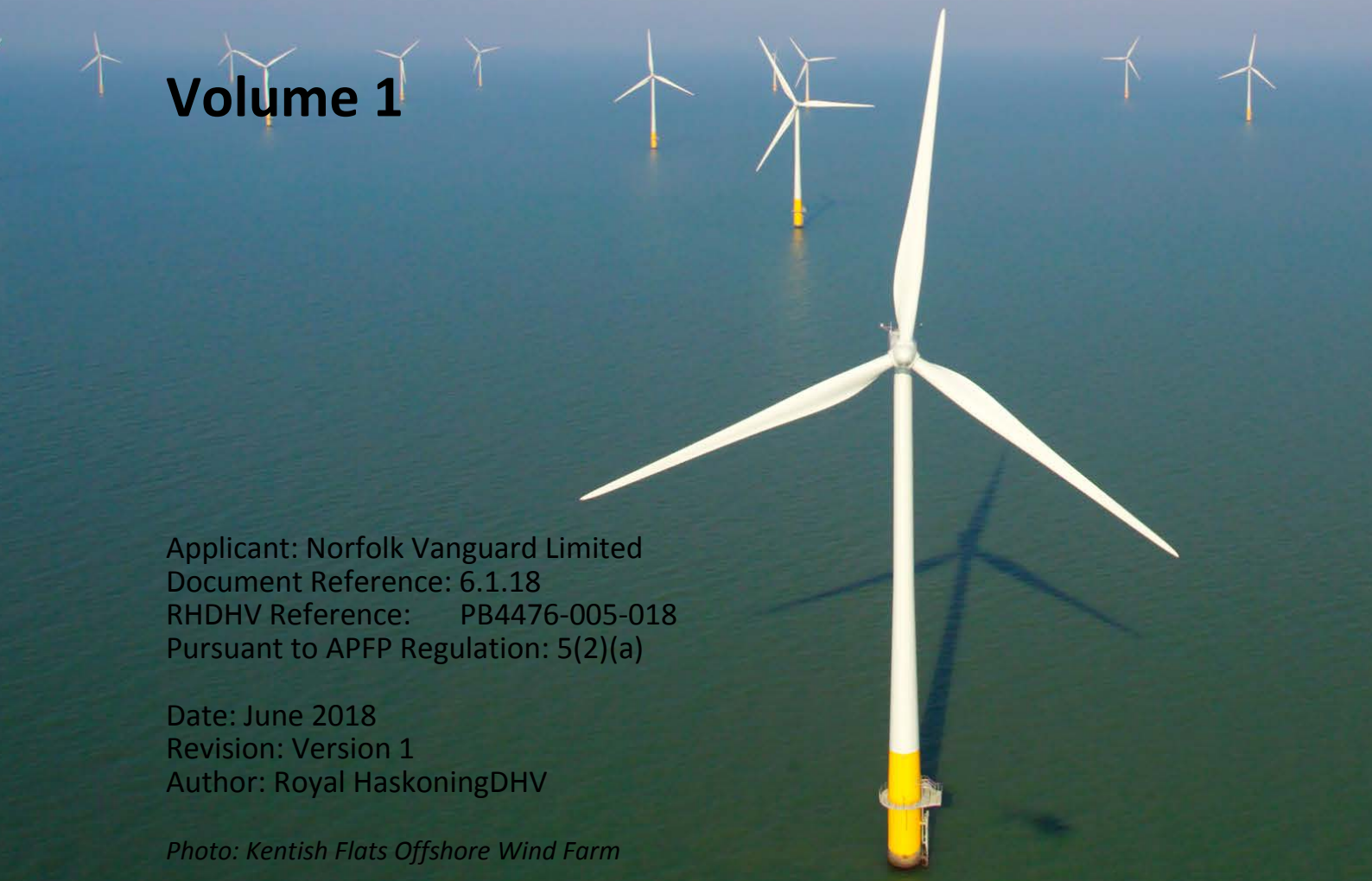
Norfolk Vanguard Offshore Wind Farm

Chapter 18

Infrastructure and Other Users

Environmental Statement

Volume 1



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Environmental Impact Assessment
Environmental Statement

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29/05/18	01F	Final for ES submission	BH	GK	AD

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Glossary

BBL	Balgzand Bacton Line
CIGRE	International Council on Large Electric Systems
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
EIA	Environmental Impact Assessment
ES	Environmental Statement
ESCA	European Subsea Cables Association
HSE	Health and Safety Executive
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
NV	Norfolk Vanguard
O&M	Operations and Maintenance
PEXA	Practice and Exercise Areas
RYA	Royal Yachting Association
SoS	Secretary of State
UKCS	UK continental shelf
UXO	Unexploded Ordnance

Terminology

Array cables	Cables which link the wind turbine generators and the offshore substation platform.
Interconnector cables	Buried offshore cables which link the offshore electrical platforms.
Landfall	Where the offshore cables come ashore at Happisburgh South.
Offshore accommodation platform	A fixed structure (if required) providing accommodation for offshore personnel. An accommodation vessel may be used instead.
Offshore cable corridor	The corridor of seabed from the Norfolk Vanguard OWF sites to the landfall site within which the offshore export cables would 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.
Offshore export cables	The cables which bring electricity from the offshore substation platform to the landfall.
Offshore project area	The overall area of Norfolk Vanguard East, Norfolk Vanguard West and the offshore cable corridor.
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 Vanguard Limited.
The OWF sites	The two distinct offshore wind farm areas, Norfolk Vanguard East and Norfolk Vanguard West.
The project	Norfolk Vanguard Offshore Wind Farm, including the onshore and offshore infrastructure.

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18 INFRASTRUCTURE AND OTHER USERS

18.1 Introduction

1. This Chapter of Environmental Statement (ES) describes the other human activities (with a marine component) occurring within the Norfolk Vanguard offshore project area or potentially affected by Norfolk Vanguard. Other projects considered include offshore wind farm projects, oil and gas activity, marine aggregate extraction, marine disposal sites, military exercise areas (note military aviation is addressed in Chapter 16 Aviation and Radar), telecommunications and electricity cables, pipelines, port developments, capital and maintenance dredging, a coal and brine consultation area and unexploded ordnance (UXO).

