

# Norfolk Boreas Offshore Wind Farm Outline Written Scheme of Investigation (Offshore)

(Version 2) (Clean)

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## Glossary of Acronyms

AEZ	Archaeological Exclusion Zone
AHOB	Ancient Human Occupation of Britain
DCO	Development Consent Order
DEFRA	Department for Environment, Food and Rural Affairs
DML	Deemed Marine Licence
EMU	EMU Limited (geophysical survey contractor)
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
Fugro	Fugro Survey B. V. (geophysical and geotechnical survey contractor)
HDD	Horizontal Directional Drilling
HSC	Historic Seascape Characterisation
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MIS	Marine Isotope Stage
MMO	Marine Management Organisation
NHER	Norfolk Historic Environment Record
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NRHE	National Record of the Historic Environment
NSIPs	Nationally Significant Infrastructure Project
nT	nanoTesla
OSL	Optically stimulated luminescence
OWF	Offshore Wind Farm
PAB	Pathways to Ancient Britain
PEIR	Preliminary Environmental Information Report
ROV	Remote Operated Vehicle
UKHO	United Kingdom Hydrographic Office
WSI	Written Scheme of Investigation

## Glossary of Terminology

Aviation archaeology	The remains of crashed aircraft and archaeological material associated with historic aviation activities.
Geoarchaeology	The application of earth science principles and techniques to the understanding of the archaeological record. Includes the study of soils and sediments and of natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes and the effects on buried sites and artefacts.
Glacial/interglacial	A glacial period is a period of time within an ice age that is marked by colder temperatures and glacier advances. Interglacial correspond to periods of warmer climate between glacial periods. There are three main periods of glaciation within the last 1 million years, the Anglian, the Wolstonian and the Devensian which ended about 12,000 years ago. The Holocene period corresponds to the current interglacial.
Historic seascape character	The attributes that contribute to the formation of the historic character of the seascape.
Marine isotope stage	Marine isotope stages are alternating warm and cool periods in the Earth's paleoclimate, deduced from oxygen isotope data reflecting changes in temperature derived from data from deep sea core samples.
Maritime archaeology	The remains of boats and ships and archaeological material associated with prehistoric and historic maritime activities.
Mesolithic	10000 to 4000 BC The Middle Stone Age, falling between the Palaeolithic and Neolithic and marking the beginning of a move from a hunter gatherer society towards a food producing society.
Norfolk Boreas site	The Norfolk Boreas wind farm boundary. Located offshore, this will contain all the wind farm array.
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.
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 project area	The area including the Norfolk Boreas site, project interconnector search area and offshore cable corridor.
Optically stimulated luminescence	OSL is a scientific technique which dates the last time quartz sediment was exposed to light and providing a precise date for the burial of a geological deposit.
Palaeoenvironmental analysis	The study of sediments and the organic remains of plants and animals to reconstruct the environment of a past geological age.
Palaeogeographic features	Features seen within sub-bottom profiler data (buried) and multibeam bathymetry data (sea floor) interpreted as representing prehistoric physical landscape features such as former river channels (palaeochannels).
Palaeolithic	500000 to 10000 BC The Old Stone Age defined by the practice of hunting and gathering and the use of chipped flint tools. This period is usually divided into Lower, Middle and Upper Palaeolithic.
Project interconnector	Offshore cables which would link either turbines or an offshore electrical

cable	platform in the Norfolk Boreas site with an offshore electrical platform in one of the Norfolk Vanguard OWF sites.
Project interconnector search area	The area within which the project interconnector cable would be installed.
Seabed features	Features seen on the seafloor in the sidescan sonar or multibeam bathymetry data which are interpreted to represent heritage assets, or potential heritage assets. Also includes magnetic anomalies which may represent shallow buried ferrous material of archaeological interest.
Seabed prehistory	Archaeological remains on the seabed corresponding to the activities of prehistoric populations that may have inhabited what is now the seabed when sea levels were lower.

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## 1 INTRODUCTION

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1. This Outline Written Scheme of Investigation (OWSI) (offshore) (hereafter the “Outline Offshore WSI”) has been produced to set out the proposed approach to archaeological mitigation and investigations to be undertaken in association with the offshore and intertidal project areas (seaward of Mean High Water Springs (MHWS)) of the Norfolk Boreas offshore wind farm (hereafter ‘the project’).
2. The requirement for an Offshore Archaeological WSI is set out in the draft Development Consent Order (DCO) for Norfolk Boreas, under Condition 14(1)(h) of the Generation DMLs (DCO Schedules 9 and 10), Condition 9(1)(h) of the Transmission DMLs (DCO Schedules 11 and 12) and Condition 7(1)(g) of the Project interconnector DML (DCO Schedule 13) which state:

*An archaeological written scheme of investigation in relation to the offshore Order limits seaward of mean high water, which must accord with the outline written scheme of investigation (offshore) [this document] and industry good practice, in consultation with the statutory historic body to include—*

*(i) details of responsibilities of the undertaker, archaeological consultant and contractor;*

*(ii) a methodology for further site investigation including any specifications for geophysical, geotechnical and diver or remotely operated vehicle investigations;*

*(iii) archaeological analysis of survey data, and timetable for reporting, which is to be submitted to the MMO within four months of any survey being completed;*

*(iv) delivery of any mitigation including, where necessary, identification and modification of archaeological exclusion zones;*

*(v) monitoring of archaeological exclusion zones during and post construction;*

*(vi) a requirement for the undertaker to ensure that a copy of any agreed archaeological report is deposited with the National Record of the Historic Environment, by submitting a Historic England OASIS (Online Access to the Index of archaeological investigations’) form with a digital copy of the report within six months of completion of construction of the authorised scheme, and to notify the MMO that the OASIS form has been submitted to the National Record of the Historic Environment within two weeks of submission;*

*(vii) a reporting and recording protocol, including reporting of any wreck or wreck material during construction, operation and decommissioning of the authorised scheme; and*

*(viii) a timetable for all further site investigations, which must allow sufficient opportunity to establish a full understanding of the historic environment within the offshore Order Limits and the approval of any necessary mitigation required because of the further site investigations prior to commencement of licensed activities.*

3. The draft DCO under Condition 15(3) of Schedules 9 and 10, Condition 10(2) of Schedules 11 and 12 and Condition 8(2) of Schedule 13 state:

*Each programme, statement, plan, protocol or scheme required to be approved under condition 14, (or 9 or 7 in schedules 11, 12 and 13) must be submitted for approval at least four months prior to the intended commencement of licensed activities, except where otherwise stated or unless otherwise agreed in writing by the MMO.*

4. This Outline Offshore WSI has been prepared in conjunction with that submitted alongside the Norfolk Vanguard DCO application with consideration to Scenario 1 (where the offshore elements of Norfolk Vanguard have been fully constructed before any construction of Norfolk Boreas begins) and Scenario 2 (where Norfolk Vanguard is not constructed). Please refer to Chapter 5 Project Description of the ES (document reference 6.1.5) for further detail on the two Scenarios.

5. In accordance with the above conditions, an updated, final Offshore WSI will be developed in consultation with Historic England, post-consent to be agreed at least four months prior to the commencement of licensed activities.

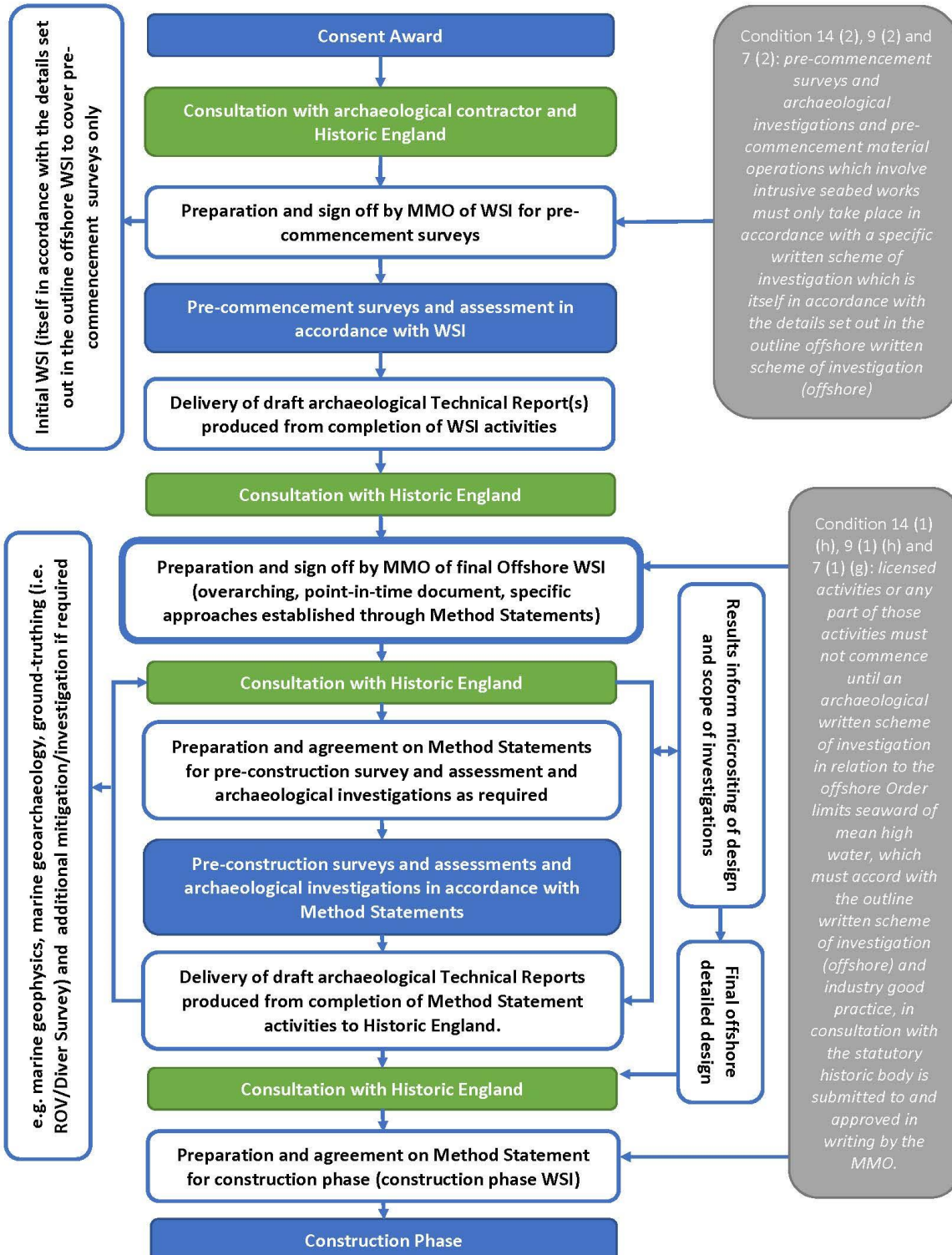
6. In addition, Condition 14(2) of the Generation DMLs (DCO Schedules 9 and 10), Condition 9(2) of the Transmission DMLs (DCO Schedules 11 and 12) and Condition 7(2) of the Project interconnector DML (DCO Schedule 13) state that:

*Pre-commencement surveys and archaeological investigations and pre-commencement material operations which involve intrusive seabed works must only take place in accordance with a specific written scheme of investigation which is itself in accordance with the details set out in the outline offshore written scheme of investigation (offshore), and which has been submitted to and approved by the MMO.*

7. In order to comply with this condition, in the event that the final Offshore WSI is not agreed in writing by the MMO prior to the delivery of pre-commencement surveys, investigations and material operations involving intrusive seabed works, then a separate, site investigation/survey specific WSI must also be submitted and approved by the MMO.

