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VATTENFALL

Norfolk Boreas Offshore Wind Farm

Appendix 9.1

Water Framework Directive Compliance Assessment- Marine WFD Water Bodies

Environmental Statement

Volume 3

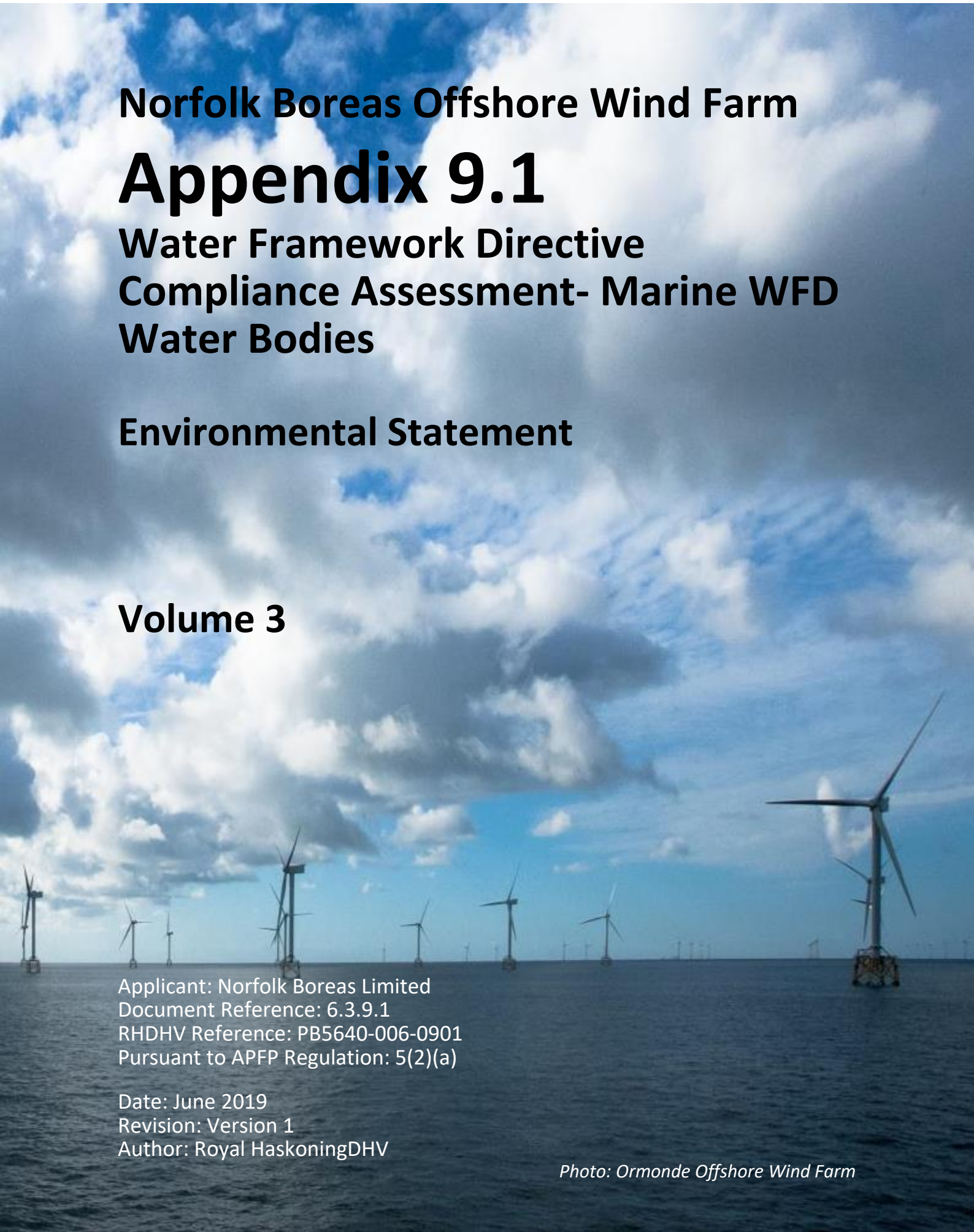

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Table of Contents

Tables

Figures

Glossary

A/HMWB	Artificial or Heavily Modified Water Body
DCLG	Department for Communities and Local Government
DCO	Development Consent Order
Defra	Department for Environment, Food & Rural Affairs
EC	European Commission
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
GEP	Good Ecological Potential
GES	Good Ecological Status
HDD	Horizontal Directional Drilling
LiDAR	Light Detection and Ranging
MCA	Maritime and Coastguard Agency
PEIR	Preliminary Environmental Information Report
PEMP	Project Environmental Management Plan
RBD	River Basin District
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SPA	Special Protection Area
UKTAG	United Kingdom Technical Advisory Group
WFD	Water Framework Directive

Terminology

Landfall	Where the offshore cables come ashore at Happisburgh South.
The Applicant	Norfolk Boreas Limited
The project	Norfolk Boreas Offshore Wind Farm, including the onshore and offshore infrastructure.
Norfolk Boreas site	The Norfolk Boreas wind farm boundary. Located offshore, this will contain all the windfarm array.
Offshore cable corridor	The corridor of seabed from the Norfolk Boreas site to the landfall site within which the offshore export cables would be located.
Offshore export cables	The cables which bring electricity from the offshore electrical platform to the landfall.
Offshore project area	The area including the Norfolk Boreas site, project interconnector search area and offshore cable corridor.
Project interconnector search area	The area within which the project interconnector cables would be installed

1 Introduction

1. This report aims to determine whether the offshore activities associated with the proposed Norfolk Boreas Offshore Wind Farm (herein referred to as 'the project') are compliant with the Directive of the European Parliament and of the Council 2000/60/EC establishing a framework for community action in the field of water policy (generally known as the Water Framework Directive (WFD)). Note that the onshore activities are considered in a separate WFD compliance Assessment found in Appendix 20.2 to Chapter 20 Water Resources and Flood Risk.