2. This chapter provides an assessment of the potential impacts of Norfolk Vanguard 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 more detailed consideration are covered in Chapter 14 Commercial Fisheries, Chapter 15 Shipping and Navigation and Chapter 16 Aviation and Radar.

18.2 Legislation, Guidance and Policy

18.2.1 Guidance

4. 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).

5. 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 Norfolk Vanguard 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 sections 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 Vanguard Limited consultation responses received to date are shown in Table 18.4.

6. 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

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 during the planning process. It is also recommended that wind farm developers*

Title	Details
	consult the following ICPC Recommendations: • *No.1: Management of Redundant and Out of Service Cables;* • *No.2: Recommended Routing and Reporting Criteria for Cables in Proximity to Others;* • *No3: 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	**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.*
ICPC Recommendation No. 2 Recommended Routing and Reporting Criteria for Cables in Proximity to Others	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.
ICPC Recommendation No. 3 Criteria to be Applied to Proposed Crossings Between Submarine Telecommunications Cables and Pipelines/Power Cables	Describes the basic considerations required and lists issues that should be addressed when pipeline/power cables cross telecommunications.

Table 18.3 Relevant recommendations of the ESCA (2016)

Title	Details
Guideline 01 - Fishing Liaison, Issue 6, March 2016	Provides recommendations for cable industry standards and formats relating to how a cable owner should undertake fisheries liaison.
Guideline 02 - UKHO Liaison, Issue 7, March 2016	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.
Guideline 04 - Offshore Liaison, Issue 7, March 2016	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.
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.

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

- Department of Energy and Climate Change (DECC) – The 30th Round general guidance (DECC, 2017).
- DECC - The 29th Round Other Regulatory Issues (DECC, 2016).
- DECC - The 28th Round general guidance (DECC, 2014).
- DECC - The 27th Round Other Regulatory Issues (DECC, 2012).
- DECC - The 26th Round Other Regulatory Issues – Version 2 (DECC, 2011).
- 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).
- The Crown Estate Submarine cables and offshore renewable energy installations Proximity study (The Crown Estate, 2012)

18.3 Consultation

8. Consultation is a key part of the Development Consent Order (DCO) application process. Consultation has been undertaken by Norfolk Vanguard Limited with owners and operators of offshore infrastructure, as well as through section 42 consultation on the Preliminary Environmental Information Report (PEIR) (Norfolk

Vanguard Limited, 2017). Full details of the project consultation process are presented within Chapter 7 Technical Consultation.

9. 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	11th November 2016 Scoping Opinion	It would be useful for figures within the Environmental Statement (ES) to identify the locations of international wind farm developments in addition to those located within UK waters.	Comments are addressed in section 18.6.2 and displayed in Figure 18.1
Secretary of State	11th November 2016 Scoping Opinion	The Scoping Report has proposed to scope out a number of matters within this topic which the Secretary of State agrees to, as below: Potential interference with other wind farms during all phases of the development - as there is no spatial overlap of wind farm infrastructure. Potential interference with oil and gas operations during all phases of the development – as the infrastructure immediately adjacent to Norfolk Vanguard is anticipated to be decommissioned by 2020, i.e. prior to construction of the wind farm (note that should the timescales for decommissioning change during preapplication, the Applicant is advised to reconsider this approach). 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 Secretary of State advises that the mitigation proposed 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. Impacts on Ministry of Defence (MoD)	Noted

Consultee	Date /Document	Comment	Response / where addressed in the ES
		activities during all phases of the development - due to the distance of the site from the nearest Military Practice and Exercise Area (PEXA) (49.3km 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	11th November 2016 Scoping Opinion	The Scoping Report states that there is no spatial overlap of aggregate areas with Norfolk Vanguard (east or west) and therefore there are limited pathways for impacts upon aggregate dredging activities. The Secretary of State agrees potential impacts on aggregate dredging operations can therefore be scoped out, however 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 considered.	Comments addressed in section 18.6.6
Secretary of State	11th November 2016 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 Vanguard and disposal sites. The Scoping Report states that the Warren Springs disposal site (HU202), shown on Figure 2.30, is disused and therefore there is no pathway for impact upon it from export cable installation. No further information on this site has been provided (e.g. what was disposed there and when); therefore the Secretary of State does not have sufficient assurances that there are no pathways for impact. In addition, the assertion in paragraph 777 of the Scoping Report, that "given the lack of contamination there is no likelihood of resuspension of contaminants", has not been fully justified. As such the Secretary of State does not agree impacts on disposal sites can be scoped out based on the information presented within the Scoping Report.	Comments addressed in section 18.6.7