8. The process for drafting, agreeing and obtaining written sign off from the MMO and WSIs (and subsequently, work specific method statements) is shown in Flowchart 1.

Flowchart 1: Process for preparation and submission of Written Schemes of Investigation



## 2 PROJECT BACKGROUND

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9. Norfolk Boreas is located in the southern North Sea, approximately 73km from the coast of Norfolk (at the closest point). Norfolk Boreas is being developed in tandem with Norfolk Vanguard with overall impacts minimised through the co-location of the export infrastructure for both projects. Norfolk Vanguard is approximately 12 months ahead of Norfolk Boreas with respect to proposed construction timetable.
10. Norfolk Boreas would consist of between 90 and 158 turbines, each having a rated capacity of between 11.55 and 20MW, with a total export capacity of up to 1,800MW.
11. Norfolk Boreas Limited is currently considering constructing the project in a single phase or two phases, up to a total capacity of 1800MW.
12. Construction of the project under either approach would be anticipated to commence between 2021 and 2022 for the onshore works, and around 2025 for the offshore works.

### 3 GUIDANCE AND BEST PRACTICE

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13. In demonstrating adherence to industry good practice, this Outline Offshore WSI has been compiled with respect to available archaeological guidance for offshore development including:

- Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014);
- Chartered Institute for Archaeologists (CIfA) Code of Practice and Standards and Guidance (CIfA, 2014a, 2014b, 2014c, 2014d);
- Marine Geophysical Data Acquisition, Processing and Interpretation – guidance notes (Plets R. et al, 2013);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011)
- Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects (The Crown Estate, 2010);
- Historic Environment Guidance for the Offshore Renewable Energy Sector. Guidance (Wessex Archaeology, 2007); and
- Code for Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC), 2006).

## 4 APPROACH

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14. The fundamental objectives of a WSI are set out in the Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects (The Crown Estate, 2010) as follows:
- Set out the respective responsibilities of the Developer, main contractors, and archaeological contractors/consultants, to include contact details and formal lines of communication between the parties and with archaeological Curators;
  - Ensure that any further geophysical and geotechnical investigations associated with the project are subject to archaeological input, review, recording and sampling;
  - Provide for archaeological involvement in any diver and/or ROV obstruction surveys conducted for the scheme;
  - Establish the exact position and extent of archaeological exclusion zones, and methodologies for their monitoring, modification and/or removal;
  - Propose measures for mitigating effects upon any archaeological material encountered during the operation and decommissioning of the scheme; and,
  - Establish the reporting, publication, conservation and archiving requirements for the archaeological works undertaken in the course of the scheme.
15. The Model Clauses (The Crown Estate, 2010) were prepared by Wessex Archaeology for The Crown Estate in order to set out agreed archaeological methodologies so that they do not have to form part of the drafting and agreement of each WSI prepared for the offshore renewables industry. As such, these methodologies will not be duplicated here. Rather, this Outline Offshore WSI draws upon these standard, agreed methodologies and, for each section, sets out how these are relevant to the delivery of Norfolk Boreas and explains any necessary adaptations and amendments for agreement with Historic England.
16. This Outline Offshore WSI has been prepared based upon the results of assessment undertaken for the Norfolk Boreas EIA as presented in Chapter 17 (Offshore and Intertidal Archaeology and Cultural Heritage) of the ES (document reference 6.1.17) and its accompanying appendices:
- Appendix 17.1: Offshore Archaeology and Cultural Heritage Consultation Responses;
  - Appendix 17.2: Norfolk Boreas Offshore Windfarm Archaeological Assessment of Geophysical Data;

- Appendix 17.3: Norfolk Boreas Offshore Windfarm Archaeological Assessment of Geophysical Data – Addendum;
  - Appendix 17.4: Norfolk Vanguard Offshore Wind Farm Marine Archaeological Technical Report;
  - Appendix 17.5: Norfolk Boreas Offshore Windfarm Stage 1 Geoarchaeological Review;
  - Appendix 17.6: Norfolk Boreas Offshore Windfarm Stage 2 Geoarchaeological Review;
  - Appendix 17.7: Norfolk Boreas Offshore Windfarm Stage 3 Geoarchaeological Assessment;
  - Appendix 17.8: Norfolk Boreas Offshore Windfarm Stage 4 Paleoenvironmental Assessment; and
  - Appendix 17.9: Offshore Archaeology Gazetteer.
17. Cross referencing to these appendices, and to the ES chapter is included where appropriate.



## 5 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

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18. The following section provides a summary of the known and potential archaeological and cultural resource of the offshore project area and its environs based on Chapter 17 Offshore and Intertidal Archaeology and Cultural Heritage in the ES and associated gazetteer (Appendix 17.9 of the ES).
19. The study area comprises the red line boundaries of Norfolk Boreas, the offshore cable corridor, including the landfall up to MHWS, and the project interconnector search area (Figure 17.1 in Volume 2 of the ES). The project interconnector search area corresponds to an area within which buried offshore cables linking a turbine or an offshore electrical platform in the Norfolk Boreas site with an offshore electrical platform in the Norfolk Vanguard site could be sited. This area partially overlaps with the offshore cable corridor.
20. The assessment of the existing environment is informed by the results of the work undertaken by Wessex Archaeology as presented in the following technical reports:
  - Appendix 17.2: Norfolk Boreas Offshore Windfarm Archaeological Assessment of Geophysical Data;
  - Appendix 17.3: Norfolk Boreas Offshore Windfarm Archaeological Assessment of Geophysical Data - Addendum;
  - Appendix 17.4: Norfolk Vanguard Offshore Wind Farm Marine Archaeological Technical Report;
  - Appendix 17.5: Norfolk Boreas Offshore Windfarm Stage 1 Geoarchaeological Review;
  - Appendix 17.6: Norfolk Boreas Offshore Windfarm Stage 2 Geoarchaeological Review;
  - Appendix 17.7: Norfolk Boreas Offshore Windfarm Stage 3 Geoarchaeological Assessment;
  - Appendix 17.8: Norfolk Boreas Offshore Windfarm Stage 4 Paleoenvironmental Assessment; and
  - Norfolk Vanguard geoarchaeological assessment Stages 1, 2, 3 and 4 (Wessex Archaeology, 2017, 2018a, 2018b, 2019).
21. Appendix 17.2, Appendix 17.3, Appendix 17.5, Appendix 17.6, Appendix 17.7 and Appendix 17.8 were informed by the following data sources:
  - Geophysical survey datasets acquired by Fugro within the Norfolk Boreas site between May and August 2017 and within the offshore cable corridor between September and November 2016;



- Geotechnical (vibrocore) logs acquired by Fugro from 50 locations within the Norfolk Boreas site in 2017;
- Known wreck and obstruction locations and information for the study area provided by the United Kingdom Hydrographic Office (UKHO); and
- Past reports and assessments undertaken by Wessex Archaeology for projects from the former East Anglia Zone.

22. Appendix 17.4 was informed by the following data sources:

- Geophysical survey and geotechnical data acquired for the project by Fugro Survey B. V. (Fugro) between September and November 2016 over NV West and the offshore cable corridor;
- Geophysical survey data previously acquired over NV East by EMU Limited (EMU) and over the eastern end of the offshore cable corridor by Coastline Surveys Ltd in 2012;
- UKHO data for charted wrecks and obstructions;
- The National Record of the Historic Environment (NRHE) maintained by Historic England, comprising data for terrestrial and marine archaeological sites, find spots and archaeological events;
- The National Heritage List for England maintained by Historic England, comprising data of designated heritage assets including sites protected under the Protection of Military Remains Act 1986 and the Protection of Wrecks Act 1973;
- The Norfolk Historic Environment Record (NHER), comprising a database of all recorded terrestrial and marine archaeological sites, find spots and archaeological events within the county and offshore;
- The HSC report for East Yorkshire to Norfolk (Newcastle University, 2014);
- The Coastal and Intertidal Zone Archaeology Network (CITiZAN) project database of archaeological find spots;
- Relevant mapping including Admiralty Charts, historic maps and Ordnance Survey; and
- Relevant documentary sources and grey literature held by Wessex Archaeology, and those available through the Archaeological Data Service and other websites.

## 5.1 Seabed Prehistory

23. There are no known seabed prehistory sites within the study area. Prehistoric archaeology at the landfall at Happisburgh is discussed in section 5.3.
24. A broad pattern of eight geological units (Table 1) within the study area has been interpreted by Wessex Archaeology based upon both marine geophysical (sub-bottom profiler) and geotechnical data (vibrocores) across both Norfolk Boreas and Norfolk Vanguard.

**Table 1 Shallow geological units identified within the study areas for Norfolk Boreas and Norfolk Vanguard by Wessex Archaeology and their Archaeological Potential**

WA Unit	WA Unit Name Age (MIS)	Geophysical characteristics	Sediment type and depositional environment	Archaeological Potential <sup>1</sup> (key areas of potential for seabed prehistory)
8	Seabed sediments <i>Holocene post-transgression (MIS 1)</i>	Generally observed as a veneer or thickening into large sand wave and bank features up to 20 m in height. Boundary between surficial sediments and underlying units not always discernible.	Medium to coarse sand with frequent shell fragments – marine.	Not in itself considered to be of prehistoric archaeological potential (may protect buried land surfaces).
7c	Elbow Formation – intertidal <i>Early Holocene (MIS 1)</i>	Not identified within the geophysical data as deposit thickness is lower than geophysical data resolution.	Laminated sand, silt and clay – intertidal.	Potential to comprise Early Mesolithic artefactual archaeology
7b	Elbow Formation – organic <i>Late Devensian to Early Holocene (MIS 2-1)</i>	Extensive areas of intermittent, relatively flat, high amplitude reflectors. Often associated with shallow channelling.	Peat ranging from strongly to weakly decomposed with plant fragments (reeds) roots and wood preserved – terrestrial/coastal wetland.	High preservation of palaeoenvironmental material. Potential to comprise Upper Palaeolithic or Early Mesolithic artefactual archaeology
7a	Elbow Formation – fluvial <i>Late Devensian to Early Holocene (MIS 2-1)</i>	Small, shallow, infilled channels. Fill characterised as acoustically chaotic or transparent, or by sub-parallel internal reflectors. Incises into the top of Upper Brown Bank.	Sand with silt and clay laminations, occasionally organic, may comprise plant/root or shell fragments – fluvial/alluvial, possible reworking of older deposits.	Potential to comprise in-situ and reworked archaeology is high, both within channels and along their margins
6	Twente Formation – <i>Late Devensian (MIS 2)</i>	Not identified in shallow geophysical data	Not identified in geotechnical core logs.	Potential for post-glacial Upper Palaeolithic <i>in situ</i> archaeological material and palaeoenvironmental material (although the Twente Formation has not been positively identified)

<sup>1</sup> The archaeological potential associated with the geological sequence and palaeogeographic features outlined in this table (illustrated on Figures 17.2 and 17.3 in Volume 2 of the ES) is described in detail in section 17.6.1 of the ES.