Consultee	Date /Document	Comment	Response / where addressed in the ES
Secretary of State	11th November 2016 Scoping Opinion	The Secretary of State 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 Secretary of State recommends consultation with the Coal Authority in this regard.	Comments addressed in section 18.6.8
Oil and gas Authority	08/12/2017 PEIR Response	Can you assure us that you have consulted with any nearby or overlying petroleum licence holders or local pipeline owners?	Relevant organisations have been contacted (see further information in the Consultation Report, document 5.1). Discussions will continue throughout the application, examination and post consent.
British Marine Aggregate Producers Association	08/12/2017 PEIR Response	The distribution of commercially viable marine sand and gravel resources is highly limited; constrained by their geological distribution and their geographical position relative to the markets location. Consequently, it is essential that existing marine aggregate interests (production licences, applications and option areas) are provided adequate protection against new developments that may interfere with their ongoing safe operation. Equally, given the limited spatial extent of marine sand and gravel deposits, it is also important that areas of potential future resource are clearly identified and flagged so they can equally be considered through the relevant safeguarding policy provisions provided in marine plan. In this respect, we consider that the background marine mineral resource data prepared by the British Geological Survey represents an incredibly valuable dataset, not only in terms of defining where the industry may want to go in the future, but also in highlighting where it is unlikely to go.	Comments addressed in section 18.6.6
British Marine Aggregate Producers Association	08/12/2017 PEIR Response	We note that while the PEIR concludes that there are no potential interactions with existing marine aggregate interests (licensed/application/options), it fails to reference the policy context that exists in	Comments addressed in section 18.2.1 and 18.6.6.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		the form of Policies AGG1 and AGG2 of the East Inshore/Offshore Marine Plan.	
British Marine Aggregate Producers Association	08/12/2017 PEIR Response	We note that no consideration has been given to the potential for impact areas of marine sand and gravel resource that may be considered for use in the future. Refer to para 403 of the East Inshore/Offshore Marine Plan (HM Government, 2014). We consider it necessary for the proposed assessment to take full and proper account of the potential for any marine mineral interests (licensed interests, applications and resources) to be affected by the changes being suggested. Where any potential interactions with marine sand and gravel resources and/or marine aggregate interests are identified, appropriate assessments should take place in accordance with the requirements defined by the relevant marine plan policies to demonstrate the steps taken to mitigate, manage or remove any potential negative interactions.	Comments addressed in section 18.6.6.
Eni UK	04/12/17 PEIR Response	A primary concern of ours is ensuring that Eni UK's offshore activities in relation to the Licenses can safely interface with those of the Project.	Discussions between Norfolk Vanguard Limited and ENI UK are on-going (see further information in the Consultation Report, document 5.1) and will continue throughout application, examination and post consent.
Eni UK	04/12/17 PEIR Response	A further concern is to ensure that windfarm infrastructure siting does not have a significant adverse impact on Eni UK's ability to search for and develop petroleum within the area of the Licenses.	Comments addressed in section 18.6.4
Eni UK	04/12/17 PEIR Response	Eni UK requests that a mechanism be included in any DCO granted which requires the applicant to consult with Eni UK prior to undertaking any conflicting offshore activities.	Discussions between Norfolk Vanguard Limited and ENI UK are on-going (see further information in the Consultation Report, document 5.1) and will continue throughout

Consultee	Date /Document	Comment	Response / where addressed in the ES
			application, examination and post consent.
Sheringham Shoal (Scira Offshore Energy Ltd)	08/12/2017 PEIR Response	Due to the expected scale of Vanguard, we fear potential grid outages or curtailments caused by the construction of Vanguard and potential loss of production at Sheringham Shoal. Scira would therefore welcome mitigation measures aiming to minimise or compensate any disruption to Scira's business.	NGET have the network and outage planning responsibility to ensure new connections can be accommodated onto the transmission network.
Tampnet	16/11/2017 PEIR Response	A key issue is the crossing by one or more of the export cables, and one or more of the inter-array cables, of our fibre optic cables. This is in general accepted but will be pending our agreement and acceptance of a suitable crossing design. Our main goal is to maintain our ability to repair our cables and make sure the crossings happen in a safe way.	Discussions between Norfolk Vanguard Limited and Tampnet are on-going will continue throughout application, examination and post consent. A crossing agreement will be sought from Tampnet.
Independent Oil and Gas	10/04/2018 Written consultation	We have no particular feedback on your project at this time. We note from your letter that you consider IOG have an interest in relation to Development of the Blythe and Elgood gas fields, and that you say that Norfolk Vanguard was not included as a consultee in our recent consultation. To clarify - we are aware of the East Anglia Array proposals but have so far not observed any potential spatial conflicts or otherwise with Blythe, as the proposed developments are some distance apart. There has been of course a public consultation and a statutory consultation with specific parties of interest nominated by the Secretary of State. Details can be found on our website. That said, you should also be aware of our proposed Vulcans Satellite gas field development, which is (marginally) closer to your development although again there are no obvious indications of conflict. We will include yourselves in the forthcoming consultation round for the Vulcans Development, which we expect to	Consultee has been acknowledged in section 18.6.4.

Consultee	Date /Document	Comment	Response / where addressed in the ES
		commence later this month.	
Swift Exploration Ltd	17/04/2018 Written consultation	Swift Exploration can confirm that it has no exploration licences or applications in the current 30th offshore licence round within the Norfolk Vanguard wind farm area and it is unlikely that the position of these wind farms will affect the commercial extraction of hydrocarbons from our current and application licences. Swift Exploration and associated company International Geoscience Ltd have undertaken extensive geological and geophysical research for hydrocarbons across and beyond your proposed wind farm areas over the past 23 years and conclude that there remains the potential for adding significant further reserves of gas, condensate and even some oil for the nation in the southern part of the North Sea. Some of this potential lies below the Norfolk Vanguard wind farm. The location of any wind farm should take this into account as there are areas particularly to the south and west of your proposed wind farms that are widely considered to have very limited hydrocarbon potential.	Potential impacts on oil and gas activity are assessed in section 18.7.3.4.

18.4 Assessment Methodology

18.4.1 Impact Assessment Methodology

10. The generic assessment methodology employed throughout the ES is explained in detail in Chapter 6 EIA Methodology.

11. 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 EIA or Scoping Report) or through consultation with the relevant operator of the activity as discussed in Section 18.2 and Chapter 7 Technical Consultation.

18.4.1.1 Sensitivity

12. 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	Receptor has very limited tolerance of effect
Medium	Receptor has limited tolerance of effect
Low	Receptor has some tolerance of effect.
Negligible	Receptor generally tolerant of effect.

18.4.1.2 Magnitude

13. 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 resource; severe damage to key characteristics, features or elements
Medium	Loss of resource, but not adversely affecting integrity of resource; partial loss of / damage to key characteristics, features or elements
Low	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements

18.4.1.3 Impact significance

14. Following the identification of receptor 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*

15. Through use of this matrix, an assessment of the significance of an impact can be made in accordance with the significance definitions 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 national, 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 unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.

16. Potential impacts identified as major and moderate are deemed to be significant in terms of the EIA and have been avoided or reduced through mitigation, where possible. Minor impacts become more important when considering potential, cumulative impacts or interactions.

17. 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

18. In accordance with the Scoping Report (Royal HaskoningDHV, 2016) and agreed by the Secretary of State (SoS) in the Scoping Opinion, cumulative impacts have been scoped out of this chapter of the ES.

18.4.3 Transboundary Impact Assessment

19. In accordance with the Scoping Report (Royal HaskoningDHV, 2016) and agreed by the SoS in the Scoping Opinion, transboundary impacts have been scoped out of this chapter of the ES.