WA Unit	WA Unit Name Age (MIS)	Geophysical characteristics	Sediment type and depositional environment	Archaeological Potential <sup>1</sup> (key areas of potential for seabed prehistory)
5	Upper Brown Bank <i>Early-Mid Devensian (MIS 5d-3)</i>	Observed as a blanket deposit across much of the area, either acoustically transparent or characterised by sub-horizontal layered reflectors. Contains numerous internal erosion surfaces, occasional fluid escape structures, and areas of acoustic blanking.	Silty clay and clayey silt with closely spaced fine laminations. May be sandy in places or comprise sand partings/laminations – restricted marine/open estuary.	Although the potential for the preservation of archaeological material is low, the Brown Bank embayment may have created a significant geographic barrier to migration pathways through the southern North Sea during the Middle Palaeolithic, correlating to a period of absence in the British archaeological record
4	Lower Brown Bank/Eem Formation <i>Ipswichian to Early Devensian (MIS 5e-5d)</i>	Observed within large topographically controlled depressions. Characterised by low relief basal reflector and either an acoustically transparent or well-layered fill.	Not identified in geotechnical data.	The marine Eem formation is of limited archaeological potential, although the unit may cover earlier Lower Palaeolithic land surfaces. The Lower Brown Bank deposits may contain in-situ and derived Middle Palaeolithic artefacts and intact organic material of palaeoenvironmental interest
3	Swarte Bank <i>Anglian (MIS 12)</i>	Not identified in shallow geophysical data.	Not identified in geotechnical data.	No archaeological potential
2	Yarmouth Roads <i>Early to Mid-Pleistocene (&gt;MIS 13)</i>	Thick unit either seismically chaotic or containing numerous areas of well-defined cross cutting channel complexes characterised by layered sub-parallel internal reflectors. Top of unit generally a well-defined regional erosion surface.	Not identified in geotechnical data.	Potential for in situ Lower Palaeolithic archaeological artefacts and <i>in situ</i> and derived palaeoenvironmental material associated with upper layers, if these have not been removed by erosion. This potential is highest in areas where channels have been observed

WA Unit	WA Unit Name Age (MIS)	Geophysical characteristics	Sediment type and depositional environment	Archaeological Potential <sup>1</sup> (key areas of potential for seabed prehistory)
1	Westkapelle Ground Formation <i>Late Pliocene to Early Pleistocene (MIS 63-103)</i>	Not identified in shallow geophysical data within Norfolk Boreas site. In offshore cable corridor observed as acoustically unstructured unit with a generally well-defined basal reflector.	Deltaic silty clays and sands.	No archaeological potential

## 5.2 Maritime and Aviation

25. Seabed features of archaeological interest are discriminated by Wessex Archaeology in accordance with the definitions set out in Table 2.

**Table 2 Wessex Archaeology's Criteria discriminating relevance of seabed features**

Archaeological Discrimination	Description	
<b>Non-Archaeological</b>	U1	Not of anthropogenic origin
	U2	Known non-archaeological feature
	U3	Position of a recorded loss at which no physical wreck remains have ever been identified
<b>Archaeological</b>	A1	Anthropogenic origin of archaeological interest
	A2	Uncertain origin of possible archaeological interest
	A3	Historic record of possible archaeological interest – UKHO reference to feature that shows no trace on seabed

26. In total there are 1425 seabed features of archaeological potential within the Norfolk Boreas study area. These are summarised in Table 5.3 and presented as a gazetteer in Appendix 17.9 to the ES. All features are discussed in detail in the corresponding technical reports for Norfolk Boreas (Appendix 17.2 and Appendix 17.3) and Norfolk Vanguard (Appendix 17.4).

**Table 5.3 Seabed features of archaeological potential within the study area**

Archaeological Discrimination	Number of seabed features				Total
	Norfolk Boreas site	Offshore cable corridor	Offshore cable corridor and Project interconnector search area	Project interconnector search area	
<b>A1</b>	14	25	1	3	43
<b>A2</b>	525	649	43	156	1373
<b>A3</b>	3	0	0	1	4
<b>U2</b>	5	0	0	0	5
<b>Total</b>	547	674	44	160	1425
<b>Figure Reference (Volume 2 of the ES)</b>	Figure 17.4	Figure 17.5 Maps 1 to 4	Figure 17.5 Maps 1 and 2	Figure 17.5 Maps 1 and 2	

27. The A1 features identified as being of archaeological interest, comprising wrecks, magnetic only buried anomalies and larger items of debris and debris fields, are summarised in Table 4.

Table 4 Summary of A1 anomalies within the study area

WA ID	Type	Summary	Area
7012	Magnetic	Magnetic only anomaly (2538nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	Norfolk Boreas site
7122	Wreck	A large broken up wreck with visible deck structure, partially buried by large sand waves and with a large magnetic anomaly (2440nT) associated. Associated with UKHO record (11154) for <i>Koningen Regentes</i> , a paddle steamer built in 1895 and in service as a hospital ship, repatriating prisoners of war when it was torpedoed and sunk by a German submarine in 1918. The wreck was dived in 2010 and described as being broken up and scattered with the paddles still showing above the seabed	
7143	Wreck	Elongate outline, with some structure visible, partially covered by sediments and appears embedded in the seabed. A small magnetic anomaly (29nT) is associated. Associated with UKHO record (11146) of an unknown wreck, previously identified in 1994.	
7153	Magnetic	Magnetic only anomaly (2487nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
7229	Wreck	Outline of a wreck, appears to have intact structure and is upright with some superstructure visible. Appears to be some linear debris to the north (7230). An associated magnetic anomaly (97nT) indicates the presence of ferrous material. This anomaly is associated with a UKHO record (11153) of an unknown wreck, previously observed by Gardline Geosurvey in 2014.	
7237	Magnetic	Magnetic only anomaly (1717.6nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted. Only observed on only one line, possibly caused by a passing vessel but retained as line spacing 100m.	
7295	Magnetic	Magnetic only anomaly (2587nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
7395	Magnetic	Magnetic only anomaly (1166nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
7407	Magnetic	Magnetic only anomaly (2709nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
7409	Magnetic	Magnetic only anomaly (2141nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
7411	Magnetic	Magnetic only anomaly (973nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
7413	Magnetic	Magnetic only anomaly (2215nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	

WA ID	Type	Summary	Area
7419	Wreck	A large wreck with the outline of the hull visible, with structure although it appears buried in the southeast. The height to the northwest edge of the bow or stern is 2 m with possible boilers or mast visible in the centre (2 m height). The wreck has a large magnetic anomaly (5123nT) associated indicating ferrous debris. Associated with UKHO record (64124) for an unknown wreck, thought to be a "three-island" steamer vessel.	
7486	Magnetic	Magnetic only anomaly (2474.4.6nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted. Only observed on only one line, possibly caused by a passing vessel but retained as line spacing 100m.	
70021	Wreck	Unidentified, partially buried wreck with an associated magnetic anomaly indicating the presence of ferrous material. Not previously charted.	Project interconnector search area
70058	Magnetic	Extremely strong magnetic anomaly (6587nT) without a corresponding sidescan sonar or bathymetry anomaly suggestive of a buried wreck with a significant amount of ferrous material in its construction. Charted by the UKHO (ID 11214).	
71479	Magnetic	Magnetic only anomaly (4455nT) with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
70342	Wreck	Very indistinct area of wreckage with a medium magnetic anomaly. Associated with UKHO record (11091) of <i>Golden Oriole</i> (possibly), a British trawler Sunk 22/01/1915. Previously observed in 2014 as well broken-up.	Project interconnector search area and offshore cable corridor
70360	Wreck	An area of wreck debris with a very high magnetic anomaly associated, the full extent of which may be buried. The wreck stands upright prominently within large sandwaves but is relatively broken up and in poor condition. Associated with UKHO record (11093) of <i>HMS Dunoon</i> (possibly), a British minesweeper sunk by a mine on 30/05/1940. Last observed as relatively intact but damaged in the bows.	Offshore cable corridor
70459	Wreck	A wreck broken in two, with dispersed wreck debris and some structure and possible deck planking discernible. The stern and hull are not clear and the full extent of the wreck is likely buried by the large sandwaves in the area. The wreck has a large magnetic anomaly associated indicating a ferrous composition. Associated with UKHO record (11092) of <i>Phillipp M</i> , a steam ship which was torpedoed and sunk in 1944. The wreck is described as lying in two parts on the seabed, probably inverted, last observed in 1999.	
70460	Debris	Small piece of possible wreck debris situated 27 m south-west of wreck 70459	
70565	Wreck	A possible area of dispersed wreck. The wreck appears to be broken up with large sections disjointed from the main structure of the wreck. A large magnetic anomaly is associated indicating some ferrous content. Associated with UKHO record 10722 for an unknown wreck described as being broken up and almost buried by sandwaves with debris in the wrecks vicinity, likely boilers and engine.	

WA ID	Type	Summary	Area
70615	Magnetic	Very large, magnetic only anomaly with no surface expression and potential to be substantial buried ferrous remains. Not previously charted.	
70617	Wreck	Large wreck possibly in two parts, with the majority of the hull intact and with deck structure visible as some straight, slatted features. There is a very large magnetic anomaly associated indicating a ferrous construction. Associated with the UKHO record (10544) for <i>Rye</i> , a steamship lying in two parts at right angles, sunk in 1941 by torpedo fire. Last observed in 2014.	
70618	Debris	Feature identified in an area of textured seafloor with a large magnetic anomaly associated indicating ferrous debris	
70639	Wreck	Large dispersed wreck, appears upright and with some structure visible with possibly two sections of wreck. The full extent and detail is likely covered by sands. There is a large magnetic anomaly associated with the wreck indicating a ferrous construction. The wreck has a possible associated piece of debris at its northern end (70640). Associated with UKHO record 10546 for <i>Trevethoe</i> , a motor vessel built in 1940 and sunk in 1941, last observed in 2014 as upright but collapsed and in two parts.	
70640	Debris	Possible wreck debris located 9 m to the north-west of wreck 70639	
70645	Wreck	Medium sized wreck with a possible broken off linear piece of debris extending from the wreck. The wreck is intact and upright. There is a medium magnetic anomaly associated with this wreck indicating some ferrous debris. Associated with UKHO record 82114, an unknown wreck that is largely intact and partially buried, previously observed in 2016.	
70659	Wreck	Large wreck that appears to be intact though possibly partially buried by sandwaves. There is a very large magnetic anomaly associated indicating a ferrous construction. Associated with UKHO record 10849 for an unknown wreck lying in two parts, last observed in 2014.	
70704	Wreck	Wreckage of an unknown sailing vessel, relatively intact though partially buried. Has a medium magnetic anomaly associated indicating a ferrous construction. Associated with UKHO record 10545 which was last observed in 2014 as intact and mainly covered by a sandwave.	
70709	Wreck	Wreckage of steamship <i>Montferlan</i> , upright with some debris to the north-east, partially disintegrated, possibly broken up into sections. Feature has a very large associated magnetic anomaly. The UKHO record 10549 states the original length was 128m and was last observed in 2014.	
70744	Wreck	Large wreck, partially broken up but intact and lying upright on the edge of a large sandwave. Associated wreck debris may be buried by sands. With a very large magnetic anomaly indicating ferrous material. Associated with UKHO record 10548 of an unknown wreck, last observed in 2014.	
70784	Debris	Possibly part of nearby debris field (70785). Has a very large magnetic contact associated indicating ferrous debris	
70785	Debris field	Small patch of disturbed seafloor with very large magnetic anomaly indicating ferrous material. Possible small debris field.	



WA ID	Type	Summary	Area
70809	Wreck	<p>Wreck of steam paddle schooner <i>Seagull</i>, partially disintegrated but intact and upright and on a sandwave rich area of the seabed with some superstructure discernible in the data. With a large magnetic anomaly. The UKHO record 10550 states that wreck was last observed in 1994 by divers.</p> <p>The <i>Seagull</i> is a Scheduled Monument (List Entry Number: 1464587, first listed with the <i>Xanthe</i> (see below) on 8<sup>th</sup> November 2019) under the Ancient Monuments and Archaeological Areas Act 1979 as amended. List summary: <i>The Seagull is a rare example of a sail-assisted paddle steamer (a type of vessel that became obsolete in the mid-C19 century with the development of screw propeller driven vessels) built in 1848 in Belfast. The vessel had been used as a cargo transport for around 20 years before it sank in a collision in 1868.</i></p>	
70810	Debris field	Small patch of disturbed seafloor. Possible debris associated with the wreck 70809	
70832	Debris	Small anomaly identified towards the bow of wreck 70834. Likely to be items of debris associated with wreck.	
70833	Debris	Small anomaly identified at the bow of a wreck. Possible similar debris identified nearby (70832). Likely to be items of debris associated to wreck 70834.	
70834	Wreck	<p>Wreck of the steam screw barque <i>Xanthe</i> (UKHO 10660) sunk in 1869. Identified as a distinct, upright wreck, relatively intact, with some possible straight deck features and some associated items of debris and a medium magnetic anomaly. Last observed by the UKHO in 2002.</p> <p>The <i>Xanthe</i> is a Scheduled Monument (List Entry Number: 1464597, first listed with the <i>Seagull</i> (see above) on 8<sup>th</sup> November 2019) under the Ancient Monuments and Archaeological Areas Act 1979 as amended. List summary: <i>The Xanthe comprises a nineteenth-century steam ship lying off Horsey Gap, near Great Yarmouth, Norfolk. Built in Hull in 1862, the Xanthe is a rare example of a sail-assisted iron steam ship; a type of vessel that became obsolete in the mid-C19 with the development of full screw propeller driven vessels.</i></p>	
70934	Wreck	Large wreck without distinguishable structural elements and appears badly degraded, though still with some height. Mostly buried and broken up and situated in a depression. Has a very large magnetic anomaly associated indicating a ferrous construction. UKHO record 10554 states this is the <i>Sheaf Water</i> , a steamship torpedoed by a German E-Boat in 1942. Previously identified in 2002.	
70954	Wreck	Large wreck that appears to be mostly intact and upright with possible deck structure visible. There is a very large magnetic anomaly associated indicating a ferrous construction. Associated with UKHO record 10680 of unknown wreck. Last observed in 1983.	
70958	Debris field	Approximately four anomalies located directly next to wreck 70962 and likely associated debris	

WA ID	Type	Summary	Area
70962	Wreck	A large area of dispersed wreck with possible deck structure. Parts of the hull outer edge appear intact. The wreck has a debris field (70958) and possible rope or chain features in close proximity (70952, 70955, 70956 and 70959). Has a large magnetic anomaly associated indicating a ferrous construction. Associated with UKHO record 10556 for <i>Fulgens</i> , a steamship built in 1912 and sunk in 1915 by torpedo.	

28. Seabed features interpreted as A2 have been identified as being of possible anthropogenic origin and have the potential to represent archaeological material on the seabed of maritime or aviation origin. Magnetic only anomalies (without visible surface expression) have the possibility to be buried objects with ferrous content that are of archaeological potential. The types of features identified are summarised in Table 5.

**Table 5 Types of A2 features within the study area**

Type of feature	Total in study area	Norfolk Boreas site	Offshore cable corridor	Offshore cable corridor and Project interconnector search area	Project interconnector search area
Debris	126	73	36	4	13
Debris Field	52	22	17	5	8
Seafloor Disturbance	60	46	3	1	10
Bright Reflector	43	19	14	3	7
Dark Reflector	267	95	100	10	62
Rope/Chain	43	11	30	-	2
Large object	8	8	-	-	-
Magnetic	761	244	445	19	53
Mound	13	7	4	1	1
<b>Total</b>	<b>1373</b>	<b>525</b>	<b>649</b>	<b>43</b>	<b>156</b>

29. There are four A3 historic records within the study area. At two of these previously recorded locations it is considered unlikely that archaeological material is present although it cannot be entirely discounted:

- 70079: an unidentified obstruction (UKHO 11216) within the project interconnector search area described as a small geophysical contact and not seen since 1994; and
- 7089: fisherman's fastener (UKHO 9545) recorded on a Danish fishery chart in 1992 within the Norfolk Boreas site, nothing has been seen in geophysical data at the location.

30. At the remaining two A3 recorded locations it is considered possible that archaeological material could still be present:
- 7181: within the Norfolk Boreas site corresponds to potential wreck remains (UKHO 11202) encountered during the drilling of a well-head; and
  - 7502: within the Norfolk Boreas site an obstruction (UKHO 64123) which was identified in 2004 in an area of sand waves and possible buried.
31. There is also potential for the presence of further maritime archaeological material to be present, associated with Unit 8, post-transgression Holocene marine sediments present across the study area. This sediment could periodically bury and expose archaeological material in areas of mobile sediment. Similarly, although there are no known aircraft crash sites within the study area, there is potential for the discovery of previously unknown aircraft material, also associated with Unit 8. Mitigation measures are detailed within section 7 and methodologies with section 9.

### 5.3 Intertidal Archaeology

32. There are 17 previously recorded heritage assets within the intertidal zone (up to MHWs) at the landfall at Happisburgh South (Figure 17.6 in Volume 2 of the ES). Sixteen of the records relate to findspots of material on the beach (positions at which finds have previously been discovered and recorded but at which material is no longer present). The final record (1045) is the site of Happisburgh Low Lighthouse, one of two lighthouses erected in Happisburgh in 1791. By 1886 it is recorded that the lighthouse had fallen into the sea although a survey in 1980 noted that remains of part of the foundations still survived *in situ* exposed in the cliff, although the majority of the remains lay on the beach or had been covered over by sand.
33. Red brick sections of masonry, assumed to be the remains of the lighthouse, were observed on the beach during a walkover carried out by Royal HaskoningDHV in November 2017. Scattered, brick, stone, breeze blocks and large flints were also observed further along the beach just to the north west of the landfall. Military features are prevalent along this stretch of coastline and the former locations of (now demolished) features such as pillboxes, Second World War coastal defences, a coastal battery and a machine gun post are recorded in the vicinity of the landfall.
34. Beneath the surface deposits, ground investigations at the landfall (detailed in Appendix 28.3 of the ES) have demonstrated the presence of till (sands, clays and gravels) relating to a large doline-type geological feature (sinkhole or solution feature). The potential for archaeological material associated with this till deposit is anticipated.

## 6 IMPACT ASSESSMENT SUMMARY

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35. Potential impacts to archaeology and cultural heritage below MHWS have been assessed as part of the ES for Norfolk Boreas. A summary of the impacts and suggested mitigation is provided in Table 6.
36. It should be noted that pre-commencement surveys and archaeological investigations and pre-commencement materials operations which involve intrusive seabed works (for example, geotechnical and environmental sampling, vessel anchoring and pre-construction trials such as jack-up trials and trenching trials) are subject to the same potential impacts as for construction. As such, in the planning and execution of intrusive, pre-commencement works, account will be taken of the embedded mitigation (Section 7.2) with specific provision for micro-siting locations where possible to avoid recommended Archaeological Exclusion Zones (AEZ)s and anomalies of possible archaeological interest and for the implementation and observation of the Protocol for Archaeological Discoveries (Section 10).