18.5 Scope

18.5.1 Study Area

20. Those marine activities that have the potential to overlap, be influenced by or influence Norfolk Vanguard have been identified where possible. For the majority of cases, consideration is given to infrastructure and activities in the southern North Sea.

18.5.2 Data Sources

21. 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
Oil and gas infrastructure	2018	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

22. 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

23. 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 leasing rounds. There are 37 planned or existing offshore wind developments within the southern North Sea.

24. Aside from the other developments within the former East Anglia Zone, Norfolk Vanguard is quite distant from other existing UK offshore wind farms, with the nearest UK wind farm development being Scroby Sands Offshore Wind Farm, a Round 1 project of 60MW situated 45km away from NV West. Dudgeon and Sheringham Shoal are the next closest UK wind farm developments, at over 66km and 75km distance from NV West. A summary of all those UK wind farm developments within 50km of the Norfolk Vanguard 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 Vanguard.

Site	Status	Developer	Nearest Distance from Norfolk Vanguard (km)		
			NV East	NV West	Offshore cable corridor
East Anglia Three	Consented	ScottishPower Renewables	0	15	0
Norfolk Boreas	Pre-planning Application	Vattenfall	1	12	1
East Anglia One North	Pre-planning Application	ScottishPower Renewables	39	42	34
Scroby Sands	Active/In Operation	E.ON UK Renewables	66	45	14
East Anglia One	Construction	ScottishPower Renewables	49	53	47

18.6.2 European Offshore Wind Farm Developments in the Southern North Sea

25. 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 79km, 85km and 88km away from NV East, respectively.

26. Table 18.11 lists planned and operational European offshore wind farms in the southern North Sea and notes their distance from Norfolk Vanguard.

Table 18.11 Summary of planned and operational offshore wind farms outside of UK waters in the southern North Sea.

Site	Country	Status	Developer	Distance from Norfolk Vanguard (km)		
				NV East	NV West	Offshore cable corridor
Hollandse Kust Noord Holland I and II (Tender 2019)	Netherlands	Concept/Early Planning	Ministerie van Economische Zaken	74	108	94
Hollandse Kust Zuid Holland I and II (Tender 2017)	Netherlands	Concept/Early Planning	Ministerie van Economische Zaken	75	106	90
Prinses Amaliawindpark	Netherlands	Fully Commissioned	Eneco	79	112	98
Hollandse Kust Zuid Holland III and IV (Tender 2018)	Netherlands	Concept/Early Planning	Ministerie van Economische Zaken	84	114	99
Eneco Luchterduinen	Netherlands	Fully Commissioned	Eneco Wind B.V	85	116	101
Egmond aan Zee	Netherlands	Fully Commissioned	NoordzeeWind	88	122	108
Borssele 1 and 2	Netherlands	Pre-construction	ØRSTED Energy AS	108	118	108
Borssele 3 and 4 - Blauwwind	Netherlands	Consent Authorised	Blauwwind II Consortium	108	118	109
Mermaid	Belgium	Consent Authorised	THV Mermaid	113	120	113
Northwester 2	Belgium	Consent Authorised	Parkwind, Colruyt, Incontrol and TTR energy	115	122	115
Nobelwind	Belgium	Fully Commissioned	Nobelwind	116	123	116
Belwind	Belgium	Fully Commissioned	Belwind NV	116	124	116
Poseidon P60 - Mermaid	Belgium	Concept/Early Planning	Floating Power Plant A/S	116	123	116
Borssele Site V - Leeghwater - Innovation Plot	Netherlands	Consent Authorised	Ministerie van Economische Zaken	117	126	117
Belwind Alstom Haliade Demonstration	Belgium	Fully Commissioned	Alstom Belgium Power NV, Lydian	118	126	118
SeaStar	Belgium	Consent Authorised	Seastar NV	121	129	121
Northwind	Belgium	Fully Commissioned	Northwind NV (formally ELDEPASCO LTD)	124	132	124
Rentel	Belgium	Under Construction	Rentel N.V.	127	135	127
Thornton Bank phase II	Belgium	Fully Commissioned	C-Power nv	131	140	131
Norther	Belgium	Pre-Construction	Norther N.V.	132	141	132

Site	Country	Status	Developer	Distance from Norfolk Vanguard (km)		
				NV East	NV West	Offshore cable corridor
Thornton Bank phase III	Belgium	Fully Commissioned	C-Power nv	133	142	133
Thornton Bank phase I	Belgium	Fully Commissioned	C-Power nv	134	142	134
Windpark Fryslân	Netherlands	Consent Application Submitted	Ventolines BV	144	177	165
Westermeerwind	Netherlands	Fully Commissioned	Ventolines BV	168	203	189
Irene Vorrink	Netherlands	Fully Commissioned	Nuon	168	203	189
Gemini	Netherlands	Fully Commissioned	Northland Power, Siemens, Van Oord	221	243	240
Deutsche Bucht	Germany	Pre-Construction	Northland Power, Inc.	234	252	252
OWP West	Germany	Consent Authorised	ØRSTED Energy AS	236	259	255
Borkum Riffgrund West 2	Germany	Consent Application Submitted	ØRSTED Energy Borkum Riffgrund West II GmbH	236	258	255
Veja Mate	Germany	Fully Commissioned	Veja Mate Offshore Project GmbH	236	255	254
Deutsche Bucht Pilot Park	Germany	Consent Authorised	British Wind Energy GmbH	238	256	256
Riffgat	Germany	Fully Commissioned	Offshore Windpark RIFFGAT GmbH & Co. KG	240	267	260
Borkum Riffgrund West I	Germany	Consent Authorised	ØRSTED Energy Borkum Riffgrund West I GmbH	241	263	260
BARD Offshore 1	Germany	Fully Commissioned	Bard Engineering GmbH	244	263	262
Borkum Riffgrund 2	Germany	Under Construction	ØRSTED Energy AS	251	275	271
Trianel Windpark Borkum II	Germany	Pre-Construction	Trianel Windkraftwerk Borkum II GmbH & Co KG	253	277	272
Trianel Windpark Borkum I	Germany	Fully Commissioned	Trianel Windkraftwerk Borkum GmbH & Co. KG	254	278	274
Borkum Riffgrund 1	Germany	Fully Commissioned	Borkum Riffgrund I Offshore Windpark A/S GmbH & Co. oHG	255	280	275
EnBW He Dreiht	Germany	Consent Authorised	EnBW He Dreiht GmbH	256	275	274
Merkur	Germany	Under Construction	Merkur Offshore GmbH	258	282	277
GICON® SOF 6-8MW Test Turbine	Germany	Concept/Early Planning	Grossmann Ingenieur Consult (GICON) GmbH	261	284	280
Alpha Ventus	Germany	Fully Commissioned	Deutsche Offshore-Testfeld- und Infrastruktur GmbH & Co. KG (DOTI)	263	287	282
Nordsee One	Germany	Partial Generation/Under	Nordsee One GmbH	270	295	290