**Table 6 Summary of Potential Impacts Identified for Offshore and Intertidal Archaeology**

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
<b>Construction</b>						
Direct impact to known heritage assets	Wrecks and Anomalies (A1)	High	High	Major adverse	50m AEZs	<b>No impact</b>
	A3 wrecks	High	High	Major adverse	50m AEZs/Avoid location	<b>No impact</b>
	Additional anomalies (A2)	High	High	Major adverse	Avoid location	<b>No impact</b>
	Intertidal assets	Low	No impact	No impact	None	<b>No impact</b>
Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment	<b>Minor adverse</b>
	In-situ intertidal sites	High	Negligible	Minor adverse	Further (geoarchaeological) assessment	<b>Minor adverse</b>
	Isolated finds associated with early prehistoric activity	High	Low	Moderate adverse	Protocol to be established	<b>Minor adverse</b>
	Isolated finds	Medium	Low	Minor adverse	Protocol to be established	<b>Minor adverse</b>
Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Low to High	Negligible	Negligible to Minor	None	<b>Negligible to Minor adverse/beneficial</b>
Impacts to the setting of heritage assets and historic seascape character	Temporary changes to setting and historic seascape character from construction activities are not considered to result in harm to the significance of heritage assets within the study area.					
Impacts to site preservation conditions from drilling fluid breakout	Intertidal assets	Low	Negligible / No impact	Negligible	None	<b>Negligible</b>
<b>Operation</b>						
Direct impact to known heritage assets	As for construction					<b>No impact</b>

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment	<b>Minor adverse</b>
Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Low to High	Negligible	No impact to Negligible	None	<b>No impact to Negligible</b>
Impacts to the setting of heritage assets and historic seascape character	Changes to setting and historic seascape character during operation are not considered to result in harm to the significance of heritage assets within the study area.					
Impacts to site preservation conditions from heat loss from installed cables	Known and potential heritage assets	Low to High	No impact	No impact	None	<b>No impact</b>
<b>Decommissioning</b>						
Direct impact to known heritage assets	As for construction					<b>No impact</b>
Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	High	High	Major adverse	Further assessment	<b>Minor adverse</b>
Indirect impact to heritage assets from changes to physical processes	As for construction (or less)					<b>Negligible to Minor adverse/beneficial</b>
Impacts to the setting of heritage assets and historic seascape character	Temporary changes to setting and historic seascape character from decommissioning activities are not considered to result in harm to the significance of heritage assets within the study area.					
<b>Cumulative</b>						
Direct impact to known heritage assets	In-situ prehistoric, maritime or aviation sites	Low to High	High	Major adverse	Avoidance	<b>No impact</b>
Direct impact to potential heritage assets	In-situ prehistoric, maritime or aviation sites	Medium to High	High	Major adverse	Further assessment/reporting protocol	<b>Minor adverse (plus positive benefit from</b>

Potential Impact	Receptor	Value/Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
						<b>accumulation of data)</b>
Indirect impact to heritage assets from changes to physical processes	Known and potential heritage assets	Low to High	Negligible	No impact	None	<b>No impact</b>
Impacts to the setting of heritage assets and historic seascape character	Cumulative impacts to the setting of heritage assets and historic seascape character will occur. Whether this is considered adverse/beneficial depends upon individual perceptions of a seascape associated with offshore renewables as a negative or positive change.					
Transboundary						
Direct impact to known heritage assets	Wrecks or aircraft of non-British origin	High	High	Major adverse	Avoidance	<b>No impact</b>
Direct impact to potential heritage assets	Wrecks or aircraft of non-British origin	High	High	Major adverse	Further assessment/ reporting protocol/ consideration of legal status in country of origin	<b>Minor adverse</b>
	Prehistoric, maritime and aviation archaeological resource (across national boundaries)	Medium to High	High	Major adverse	Further assessment/ reporting protocol	<b>Minor adverse (plus positive benefit from accumulation of data)</b>
Indirect impact to heritage assets from changes to physical processes	Tidal ellipses show that all movement is in a north south direction so will not cross the international boundary and transboundary impacts will not occur.					

## 7 COMMITTED MITIGATION MEASURES

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### 7.1 Embedded Mitigation

37. In order to prevent significant impacts, the following mitigation will be embedded in the project design and will be secured through conditions set out in the DCO (and Deemed Marine Licences (DMLs)):
- 50m AEZs around the extents of known wreck sites and anomalies of archaeological interest (A1s) within which no development related activities will take place (see section 9.3);
  - 50m AEZs around the recorded point locations of previously recorded sites that have not been seen in the geophysical data (A3s) but at which archaeological material is likely to be present, possibly buried (see section 9.3);
  - Avoidance where possible of identified anomalies (A2s) by micro-siting of design;
  - Avoidance by micro-siting where possible of previously recorded sites that have not been seen in the geophysical data (A3s) and at which the presence of surviving material is considered unlikely, although it cannot be entirely discounted;
  - Further investigation of any identified anomalies (A2s) and previously recorded sites (A3s) that cannot be avoided by micro-siting of design (see section 9.6);
  - Further examination of potential prehistoric deposits including geoarchaeological recording of core samples, deposit modelling and archaeological input into any future sampling programme(s) (see section 9.5);
  - In the event of impact to potential sites, the establishment of a formal protocol to ensure that any finds are promptly reported, archaeological advice is obtained, and any recovered material is stabilised, recorded and conserved (see section 10);
  - Watching briefs where seabed material is brought to the surface, for example during pre-lay grapnel runs (see section 9.7);
  - Watching briefs for any intrusive works carried out in the intertidal landfall zone; and
  - The archaeological assessment of any further geophysical data (see section 9.3).

### 7.2 Additional Mitigation

38. Additional mitigation may be required where anomalies or AEZs cannot be avoided or where unexpected discoveries are encountered and reported through the protocol. This may include measures to further investigate the nature and extent of anomalies and/or discoveries, to establish the archaeological interest and to record them prior to removal. The methodology for such works would be set out in works package specific method statements and agreed with the Marine management



Organisation (MMO) in consultation with Historic England (or the relevant Planning Authority in consultation with the Norfolk County Council (NCC) Historic Environment Service for works above MLWS) prior to works commencing.

## 8 ROLES, RESPONSIBILITIES AND COMMUNICATION

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39. Overall responsibility for the implementation of the final Offshore WSI will lie with Norfolk Boreas Limited who will ensure that its agents and contractors are contractually bound to adhere to the terms of the final Offshore WSI and to implement the protocol for archaeological discoveries (section 10).
40. For each package of archaeological works Norfolk Boreas Limited or their agents will, as required, procure the services of specialist archaeological contractors with the requisite experience and expertise to undertake the necessary works. In addition, Norfolk Boreas Limited will retain the services of a suitably qualified and experienced archaeological contractor (the retained archaeologist) to ensure the effective implementation of the final Offshore WSI and other contractual commitments in relation to archaeology.
41. The responsibilities of a retained archaeologist include:
- Compiling, agreeing and issuing a separate, site investigation/survey specific WSI (in accordance with the details set out in the Outline Offshore WSI) in the event that the final Offshore WSI is not agreed in writing by the MMO prior to the delivery of pre-commencement surveys, investigations and material operations involving intrusive seabed works;
  - Compiling, reviewing and updating this Outline Offshore WSI following consultation with Norfolk Boreas Limited and the regulators (MMO) and curators (Historic England) post-consent to produce a final, agreed Offshore WSI;
  - Advising Norfolk Boreas Limited on their responsibilities regarding the implementation of the final Offshore WSI and the Protocol for Archaeological Discoveries;
  - Compiling, agreeing and issuing method statements for archaeological contractors to adhere to, following consultation with Norfolk Boreas Limited and the regulators and curators;
  - Advising Norfolk Boreas Limited on the necessary interaction with the regulators, curators and other third parties;
  - Procuring, monitoring the work of, and liaising with specialist archaeological contractors;
  - Monitoring the preparation and submission of archaeological reports as appropriate and making them available to the regulators and curators for review and approval; and
  - Advising Norfolk Boreas Limited on any final requirements and arrangements for further analysis, archive deposition, publication and popular dissemination.
42. All agents and contractors engaged by Norfolk Boreas Limited will:

- Familiarise themselves with the requirements of the final Offshore WSI and make it available to their staff, explaining the requirements and need for strict adherence;
  - Familiarise themselves with the protocol for archaeological discoveries (section 10) and ensure the implementation of and adherence to the protocol by staff, including ensuring staff awareness of the protocol and making staff available for training through toolbox talks, as necessary;
  - Assist and afford access to archaeological contractors as advised by Norfolk Boreas Limited and the retained archaeologist; and
  - Inform the retained archaeologist and the archaeological contractors of any environmental or health and safety constraints of which they may be aware that is relevant to the archaeologist's activities on site.
43. The specific responsibilities of specialist archaeological contractors during subsequent phases of work will be set out in separate task/work package specific method statements.
44. The regulatory body responsible for enforcing conditions specified in the DMLs is the MMO. The regulatory body responsible for enforcing the implementation of requirements within the DCO is the relevant Planning Authority in which the works are situated.
45. The MMO's statutory advisor on the marine historic environment and the archaeological curators for heritage matters offshore (below MHWS) is Historic England. The archaeological curators responsible for heritage matters onshore (above MLWS) are the archaeological advisors from the NCC Historic Environment Service and Historic England's Inspector of Ancient Monuments.
46. Prior to and during the course of any geoarchaeological recording, assessment and analysis, consultation with the Historic England Regional Science Advisor for the East of England is also recommended to agree on the suitability of the approach.

## 9 WRITTEN SCHEME OF INVESTIGATION

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47. As stated in Section 4 the methodologies presented below draw upon the Model Clauses for WSI (The Crown Estate, 2010). In order to avoid repetition, only key statements from the Model Clauses are paraphrased below. However, it is an essential requirement of this Outline Offshore WSI that all approaches presented in this document adhere to the methodologies presented in full in the Model Clauses as appropriate and relevant to Norfolk Boreas. Any adaptations and amendments to these standard approaches will require agreement with the MMO in consultation with Historic England.

### 9.1 Archaeological Recording, Reporting, Data Management and Archiving

48. With regard to survey reports, each package of works will be accompanied by written reports pursuant to the requirements of those works and demonstrating appropriate planning, recording and data management and archiving and public dissemination of results as appropriate.

49. For all aspects of recording, reporting, data management and archiving, Norfolk Boreas Limited will adhere to standards and guidance as set out in the Model Clauses document. Key points relevant to archaeological recording, reporting, data management and archiving are outlined below.

50. Once agreed, the methodology for each package of works will be set out in a method statement prepared under the requirements of the final Offshore WSI and appended to it. Each method statement (work specific WSI) will be agreed with the relevant archaeological curator prior to works commencing.

51. Each archaeological report will satisfy the method statement for the investigation and will present the project information in sufficient detail to allow interpretation without recourse to the project archive. Reports will typically include:

- A non-technical summary;
- The aims and methods of the work;
- The results of the work including finds and environmental remains;
- A statement of the potential of the results, including the identification of any limitations in the data;
- Proposals for further analysis and publication (if appropriate); and
- Illustrations and appendices to support the report.

52. Each archaeological report will be submitted in draft to the retained archaeologist for submission to Norfolk Boreas Limited. If the report is prepared by the retained archaeologist it will be submitted directly to Norfolk Boreas Limited.