Site	Country	Status	Developer	Distance from Norfolk Vanguard (km)		
				NV East	NV West	Offshore cable corridor
		Construction				
OWP Albatros	Germany	Under Construction	EnBW Albatros GmbH	271	289	288
Hohe See	Germany	Under Construction	EnBW Energie Baden-Württemberg AG	271	290	289
Delta Nordsee 2	Germany	Consent Authorised	Offshore-Windpark Delta Nordsee GmbH	272	297	292
Delta Nordsee 1	Germany	Consent Authorised	Offshore-Windpark Delta Nordsee GmbH	272	297	292
Nordsee Two	Germany	Consent Authorised	Nordsee Two GmbH	276	300	295
Global Tech I	Germany	Fully Commissioned	Global Tech I Offshore Wind GmbH (formerly Wetfeet Offshore Wind Energy GmbH)	277	295	294
ENOVA Offshore Project Ems Emden	Germany	Fully Commissioned	ENOVA Energieanlagen GmbH,ENERCON GmbH,EWE AG	280	312	301
Nordsee Three	Germany	Consent Authorised	Nordsee Three GmbH	281	305	300
Gode Wind 1 and 2	Germany	Fully Commissioned	ØRSTED Energy AS	283	308	303
Gode Wind 4	Germany	Consent Authorised	Gode Wind II GmbH	290	315	310
Gode Wind 3	Germany	Consent Authorised	Gode Wind 03 GmbH	293	318	313
Meerwind Süd/Ost	Germany	Fully Commissioned	WindMW GmbH	341	365	361
Nördlicher Grund	Germany	Consent Authorised	ØRSTED Energy AS	343	359	360
Nordsee Ost	Germany	Fully Commissioned	Essent Wind Nordsee Ost Planungsund Betriebsgesellschaft mbH	344	367	363
Sandbank Plus	Germany	Consent Authorised	Sandbank Offshore Wind GmbH	347	362	363
Kaskasi II	Germany	Consent Application Submitted	Innogy SE	348	370	367
Sandbank	Germany	Fully Commissioned	Sandbank Offshore Wind GmbH	349	363	365
Amrumbank West	Germany	Fully Commissioned	Amrumbank West GmbH	349	372	368
Nordergründe	Germany	Fully Commissioned	OWP Nordergründe GmbH & Co	353	381	374
DanTysk	Germany	Fully Commissioned	DanTysk Offshore Wind GmbH	360	376	377
Butendiek	Germany	Fully Commissioned	WPD offshore GmbH	384	403	402
Horns Rev 2	Denmark	Fully Commissioned	ØRSTED Energy Horns Rev 2 A/S	413	428	430
Horns Rev 1	Denmark	Fully Commissioned	ØRSTED Energy & Vattenfall AB	419	435	436
Horns Rev 3	Denmark	Under Construction	Vattenfall AB	424	437	440

18.6.3 Oil and Gas Pipelines and Platforms

27. The southern North Sea has over 1100 oil and gas wells and platforms according to a review of available data, however some of this infrastructure is now undergoing decommissioning.

28. There is no known surface or subsurface infrastructure within the Norfolk Vanguard offshore project area as the Order limits for Norfolk Vanguard have been developed with the aim of avoiding this infrastructure.

29. Figure 18.2 shows the extent of infrastructure and licence blocks in the surrounding area. Oil and gas wells and platforms situated within close proximity to the Norfolk Vanguard offshore project area are shown in Figure 18.2 and those listed in Table 18.12 are within 5km. It is understood from discussions with oil and gas operators that the majority of the infrastructure has been decommissioned/ removed.

Table 18.12 Oil or gas platforms within 5km of Norfolk Vanguard

Platform	Developer	Distance from NV (km)		
		NV East	NV West	Offshore cable corridor
Horne and Wren Platform	Tullow	11.8	1.8	6.1
ARTHUR 2 - BALMORAL SG2 SPAR BUOY: KFB 09/2005	Unknown	32.2	3.8	10.6
Yare C	Perenco	23.9	0.1	21.5
UK BLK 53/2 Arthur 2	Perenco	32.2	3.8	10.6
53/2-13 (ARTHUR 2)	Perenco	32.1	3.6	10.6
ARTHUR MANIFOLD	Perenco	34.9	4.9	13.8
ARTHUR P1	Perenco	34.9	4.9	13.8
Wissey	Tullow	4.2	12.2	4.4
Orwell	Tullow	28.5	4.8	28.2

30. Any potential for contaminants from oil and gas infrastructure is discussed in Chapter 9 Marine Water and Sediment Quality.

31. 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 Norfolk Vanguard 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

32. 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 DECC through competitive annual Seaward Licensing Rounds

under the Petroleum Act 1998 (as amended). The most recent was the 30th Offshore Licensing Round published in July 2017, areas are shown in Figure 18.2. The decisions of this round are expected in Q2 2018.

33. Currently the following awarded licenced blocks which are licenced to ENI UK Ltd overlap with NV East:

- 53/5c,
- 53/10a,
- 54/1b, and
- 54/6a.

34. Currently the following blocks overlap with NV West:

- 53/3c, licenced to Centrica and Tullow,
- 49/28a, licenced to Centrica 10% Perenco 23.3% Tullow and
- 53/2a, licenced to Perenco

35. There are also licence blocks undergoing consultation for development, 41km north of the offshore cable corridor and 49km north west of NV West. These blocks are licensed to Independent Oil and Gas Limited (IOG).

36. Discussions with license holders are ongoing 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

37. 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 NV East 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 and NV West. All other cables intersecting the Norfolk Vanguard offshore project area are inactive.

38. The offshore cable corridor will intersect the Bacton-Zeebrugge gas pipeline and the BBL Balgzand-Bacton gas pipeline. Selection of the Norfolk Vanguard Agreement for Lease areas 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 of NV West and then to the northern boundary of NV East.

39. Table 18.13 presents all known sub-sea cables and gas pipelines that pass through the Norfolk Vanguard offshore project area.

Table 18.13 Summary of operational offshore oil and gas pipelines and offshore cables which intersect the Norfolk Vanguard offshore project area (as shown in Figure 18.2).

Asset Name	Asset type	Operator	General Trajectory	Crossings / Intersects		
				NV East	NV West	Offshore cable corridor
UK-Netherlands 14	Telecommunications	Vodafone	East/West	Yes	No	Yes
UK-Germany 5	Telecommunications	BT	East/West	Yes	No	Yes
Tampnet	Telecommunications	Tampnet	North/South	No	Yes	Yes
Bacton to Zeebruge	Gas	Interconnector	North/South	No	No	Yes
BBL Balgzand to Bacton	Gas	BBL	East/West	No	No	Yes

40. Crossing and proximity agreements with the asset owners would be finalised prior to construction commencing.

41. Shipping traffic associated with sub-sea cables and pipelines is discussed in Chapter 15 Shipping and Navigation.

18.6.6 Marine Aggregate Dredging

42. There are no aggregate dredging licenced or application areas within the Norfolk Vanguard offshore project area. There are aggregate dredging licences and exploration agreements approximately 27km south west of NV West and 42km south west of NV East; these are shown in Figure 18.3. The offshore cable corridor runs through an area of high potential aggregate resource, shown in Figure 18.4. These areas are covered by Policy AGG3 in the East Inshore and East Offshore Marine Plans (2014).

43. Shipping traffic associated with marine aggregate dredging is discussed in Chapter 15 Shipping and Navigation.

18.6.7 Disposal Sites

44. There is one disused marine disposal site HU202 (BBL Pipeline disposal site) that runs through NV East and the offshore cable corridor. There are two closed marine disposal sites, HU146 and HU148 within 2km of the Norfolk Vanguard landfall site and two closed marine disposal sites approximately 25km north of NV West, 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 Norfolk Vanguard

offshore project area and has been closed since 1995. The closest open marine disposal site from the Norfolk Vanguard is HU176, located 38km south west of NV West.

45. HU202 was a temporary disposal site that received deposits during the pre-sweep survey prior to the BBL Pipeline being laid. Material from the survey was temporarily deposited to HU202 and re-deposited to its original location on the seabed (EMU, 2010).

46. Any potential for contaminants from disposal sites are discussed in Chapter 9 Marine Water and Sediment Quality.

18.6.8 Coal Authority

47. The Norfolk Vanguard offshore cable corridor overlaps with a Coal and Brine Consultation Area (also known as a Coal Mining Reporting Area). Consultation with the Coal Authority is ongoing to determine the nature of coal mining activity in this area and to request a coal mining report.

18.6.9 Ministry of Defence Activities

48. No military practice and exercise areas (PEXAs) overlap with Norfolk Vanguard. The closest PEXA is the Southern Military Defence Area (MDA); 49km from NV West, and the distance to the closest point of the offshore cable corridor is 71km. The closest military base is RAF Trimingham (see Chapter16 Aviation and Radar).

18.6.10 Unexploded Ordnance

49. The area surrounding Norfolk Vanguard 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 in the offshore project area and a detailed UXO survey will be carried out prior to construction of Norfolk Vanguard.

50. Norfolk Vanguard Limited commissioned a strategic UXO risk management assessment (Ordtek, 2018 provided in Volume 3 Appendix 5.2) to determine the potential nature of UXO which may be encountered at Norfolk Vanguard.

51. As identified in the Norfolk Vanguard Scoping Report (Royal HaskoningDHV, 2016), the impact of UXO clearance on Infrastructure and Other Users is a health and safety risk which will be carefully mitigated by preconstruction surveys, avoidance by micrositing or UXO clearance operations, where necessary.

52. There are two Ministry of Defence (MOD) identified explosives dumping grounds approximately 83km and 128km to the south west of the Norfolk Vanguard OWF

sites. There is also potential for wartime UXO within the southern North Sea (EAOW, 2012a).

18.6.11 Anticipated Trends in Baseline Conditions

53. The baseline of infrastructure and other users is subject to a range of global and local market variables.

54. The UK and European offshore wind industry appears to be on a relatively rapid growth trajectory with increasing numbers and sizes of offshore wind developments in planning and construction across the North Sea Basin. Government policy across Europe and the UK is supportive of offshore wind development and the cost of generation of electricity by offshore wind has dropped dramatically. Consequently, there is an expectation of continued development of new offshore wind farms in to the future.

55. The oil and gas industry, especially that in the UK Southern North Sea, is in a period of slow decline with existing gas fields reaching the ends of their lives and the rate of new finds declining, however it is acknowledged that a new licencing round is in preparation. With or without the development of Norfolk Vanguard, it is likely that this baseline of steady decline in the oil and gas industry of the UK Southern North Sea will continue.

56. It is anticipated that the number and capacity of electricity transmission cables within the North Sea is likely to increase in the future as the UK energy grid becomes more integrated with Europe. The move away from traditional thermal power favours greater grid integration and so increases the demand for subsea interconnectors (McKinsey & Company, 2010).

57. The aggregate industry is dominated by a small number of major companies with a comparatively consistent 15 to 20 million tonnes of sand and gravel extracted annually from UK waters (The Crown Estate, 2017). This figure is relatively stable but is subject to economic and market factors as well as government policy.

58. It is unlikely that there will be a significant requirement for an increase in the number or size of marine disposal sites and military PEXA areas. However, the existing sites are expected to be maintained.