53. Decisions regarding the scope of post-fieldwork assessment will be made by agreement between Norfolk Boreas Limited and the archaeological curators following submission of investigation reports and based on the possible importance of the results in terms of their contribution to archaeological knowledge, understanding or methodological development.
54. The assessment phase may include (but is not limited to) the following elements:
  - The conservation of appropriate materials, including the X-raying of metalwork;
  - The spot-dating of all pottery from any investigation. This will be corroborated by the scanning of other categories of material;
  - The preparation of site matrices with supporting lists of contexts by type, by spot-dated phase, and by structural grouping supported by appropriate scaled plans;
  - An assessment statement will be prepared for each category of material, including reference to quantity, provenance, range and variety, condition and existence of other primary sources; and
  - A statement of potential for each material category and for the data set as a whole will be prepared, including specific questions that can be answered and the potential value of the data to local, regional and national investigation priorities.
55. On the basis of post-fieldwork assessment, and as agreed by the relevant archaeological curators, mitigation requirements will be satisfied by carrying out analysis and reporting of the post-fieldwork assessment. If appropriate, this may include publication of important results in a recognised peer-reviewed journal or as a monograph.
56. On completion of archaeological works relating to construction of the scheme, an overarching report on the archaeology of the scheme will be prepared and submitted to the MMO and Historic England to a timetable to be agreed with Norfolk Boreas Limited, the regulator and the archaeological curators. The overarching report need not repeat the details contained in each preceding report, but should serve as an index to, and summary of, the archaeological investigations as a whole.
57. It is accepted practice to keep project archives, including written, drawn, photographic and artefactual elements (together with a summary of the contents of the archive) together wherever possible and to deposit them in appropriate receiving institutions once their contents are in the public domain. Archives will be developed in line with guidance including:
  - Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives (CIfA, 2014b);

- Environmental Guidelines for the Permanent Storage of Excavated Material from Archaeological Sites (Institute of Conservation, 1984); and
  - Guidelines for the preparation of excavation archives for long-term storage, (Walker, 1990).
58. The relevant archaeological curators and the archaeological contractor will agree with the receiving institution a policy for the selection, retention and disposal of excavated material, and confirm requirements in respect of the format, presentation and packaging of archive records and materials, and will notify the receiving institution in advance of any fieldwork.
59. In England, the NRHE is the repository for fieldwork records. The NRHE operates a policy for the selection of records relating to sites of national importance. Norfolk Boreas Limited or their agents will produce an OASIS form for any completed and agreed archaeological reports produced as a result of the final Offshore WSI and ensure that a copy is submitted as a PDF file to the NRHE.

## 9.2 Archaeological Samples and Artefacts

60. Environmental samples, obtained during pre-construction geotechnical surveys, that are suitable for archaeological and palaeoenvironmental assessment, will be subject to geoarchaeological assessment (see section 9.5 below).
61. Any finds encountered during activities associated with Norfolk Boreas will be treated in accordance with the relevant guidance provided in the Model Clauses (The Crown Estate 2010) and:
- Standards and guidance for the collection, documentation, conservation and research of archaeological materials (CifA, 2014c); and
  - First Aid for Underwater Finds (Robinson, 1998).
62. General specifications set out in the Model Clauses are summarised below.
63. Isolated discoveries of artefacts that may come to light during the course of the development will be dealt with through the Protocol for Archaeological Discoveries (see section 10 below).
64. With regard to archaeological works from the point of discovery, all finds will be held by the archaeological contractor in appropriate conditions pending further recording, investigation, study or conservation.
65. Recovered objects will be selected, retained or disposed of in accordance with the policy agreed with the institution receiving the archive, and in consultation with the archaeological contractors.

66. Contingency will be made for specialist advice and conservation needs on-site should unexpected, unusual or extremely fragile and delicate objects be recovered.
67. In the event that any item(s) of ordnance is discovered it should be treated with extreme care as it may not be inert. Guidelines on addressing Unexploded Ordnance (UXO) discoveries provided to contractors by Norfolk Boreas Limited must be followed prior to any recording of items for archaeological purposes.
68. If human remains are discovered an application for a licence from the Ministry of Justice under Section 25 of the Burials Act 1857 will be made by the Archaeological Contractor(s). The works will also take place in accordance with the appropriate Environmental Health regulations. With regard to the remains of crashed aircraft, the majority of aircraft wrecks are military and so fall under the legal protection of the Protection of Military Remains Act 1986. Other specific and bespoke requirements may also be required, on a case-by-case / area-by-area basis.
69. All archaeological artefacts that have come from a ship are wreck for the purposes of the Merchant Shipping Act 1995. Norfolk Boreas Limited, via their archaeological contractors, should ensure that the Receiver of Wreck is notified within 28 days of recovery, by Norfolk Boreas Limited or their agents, for all items of wreck that have been recovered.
70. All recovered materials, on land and underwater, will be subject to a conservation assessment to gauge whether special measures are required while the material is being held. This conservation assessment will be carried out by the retained archaeologist or an archaeological contractor with an appropriate level of expertise, with advice from appropriate specialists. The retained archaeologist (where appointed) or an archaeological contractor with appropriate expertise will implement recommendations arising from the conservation assessment. Where no special measures are recommended, finds will be conserved, bagged, boxed and stored in accordance with industry guidelines.

### 9.3 Archaeological Exclusion Zones

71. The principal objective of an AEZ is to prevent damage to or disturbance of a wreck, aircraft or features on the seafloor during activities that may cause direct impacts to a receptor.
72. The implementation, monitoring and modification of AEZs will take place in accordance with the measures specified in the Model Clauses.
73. AEZs preclude development activities from taking place within their boundaries, thereby avoiding significant impacts to assets contained within. The position, extent and design of an AEZ should take into account all available information including

geology, hydrology and sediment transport and should extend around the boundaries of the asset rather than around a centre-point within the site. In addition, an AEZ will incorporate a buffer in order to ensure that all material associated with that asset is encapsulated within its boundary, as well as to reduce the risk of unintentional impacts.

74. As part of the embedded mitigation for Norfolk Boreas, the size and position of AEZs agreed between Norfolk Boreas Limited and Historic England will inform the design of the wind farm and export cable route. The size and position of AEZs are currently proposed as:
- 50m AEZs around the extents of known wreck sites and anomalies of archaeological interest (A1s) within which no development related activities will take place (see section 9.3);
  - 50m AEZs around the recorded point locations of previously recorded sites that have not been seen in the geophysical data (A3s) but at which archaeological material is likely to be present, possibly buried (see section 9.3);
75. Following scheduling of the *Seagull* (70809) and *Xanthe* (70834) under the Ancient Monuments and Archaeological Areas Act 1979 as amended, subsequent to completion of the ES for Norfolk Boreas, the recommendation for AEZs for these two wrecks has now been amended (see Table 7). Rather than 50m exclusion zones around the wrecks, as required by the embedded mitigation, it is recommended that the AEZ be enlarged to correspond to the scheduled area as a minimum (100m buffer around the recorded location, see Table 7). As part of further considerations relating to post-consent survey and investigations, and the refinement of the export cable route post-consent, Norfolk Boreas Limited may elect to further enlarge the recommended AEZ to incorporate an additional buffer if possible. This may benefit the project in providing further security that the wrecks will be avoided throughout construction and operation and accidental damage will not occur.
76. AEZs have not been proposed for the A2 anomalies and two of the A3 historic records. Additional work will be required to further investigate the nature and extent of anomalies, to establish the archaeological interest and to record them prior to removal, if they cannot be avoided through micro-siting of design (see section 9.6).
77. AEZs can be reduced, enlarged or removed in agreement with the MMO in consultation with Historic England if further relevant information becomes available. Unless modified by agreement, it is important that AEZs are retained throughout the project lifetime and monitoring of AEZs may be required by the regulator and curator to ensure adherence both during construction and in the future operation of the wind farm (see section 11).



78. Norfolk Boreas Limited will ensure that details of the AEZs are supplied to all agents and contractors and will retain responsibility for ensuing adherence to the AEZs throughout the project lifespan (pre-construction, construction, operation and decommissioning).
79. There are 39 AEZs within the Norfolk Boreas red line boundary. Six of the total of 43 A1 anomalies relate to items of debris located within the AEZs already recommended for A1 wrecks. These are listed in Table 7 and illustrated in Figures 17.4 and 17.5 in Volume 2 of the ES.

**Table 7 Recommended AEZs and avoidance for A1 anomalies**

Area	WA ID	Type	Position		Recommendation
			Easting	Northing	
Norfolk Boreas site	7012	A1 Magnetic	484357	5874120	50m around point location
	7122	A1 Wreck	491727	5872289	50m around extents
	7143	A1 Wreck	492759	5861314	50m around extents
	7153	A1 Magnetic	491824	5885902	50m around point location
	7181	A3 Recorded Obstruction	495427	5869436	50m around point location
	7229	A1 Wreck	499363	5868328	50m around extents
	7237	A1 Magnetic	497859	5866964	50m around point location
	7295	A1 Magnetic	499266	5875753	50m around point location
	7395	A1 Magnetic	501554	5879165	50m around point location
	7407	A1 Magnetic	501685	5877229	50m around point location
	7409	A1 Magnetic	501698	5877152	50m around point location
	7411	A1 Magnetic	501493	5876942	50m around point location
	7413	A1 Magnetic	501800	5876555	50m around point location
	7419	A1 Wreck	504730	5875044	50m around extents
	7486	A1 Magnetic	504114	5886610	50m around point location
	7502	A3 Recorded Obstruction	506253	5880785	50m around point location
Offshore cable corridor	70360	A1 Wreck	466386	5846784	50m around extents
	70459	A1 Wreck	446041	5844450	50m around extents
	70460	A1 Debris	446039	5844401	Covered by AEZ for 70459
	70565	A1 Wreck	431217	5841986	50m around extents
	70615	A1 Magnetic	429652	5846468	50m around point location
	70617	A1 Wreck	429617	5846348	50m around extents
	70618	A1 Debris	429562	5846957	50m around point location
	70639	A1 Wreck	428802	5847632	50m around extents
	70640	A1 Debris	428758	5847714	Covered by AEZ for 70639
	70645	A1 Wreck	428283	5848091	50m around extents
	70659	A1 Wreck	426967	5850445	50m around extents
	70704	A1 Wreck	422267	5849082	50m around extents
	70709	A1 Wreck	421671	5849182	50m around extents
	70744	A1 Wreck	419288	5849507	50m around extents
70784	A1 Debris	415366	5849564	50m around point location	

Area	WA ID	Type	Position		Recommendation
			Easting	Northing	
	70785	A1 Debris field	415354	5849572	50m around extents
	70809	A1 Wreck	413550	5850143	Corresponding to scheduled area defined as 100m buffer around grid reference TG5078728343.
	70810	A1 Debris field	413518	5850156	Covered by AEZ for 70809
	70834	A1 Wreck	412105	5850354	Corresponding to scheduled area defined as 100m buffer around grid reference TG4929828452.
	70832	A1 Debris	412148	5850351	Covered by AEZ for 70834
	70833	A1 Debris	412143	5850353	Covered by AEZ for 70834
	70934	A1 Wreck	406929	5852021	50m around extents
	70954	A1 Wreck	406125	5853694	50m around extents
	70962	A1 Wreck	406058	5852977	50m around extents
	70958	A1 Debris field	406085	5852987	Covered by AEZ for 70962
Offshore cable corridor and Project interconnector search area overlap	70342	A1 Wreck	477521	5849048	50m around extents
Project interconnector search area	70021	A1 Wreck	496438	5859769	50m around extents
	70058	A1 Magnetic	494268	5856763	50m around point location
	71479	A1 Magnetic	464147	5851155	50m around point location

## 9.4 Marine Geophysical Investigations

80. The following geophysical data (sidescan sonar, multibeam bathymetry, magnetometer and sub-bottom profiler data) was archaeologically assessed by Wessex Archaeology to inform the offshore archaeology baseline assessed as part of the EIA:
- Geophysical survey data previously acquired over NV East by EMU Limited (EMU) and over the eastern end of the offshore cable corridor by Coastline Surveys Ltd in 2012;
  - Geophysical survey acquired for the project by Fugro Survey B. V. (Fugro) between September and November 2016 over NV West and the offshore cable corridor; and
  - Geophysical survey datasets acquired by Fugro within the Norfolk Boreas site between May and August 2017 and within the offshore cable corridor between September and November 2016.
81. Full technical specifications of the acquired geophysical data can be found in section 2.2 of Appendix 17.2 and section 3.3 of Appendix 17.4 to the ES and are summarised in Table 9.8 below.

Table 9.8 Summary of Acquired Geophysical Data

Survey campaign		Line spacing	Data type and resolution	Data quality*	Suitability
Norfolk Boreas, Fugro 2017	<i>Fugro Pioneer</i>	Main line spacing of 100m, with cross lines at 1,000m	Sidescan sonar (typically 125m horizontal range)	Average	Overall of good quality, some lines affected by poor weather conditions.
			Multibeam bathymetry (1m resolution)	Good	Good standard for archaeological assessment
			Magnetometer	Average	Overall of good quality for archaeological assessment, some noise due to poor weather conditions And evidence of strong background geological noise.
			Sub-bottom profiler (hull-mounted Pinger)	Good	Some slight weather effects but where large sand dunes were not present small reflectors were clearly visible and good penetration was achieved.
NV West and offshore cable corridor, Fugro 2016	<i>Fugro Pioneer</i> (NV West and offshore section of offshore cable corridor)	Main line spacing of 100m, with cross lines run every 1,000m	Sidescan sonar (typically 125m horizontal range)	Variable	Overall suitable quality to support a robust archaeological assessment
			Multibeam bathymetry (1m resolution)	Good	Good standard for archaeological assessment
			Magnetometer	Average	Affected by noise and some background variation
			Sub-bottom profiler (hull-mounted pinger)	Good	Good standard for archaeological assessment
	<i>RV Discovery</i> (mid-section of offshore cable corridor)	Line spacing ranging from 50m to 100m, depending on the area.	Sidescan sonar (typically 75m horizontal range)	Variable	Overall suitable quality to support a robust archaeological assessment
			Multibeam bathymetry (1m resolution)	Good	Good standard for archaeological assessment

Survey campaign	Line spacing	Data type and resolution	Data quality*	Suitability	
Valkyrie (inshore section of offshore cable corridor)		Magnetometer	Average	Affected by noise and some background variation	
		Sub-bottom profiler (hull-mounted pinger)	Variable	Cannot be guaranteed that all palaeogeographic features of archaeological potential have been identified	
	Line spacings ranging from 15m to 75m, depending on the area	Sidescan sonar (25m horizontal range)	Variable	Overall suitable quality to support a robust archaeological assessment	
		Multibeam bathymetry (1m resolution)	Good	Good standard for archaeological assessment	
		Magnetometer	Average	Affected by noise and some background variation	
		Sub-bottom profiler (hull-mounted pinger)	Variable	Cannot be guaranteed that all palaeogeographic features of archaeological potential have been identified	
NV East, Emu 2012	MV Aurelia	Main line spacing of 100m, with cross lines acquired every 2,000m	Sidescan sonar (75m horizontal range)	Good	Some weather noise; on the whole suitable for archaeological assessment
			Multibeam bathymetry (1m resolution)	Good	Good standard for archaeological assessment
			Magnetometer	Variable	Affected by the geological composition of the site
			Sub-bottom profiler (pinger and sparker)	Average	High degree of swell on some lines; still deemed suitable for archaeological interpretation.
Eastern end of offshore cable corridor,	MV Flatholm	Main line spacing of 100m, with cross lines	Sidescan sonar (75m horizontal range)	Good (small number of lines Variable)	On the whole suitable for archaeological assessment

Survey campaign		Line spacing	Data type and resolution	Data quality*	Suitability
Coastline Surveys Ltd 2012		acquired every 2,000m	Multibeam bathymetry (1m resolution)	Good	Good standard for archaeological assessment
			Magnetometer	Variable	Affected by the geological composition of the site
			Sub-bottom profiler (pinger and boomer)	Poor or very poor, with very few lines rated as 'Average' or 'Good'	Data affected by high degrees of swell and penetration and resolution of features is generally very low
<b>*Wessex Archaeology criteria for assigning geophysical data quality rating (Appendix 17.4, Table 4)</b>					
<b>Good</b>	Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris.				
<b>Average</b>	Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but their identification as such is likely to be difficult.				
<b>Variable</b>	This category contains datasets with the quality of individual lines ranging from good to average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified.				

82. It has been acknowledged by Norfolk Boreas Limited (see section 17.5.3 of Chapter 17) that confidence in the data assessed to date is sufficient to provide an accurate characterisation of the archaeological potential of the study area for ES purposes. The acquisition of further pre-construction data (post-consent) will provide additional information at a greater resolution within areas where construction will take place. Therefore, the archaeological assessment of any further geophysical data acquired for the project forms part of the commitment by Norfolk Boreas Limited to embedded mitigation (see section 7.1).
83. Prior to the acquisition of further survey data post-consent, it is recommended that a data review is undertaken by a suitability qualified and experienced archaeological contractor in order to qualify the continued suitability of the existing data and assessment to the project. This will include the identification of any data gaps and any further requirements to inform the acquisition of further geophysical data in the light of new information which may come to light before the start of the pre-construction phase.

84. The overarching objectives of the assessment of marine geophysical survey data are to:
- Identify known heritage assets and provide additional detail on the nature and extent of those assets;
  - Identify previously unidentified seabed features;
  - Identify buried palaeolandscape features that help to clarify the nature of the submerged prehistoric landscape; and
  - Monitor the construction and post-construction effects of Norfolk Vanguard.
85. As part of the data review, the archaeological contractor should identify specific objectives to inform the scope of further survey work. The acquisition and assessment of geophysical data (including consideration of recommended line spacings) will be carried out in accordance with good practice as set out in the Model Clauses and in industry guidelines including Plets et al (2013).
86. Historic England will be consulted on the scope of all further geophysical surveys (including pre-commencement geophysical surveys) undertaken for the project in order to ensure that the data generated are sufficiently robust to meet these archaeological objectives and to enable professional archaeological interpretation and analysis.
87. Data will be processed, assessed and interpreted by a suitably experienced and qualified archaeological contractor and integrated with the existing assessments as outlined in section 5. Data will be provided in raw format to allow the data to be processed by the archaeological contractor using appropriate software in order to facilitate archaeological assessment and interpretation. Vessel trackplots and factual reporting will also be made available to the archaeological contractor.
88. If required, a method statement will be issued by Norfolk Boreas Limited in advance of any further geophysical survey campaigns that incorporate archaeological objectives, as advised by the retained archaeologist and/or archaeological contractor. The method statement will set out the specific details of the campaign and the methodology for archaeological assessment in order to inform consultation with Historic England and to provide sufficient instruction for completion of data acquisition programmes to the highest quality standards possible. Archaeological briefings for survey staff will be carried out prior to the commencement of surveys and Norfolk Boreas Limited will be responsible for ensuring that surveys proceed in accordance with any planned method statement as agreed with the MMO in consultation with Historic England.
89. The results of further geophysical interpretation will be compiled as an archaeological report consistent with the Model Clauses on reporting and will form part of the project archive (see section 9.1).

90. The results of further geophysical interpretation will also inform requirements for further investigation (e.g. ground truthing as set out in section 9.6).
91. As part of consultation undertaken through the Evidence Plan Process (EPP) for Norfolk Boreas, Historic England have also highlighted the importance of notifying the National Maritime Information Centre (NMIC) as soon as possible following new discoveries with the aim of protecting any new wreck sites from salvage attempts. Procedures for contacting the NMIC following the identification of any new wreck sites should be made clear within agreed documentation, including method statements for the archaeological assessment of geophysical data.

## 9.5 Marine Geoarchaeological Investigations

92. Geotechnical data comprising 65 vibrocores acquired by Fugro in 2016 was geoarchaeology assessed by Wessex Archaeology to inform the seabed prehistory baseline for Norfolk Vanguard. To date, four stages of assessment have been undertaken:
  - Stage 1: Geoarchaeological review of preliminary core logs (Wessex Archaeology, 2017);
  - Stage 2: Geoarchaeological description and interpretation (Wessex Archaeology, 2018a);
  - Stage 3: Sub-sampling and palaeoenvironmental assessment (Wessex Archaeology, 2018b); and
  - Stage 4: Palaeoenvironmental assessment (Wessex Archaeology, 2019)
93. A further 61 vibrocores acquired by Fugro in 2017 from 50 locations across the Norfolk Boreas site have also been geoarchaeology assessed by Wessex Archaeology to inform the seabed prehistory baseline for Norfolk Boreas. To date, four stages of assessment have been undertaken:
  - Stage 1: Geoarchaeological review of preliminary core logs (Appendix 17.5);
  - Stage 2: Geoarchaeological description and interpretation (Appendix 17.6);
  - Stage 3: Sub-sampling and paleoenvironmental assessment (Appendix 17.7); and
  - Stage 4: Palaeoenvironmental assessment (Appendix 17.8).
94. As for the geophysical survey data, prior to the acquisition of further geotechnical data post-consent, it is recommended that a data review is undertaken by a suitability qualified and experienced archaeological contractor. As part of the review the archaeological contractor will identify any data gaps and any specific archaeological objectives to inform the acquisition of geotechnical data. This will include detail concerning proposals for further palaeoenvironmental assessment and dating in terms of what should be assessed and how this work should be carried out.



Objectives should take account of the specific research objectives identified through previous geoarchaeological assessment for both Norfolk Vanguard and Norfolk Boreas.