18.7 Potential Impacts

18.7.1 Embedded Mitigation

59. The location of the Norfolk Vanguard offshore project area has been selected to minimise potential interaction with neighbouring infrastructure. The project is:

- Located outside any existing active oil and gas wells;
- Located outside any areas licensed for dredging and aggregate extraction;
- Located outside any known MOD danger areas; and
- Located outside any known PEXA.

60. Norfolk Vanguard offshore project area has been located to avoid existing pipelines, telecommunication and transmission cables where possible.

61. Owners and operators of infrastructure (including oil and gas developers, other wind farm developers, the coal authority, dredging companies and electrical and telecommunication cable operators) are, and will continue to be, consulted by Norfolk Vanguard Limited and commercial and technical agreements would be put in place where required ahead of construction. Crossing and proximity agreements would be agreed post-consent with the relevant asset owners.

18.7.2 Worst Case

62. In relation to infrastructure and other users, the worst case parameters are those that have the greatest potential impact upon other infrastructure and other users of the sea during construction, operation and decommissioning. The worst case parameters are outlined in Table 18.14 (see also Chapter 5 Project Description).

Table 18.14 Worst case assumptions

Impact	Parameter	Notes
Construction		
Impact 1: Impacts on subsea cables and pipelines	Installation of up to two offshore export cable trenches, up to three interconnector cable trenches and up to 600km of array cables. Removal of disused cables.	Each Norfolk Vanguard export cable pair would cross 11 existing operational pipelines/cables (i.e. 22 individual crossings in total based on up to 2 export cable pairs). Disused cables may be partially removed.
Impacts 2: Impacts on aggregate dredging activities	Installation of up to 200 turbines, 2 offshore electrical platforms, 2 accommodation platforms, 2 metmasts, 2 LiDARs, 2 wave buoys, 2 export cable trenches and 600km of array cables	There is no overlap of aggregate licence areas with Norfolk Vanguard. The offshore cable corridor goes through <0.1% of an area of high potential aggregate resource.
Impacts 3: Impacts on disposal sites	Installation of up to 200 turbines, 2 offshore electrical platforms, 2 accommodation platforms, 2 metmasts, 2 LiDARs, 2 wave buoys, 2 export cable trenches and 600km of array cables	There are no active disposal sites within the offshore project area.

Impact	Parameter	Notes
Operation		
Scoped out (see Royal HaskoningDHV, 2016 and the Planning Inspectorate, 2016)		
Decommissioning		
Impact 1: Impacts on subsea cables and pipelines	Some or all of the export cables, array cables and interconnector cables may be removed. Cable protection would likely be left *in situ*.	Subject to crossings agreements and decommissioning plan.
Impacts 2: Impacts on aggregate dredging activities	Some or all of the export cables, array cables and interconnector cables may be removed. Cable protection would likely be left *in situ*.	There is no overlap of aggregate licence areas with Norfolk Vanguard. The offshore cable corridor goes through <0.1% of an area of high potential aggregate resource.
Impacts 3: Impacts on disposal sites	Removal of foundations is likely to be limited to parts that are above the seabed. Impacts would be less than during the construction phase. Scour protection would likely be left *in situ*. Some or all of the export cables, array cables and interconnector cables may be removed. Cable protection would likely be left *in situ*.	There are no active disposal sites within the offshore project area.

18.7.3 Potential Impacts during Construction

63. This section outlines the potential impacts during the lifecycle of the project and their significance, using the methodology described in section 18.4.1 and in Chapter 6 EIA methodology.

18.7.3.1 Impact 1: Impacts on subsea cables and pipelines

64. Existing operational cables and pipelines within Norfolk Vanguard will be avoided when siting the foundations. However, it may be necessary for array cables to cross the existing subsea cables / pipelines and therefore crossing agreements with the operators of these will be sought.

65. The offshore cable corridor crosses several existing cables/ pipelines (Figure 18.3). Crossing agreements will therefore be prepared with the relevant owners. Where existing cables are disused these may be removed, subject to agreement with the owner.

66. As detailed in sections 18.6.5 and Figure 18.2, the offshore project area will intersect:

- Two telecommunications cables (NV East and offshore cable corridor);

- The Tampnet (formally known as North Sea Com 1) fibre optic cable (NV West and offshore cable corridor);
- The BBL Balgzand to Bacton gas pipeline (the offshore cable corridor); and
- The Bacton-Zeebrugge gas pipeline (the offshore cable corridor).

67. Construction activities, such as for offshore export cables, interconnector and array cable installation, vessel anchoring and debris cleaning operations have the potential to interfere with submarine cables and gas pipelines.

68. Damage to offshore cables and pipelines caused during the installation of Norfolk Vanguard export cables has the potential to cause disruption to power distribution and telecommunications, therefore the sensitivity of the receptor is high. However, proactive cable and pipeline crossing agreements with operators would be agreed 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 to negligible. As a factor of the high receptor sensitivity and negligible magnitude, the impact would be of **minor adverse** significance.

18.7.3.2 Impact 2: Impacts on aggregate dredging activities

69. As there is no overlap of aggregate licence areas with Norfolk Vanguard there are limited pathways for impacts upon aggregate dredging activities. Cable installation works would be transient and temporary in nature.

70. As discussed in section 18.6.6, the offshore cable corridor runs through an area of high potential aggregate resource (Figure 18.3) which is approximately 31,454km^2. The area of the offshore cable corridor which overlaps this AGG3 area is approximately 27.2km^2 (0.1%) of this high potential aggregate resource and a far smaller proportion of the wider AGG3 high potential aggregate resource in the southern North Sea region.

71. Figure 18.4 illustrates that the high potential aggregate resource area AGG3 is in a location with a large number of existing cables and pipelines, in particular pipelines making landfall at Bacton. The Norfolk Vanguard offshore cable corridor lies between existing cables and pipelines and therefore it is highly unlikely that aggregate extraction in this area would be practical regardless of the installation of Norfolk Vanguard export cables.