95. The primary aim of any geoarchaeological investigations will be the further development of a Quaternary (sedimentary) deposit model for the study area which will both inform and be expanded by subsequent phases of work. An outline deposit model has been prepared as part of the geoarchaeological assessment undertaken to date (see section 5.1).
96. Historic England will be consulted on the scope of all further geotechnical surveys and all geotechnical investigations and subsequent geoarchaeological assessment commissioned by Norfolk Boreas Limited will be undertaken in accordance with the Model Clauses (The Crown Estate, 2010) and with industry good practice as set out in:
  - Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
  - Environmental Archaeology: A Guide to the theory and practice of methods, from sampling and recovery to post-excavation (Historic England, 2011); and
  - Geoarchaeology: using earth sciences to understand the archaeological record (Historic England 2007).
97. In planning geotechnical surveys, which may be undertaken primarily to meet engineering/design objectives, in order to incorporate archaeological objectives, general provisions should include:
  - Micro-siting of borehole/vibrocore locations to avoid recommended AEZs and anomalies of possible archaeological interest, as set out in section 9.3;
  - Comparison of the proposed locations to the positions of previously identified paleogeographic features and deposits of archaeological interest and consideration given to micro-siting the proposed locations to ensure that opportunities to obtain samples to inform archaeological interpretation are not missed; and
  - Consideration given to the acquisition of a second 'archaeology only' cores at specific locations, if required, following advice from the retained archaeologist, the geoarchaeological contractor and in consultation with the Historic England.
98. During all geotechnical surveys, all operatives should observe the Protocol for Archaeological Discoveries, as set out in Section 10.
99. Norfolk Boreas Limited will procure the services of a specialist geoarchaeological contractor to undertake assessment, and, if required, palaeoenvironmental analysis and dating. Geoarchaeological assessment will also be carried out in accordance with



existing interpretations of sub-bottom profiler data assessed for Norfolk Boreas. Any further sub-bottom profiler data acquired for the project will be assessed by a suitably qualified and experienced archaeological contractor for integration with the results of the geotechnical surveys and any subsequent geoarchaeological assessment.

100. Prior to the commencement of any site investigation campaign a method statement will be issued by Norfolk Boreas Limited setting out the specific details of the campaign once the geoarchaeological requirements and locations have been established in order to inform consultation with Historic England. Archaeological briefings for survey staff will be carried out prior to the commencement of surveys and Norfolk Boreas Limited will be responsible for ensuring that surveys proceed in accordance with any planned method statement agreed with the MMO in consultation with Historic England.
101. The results of further marine geoarchaeological assessment will be compiled as an archaeological report consistent with the Model Clauses on reporting and will form part of the project archive (see section 9.1).

## 9.6 Archaeological Investigations Using Divers and/or ROVs

102. The principal objective of diver/ROV investigation will be to further establish the archaeological interest of previously unidentified seabed features seen in the geophysical data in order to inform the strategy of avoidance through revisions to the scheme design.
103. It is possible that certainty of the nature and extent of individual anomalies (A2s) may only be achieved through the use of drop down cameras or diver/ROV survey. Ground truthing may also be required in order to clarify the extent of a site in order to alter (enlarge, reduce, move or remove) AEZs (9.3).
104. All ground truthing that may be required to inform the construction of Norfolk Boreas will be carried out in accordance with good practice as set out in the Model Clauses.
105. Diver or ROV-based investigations will take place as required and, where the primary objectives are archaeological, operations will be led by archaeologists. However, it may also be possible to combine such surveys with non-archaeological objectives, for identification of UXO for example.
106. In order to maximise the potential benefits of any proposed diver or ROV surveys, Norfolk Boreas Limited will seek archaeological input at the planning stage of any such works. Any such survey specification will be informed by previous stages of the project, including the Norfolk Boreas ES and assessment of geophysical data so that

archaeological considerations can be taken into account. Following the completion of a diver/ROV survey, all data, including video footage, will be reviewed by an archaeological contractor with appropriate expertise.

107. Anomalies, as identified from the archaeological assessment of post-consent geophysical data acquisition (see section 5), will be selected for further study if they cannot be avoided through micro-siting, or where clarification is required to inform micro-siting in the final design. A detailed method statement for any archaeological works will be agreed in advance of works commencing with the MMO in consultation with Historic England.
108. The results of diver/ROV assessment will be compiled as an archaeological report consistent with the Model Clauses on reporting and will form part of the project archive (see section 9.1).
109. As stated above for marine geophysical assessments, in the event of a new discovery, it is important to notify the NMIC as soon as possible following the identification of a new wreck site in order to protect against salvage attempts. Procedures for contacting the NMIC will be agreed between the consent holder, Historic England and any other relevant competent authority following the identification of any new wreck sites, and should be made clear within agreed documentation, including method statements for archaeological investigations using divers and/or ROVs.

## 9.7 Archaeological Watching Brief

110. Due to the use of long HDD to install cables at the landfall, watching briefs within the intertidal area will not be required.
111. In the event that activities are planned which may result in archaeological material being brought to the surface, through clearance operations and pre-lay grapnel runs, for example, on board supervision by a suitably qualified and experienced archaeologist may be required.
112. The approach to any archaeological watching brief which may be required will be agreed with the MMO in consultation with Historic England. If areas subject to clearance are considered of medium or high archaeological importance, on board monitoring may be considered necessary to ensure appropriate consideration of archaeological material brought to the surface. In areas of low archaeological importance any material brought to the surface will be dealt with through the Protocol for Archaeological Discoveries (see section 10).
113. If required, the methodology for onboard watching briefs and/or monitoring will be set out in a method statement to be agreed in advance of works commencing with

the MMO in consultation with Historic England and in accordance with the Model Clauses. The detail contained within the method statement will necessarily state how any areas subject to clearance have been determined to be of low, medium or high archaeological importance.

## 10 ARCHAEOLOGICAL RECORDING PROTOCOL

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114. In order to account for unexpected discoveries of archaeological material during construction, operation and decommissioning a formal protocol will be required. It is recommended that if any objects of possible archaeological interest are encountered, that they should be reported using the established Protocol for Archaeological Discoveries: Offshore Renewables Projects (The Crown Estate, 2014) (ORPAD). This will establish whether the objects are of archaeological interest and recommend appropriate mitigation measures where necessary.
115. Activities during which previously unidentified sites or unexpected discoveries of material may be encountered include:
- Pre-construction surveys, for example:
    - Anomalies on the seabed identified by geophysical contractors;
    - Obstructions on the seabed encountered during geotechnical surveys or grab sampling;
    - archaeological material within cores or grab samples; and
    - Seabed features identified during diver or ROV surveys.
  - Seabed clearance, pre-lay grapnel runs (e.g. finds brought to the surface);
  - Vessel anchoring (e.g. anchor caught on obstruction);
  - Installation of the export cables (e.g. obstruction interactions with plough); and
  - Installation of wind turbine foundations (e.g. obstruction interactions with jack-up legs).
116. ORPAD came into effect in December 2010 and applies to pre-construction, construction and installation activities in developing offshore renewable energy schemes where an archaeologist is not present on site. The protocol allows for the effective reporting of discoveries of archaeological material in order to ensure that advice, concerning measures to address discoveries, is received, and implemented, in a timely and efficient manner.
117. Each vessel or worksite team has a Site Champion, a single person who is responsible for reporting discoveries to a Nominated Contact within the Developer's core team. The Nominated Contact uploads discoveries onto a secure web portal and the Implementation Service is alerted to the presence of new discoveries. The Crown Estate provides for the reporting and assessment of discoveries through the ORPAD Implementation Service, currently maintained by Wessex Archaeology.
118. Individual Site Champions for specific activities will be specified in work package method statements and the identity of the Site Champion will be clearly communicated to work teams, via pre-commencement briefings for example.

119. Norfolk Boreas Limited will be responsible for ensuring that teams are provided with appropriate training in the application of ORPAD and that all staff and contractors are aware of their responsibilities under the protocol. The ORPAD documentation, including a full description of the methodology and requirements for implementing the protocol, can be found via the following web link:
  - <http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects.pdf>
120. Training to construction staff, site crews and work teams with regard to the practical application of the protocol in their day to day work can be provided by the Implementation Service or by an alternative sufficiently experienced and qualified archaeological contractor. Hard copies of the ORPAD document will be made available for use on board the construction vessels.
121. Provision will be made by Norfolk Boreas Limited, in accordance with ORPAD, for the prompt reporting/recording to Historic England of archaeological remains encountered or suspected during works. If the find is a wreck within the meaning of the Merchant Shipping Act (1996) then a report will also be made to the Receiver of Wreck. If the find is treasure within the meaning of the Treasure Act (1996) then a report will also be made to the Coroner.
122. Following completion of the construction phase, a report will be prepared presenting the results of the ORPAD implementation during activities and submitted to the MMO within four months. In the event that no discoveries are made, a nil discoveries report should be compiled in order to demonstrate adherence to the scheme.

## 11 MONITORING

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123. Monitoring requirements are anticipated to comprise:
- Monitoring of the site investigation/survey specific WSI produced post-consent to inform pre-commencement design of survey programmes to ensure that the scheme of investigation is appropriate to planned phases of data acquisition;
  - Monitoring of the final Offshore WSI by the retained archaeologist in order to ensure that the scheme of investigation is appropriate to the scheme design;
  - Monitoring of archaeological works by the archaeological curators, including monitoring of the effectiveness of AEZs; and
  - Monitoring during and post construction, including a conservation programme for finds (see section 9.2).
124. The performance of the final Offshore WSI will be monitored during the course of the pre-construction phase and the contents of the final Offshore WSI will be reviewed and updated as necessary prior to construction in order to inform a construction phase document specific to the final design. Provision will also be made for the final Offshore WSI to be revised as appropriate should elements of the project change or particular archaeological issues come to light. Any revisions will be prepared by the retained archaeologist and submitted by Norfolk Boreas Limited, or their agents to the MMO for approval in consultation with Historic England.
125. All reports prepared for each package of archaeological works will be disseminated to MMO and Historic England by Norfolk Boreas Limited, or their agents, so that the results can be reviewed and any concerns addressed. All survey reports undertaken for the purposes of archaeological evaluation will be submitted to the MMO and Historic England within a specified timescale of the survey being completed to be agreed with the regulator.
126. Historic England and the MMO will be notified in advance by Norfolk Boreas Limited or their agents of the commencement of work timetables and the commencement of any work on site that may have an impact on archaeology and will be informed at this time of the name and contact details for the retained archaeologist. During any site evaluation/investigation or construction work that has the potential to impact archaeological remains the retained archaeologist may liaise directly with Historic England with regard to site monitoring and reporting only after prior reference to Norfolk Boreas Limited. Norfolk Boreas Limited will be kept informed of all contact between the retained archaeologist and the archaeological curators.
127. In order to monitor the effectiveness of AEZs, periodic archaeological reports will be prepared by Norfolk Boreas Limited, or by the retained archaeologist on behalf of Norfolk Boreas Limited, to review whether there have been any incursions into each

zone and whether there are still archaeological grounds for maintaining each zone. The frequency of such reports will be agreed with the MMO in consultation with Historic England, but may include reports at the conclusion of key construction phases and a post-construction monitoring report, including an archaeological assessment of post-construction geophysical survey data. If it becomes apparent that activities have encroached upon an AEZ, Norfolk Boreas Limited will seek advice from the retained archaeologist.

128. A post-construction monitoring report including the archaeological assessment of post-construction geophysical survey data relative to the baseline data will also assess the effects of any indirect impacts that may have occurred to heritage assets as a result of the wind farm construction. Based on the results of the initial post-construction review, any further requirements during the operation phase will be agreed in consultation with Historic England. Further monitoring may only be necessary if significant changes to coastal and/or offshore processes are identified or if new information relevant to the integrity of archaeologically important items comes to light.

## 12 REFERENCES

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