72. The sensitivity and magnitude of the impact on dredging activity is considered to be negligible given the distance between Norfolk Vanguard and existing aggregate extraction sites, and the small percentage of an area of high potential aggregate resource, which is already highly constrained with existing and defunct cables and pipelines, that would overlap Norfolk Vanguard offshore cable corridor. Therefore, the impact would be of **negligible** significance.

18.7.3.3 Impact 3: Impacts on disposal sites

73. There are no active dredge sediment disposal sites within the offshore project area. The H202 site is disused and therefore, there is no pathway for impact upon it from export cable installation. Given the lack of historic contamination there is no likelihood of resuspension of contaminants, this is covered in Section 18.6.7.

74. There are reasonable distances between the active disposal sites HU147 and TH057 and Norfolk Vanguard (39km and 60km respect to the offshore cable corridor), the sensitivity and magnitude of the impact on disposal sites during construction are considered to be negligible. The significance of impact on disposal sites is considered to be **negligible**.

75. A consideration of the potential for impacts on sediment quality is presented in Chapter 9 Marine Water and Sediment Quality.

18.7.3.4 Impact 4: Impacts on oil and gas exploration and production

76. There is potential for oil and gas exploration within the existing licence blocks within NV East and NV West and/or as a result of the 30th Offshore Licensing Round (section 18.6.4).

77. Norfolk Vanguard Limited continues to engage with oil and gas developers, mainly ENI UK Limited who currently hold the licence for blocks in NV East. This consultation will be ongoing to discuss any impacts that may arise from Norfolk Vanguard and would enable any impacts to be mitigated as far as possible. This will ensure that with necessary planning and engagement, disruption due to construction will be avoided.

78. It is difficult to predict the level of impact that Norfolk Vanguard 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 low.

79. The oil and gas industry as a receptor is an industry of national importance; however, the integrity of the resource (oil and gas) would not be affected by Norfolk Vanguard and therefore the sensitivity is deemed to be low, resulting in an impact significance of **minor adverse**.

18.7.4 Potential Impacts during Operation

80. As discussed in the Norfolk Vanguard scoping report (Royal HaskoningDHV, 2016) and agreed in the scoping opinion (the Planning Inspectorate, 2016), there is no potential for O&M activities of Norfolk Vanguard to impact on infrastructure and other users discussed in this chapter. O&M impacts on shipping and fishing are considered in chapters 14 and 15.

18.7.5 Potential Impacts during Decommissioning

81. Impacts upon infrastructure and other users during decommissioning are anticipated to be similar to those discussed during construction of the wind farm, with an incremental reduction of impact as the Norfolk Vanguard infrastructure is removed from the site. 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 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 and damage on subsea cables and pipelines

82. To minimise environmental impacts, the offshore export, 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 and therefore the impact significance is deemed to be negligible.

83. Wind turbine and offshore platform foundations would be removed from the Norfolk Vanguard sites, but these would have been located to avoid any impact upon cables and pipelines during construction. Therefore, there would be **no impact** upon other cables or pipelines.

18.7.5.2 Impact 2: Impacts on aggregate dredging activities

84. Subject to any new aggregate dredging within the Norfolk Vanguard areas during the time of decommissioning, there would be limited pathways for impacts upon aggregate dredging activities.

85. Should they remain at a reasonable distance from Norfolk Vanguard the sensitivity and magnitude of the impact on dredging activity would be negligible. The impact would be of **negligible** significance.

18.7.5.3 Impact 3: Impacts on disposal sites

86. Subject to any new disposal sites during the time of decommissioning, there would be limited pathways for impacts upon disposal sites.

87. As stated with impacts on aggregate dredging activities, should active disposal sites remain at a reasonable distance from Norfolk Vanguard the sensitivity and magnitude of the impact on dredging activity would be negligible. The impact would be of **negligible** significance.

18.8 Cumulative Impacts

88. In accordance with the Scoping Report (Royal HaskoningDHV, 2016), cumulative impacts have been scoped out of the EIA.

18.9 Transboundary Impacts

89. In accordance with the Scoping Report (Royal HaskoningDHV, 2016), transboundary impacts have been scoped out of the EIA.

18.10 Inter-relationships

90. Table 18.15 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 Vanguard, the main potential for impact is associated with interactions between traffic associated with Norfolk Vanguard and the other infrastructure which is assessed in Chapter 15 Shipping and Navigation and Chapter 16 Aviation and Radar.

Table 18.15 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
Helicopter traffic associated with oil and gas platforms	Chapter 16 Aviation and Radar	Section 18.6.3	Helicopter traffic associated with oil and gas platforms will be considered during consultation with these operators
Shipping traffic associated with other offshore wind farms	Chapter 15 Shipping and Navigation	Section 18.6.1	Shipping traffic associated with other offshore wind farms will be considered during consultation with these operators
Shipping traffic associated with oil and gas industry	Chapter 15 Shipping and Navigation	Section 18.6.3	Shipping traffic associated with oil and gas platforms will be considered during consultation with these operators
Shipping traffic associated with sub-sea cables	Chapter 15 Shipping and Navigation	Section 18.6.5	Shipping traffic associated with other subsea cables will be considered during consultation with these operators
Shipping traffic associated with marine aggregate dredging	Chapter 15 Shipping and Navigation	Section 18.6.6	Shipping traffic associated with aggregate dredging will be considered during any consultation with these operators

18.11 Interaction

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 18.16 summarises the predicted impacts to infrastructure of Norfolk Vanguard through the construction, operation and decommissioning phases.

Table 18.16 Potential impacts identified for infrastructure and other users

Potential Impact	Value/ Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Construction					
Impacts on subsea cables and pipelines	High	Negligible	Minor	Agreements with operators would be put in place as embedded mitigation	Minor
Impacts on aggregate dredging activities	Negligible	Negligible	Negligible	None proposed	Negligible
Impacts on disposal sites	Negligible	Negligible	Negligible	None proposed	Negligible
Impacts on oil and gas exploration and production	Low	Low	Minor	Ongoing consultation with developers	Minor
Operation					
Scoped out (see Royal HaskoningDHV, 2016)					
Decommissioning					
Subsea cables and pipelines	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 and operators of cables for which there are crossing agreements. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be the same as those identified during the construction stage.				
Aggregate dredging activities					
Disposal sites					

18.13 References

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