2. A brief description of the offshore project is provided in section 2 of this report. A more detailed description is provided in Chapter 5 Project Description.

3. The objectives of this compliance assessment are to:

- Identify water bodies that could potentially be affected by the offshore activities;
- Identify individual activities that could affect these WFD water bodies;
- Assess the potential for the proposed project activities to result in a deterioration in the status of WFD water bodies, or prevent status objectives being achieved in the future; and
- Determine the compliance of the offshore activities with the requirements of the WFD.

4. This report is an appendix to Chapter 9 Marine Water and Sediment Quality, and has been prepared as part of the ES.

1.1 The Water Framework Directive

1.1.1 Overview

5. The WFD was transposed into national law by means of the Water Environment (WFD) (England and Wales) Regulations 2003. These regulations have recently been updated by the Water Environment (WFD) (England and Wales) Regulations 2017. The WFD Regulations provide for the implementation of the WFD, from designation of all surface waters (rivers, lakes, transitional (estuarine) waters, coastal waters (out to 1 nautical mile) and ground waters) as water bodies, to the requirement to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP).

6. Unlike the EU Birds and Habitats Directives (EC Directive on the Conservation of Wild Birds (2009/147/EC) and EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC), respectively), which apply only to designated sites, the WFD applies to all bodies of water, including those that are man-made. The consideration of the proposals under the WFD will, therefore, apply to all water

bodies that have the potential to be impacted by any activities within the marine environment.

1.1.2 Surface waters

7. There are two separate classifications for transitional and coastal water bodies; ecological and chemical. For a water body to be in overall 'good' status, both ecological and chemical status must be at least 'good'. Ecological status is classified using information on the biological, physico-chemical and hydromorphological quality of the body of water and is assessed according to:

    - The condition of biological elements, for example fish, benthic invertebrates and other aquatic flora;
    - The condition of supporting physico-chemical elements, for example thermal conditions, salinity, and concentrations of oxygen, ammonia and nutrients;
    - Concentrations of specific pollutants, for example copper and other priority substances; and
    - The condition of the hydromorphological quality elements, including morphological condition, hydrological regime and tidal regime.

8. Ecological status is recorded on the scale of high, good, moderate, poor or bad. 'High' denotes largely undisturbed conditions and the other classes represent increasing deviation from this natural condition, otherwise described as a 'reference condition'. The ecological status classification for the water body, and the confidence in this, is determined from the worst scoring quality element. This means that the condition of a single quality element can cause a water body to fail to reach its WFD classification objectives.

9. Chemical status is assessed by compliance with environmental standards for chemicals that are listed in the EC Environmental Quality Standards Directive (2008/105/EC). These chemicals include priority substances, priority hazardous substances, and eight other pollutants carried over from the Dangerous Substance Daughter Directives. Chemical status is recorded as 'good' or 'fail'. The chemical status classification for the water body is determined by the worst scoring chemical.

10. Where the hydromorphology of a surface water body has been significantly altered for anthropogenic purposes, it can be designated as an Artificial or Heavily Modified Water Body (A/HMWB). An alternative environmental objective, Good Ecological Potential (GEP) applies in these cases.

11. HMWBs are classified according to the 'mitigation measures approach' (UKTAG, 2013). This approach first assesses whether actions to mitigate the impact of

physical modification are in place to the extent that could reasonably be expected. If this mitigation is in place, then the water body may be classified as achieving 'good' or better ecological potential. If this level of mitigation is not in place, then the water body will be classed as 'moderate' or worse ecological potential. Before an overall ecological potential classification is applied, the second step is for the results of the mitigation measures assessment to be cross-checked with data from biological and physico-chemical assessments. This approach is known as the "Alternative Approach" and is defined in more detail in the WFD Common Implementation Strategy (EC, 2004).

12. The process of classifying ecological potential is based on an assessment of:

- Whether all appropriate measures have been taken to mitigate the modified or artificial hydromorphological characteristics of the water body;
- Whether these measures are functioning; and
- Whether all non-sensitive quality elements are at good status or better.

13. Where the Environment Agency has data for biological quality elements that show signs of damage from pressures other than hydromorphological alterations (for example, if the benthic invertebrate status is poor because of nutrient pressures) the ecological potential will be changed. To reflect this other pressure the water body will be labelled as having 'Poor Ecological Potential'. This is also true where data are available for physico-chemical quality elements.

14. In addition, some surface waters require special protection under other European legislation. The WFD therefore brings together the planning processes of a range of other European Directives, such as the revised Bathing Waters Directive (2006/44/EC) and the Habitats Directive. These Directives establish protected areas to manage water, nutrients, chemicals, economically significant species and wildlife, and have been brought in line with the planning timescales of the WFD.

1.2 Roles and Responsibilities

15. The Environment Agency is the competent authority for WFD implementation in England, and therefore must assess schemes to ensure that they are compliant with the requirements of the WFD. The Environment Agency also acts as a consultee to other regulators and bodies in relation to WFD compliance and therefore will advise the organisations involved in consenting the project on the requirements of the WFD.

16. Whilst the Environment Agency acknowledges that assessing schemes for WFD compliance is best aligned with the steps of an Environmental Impact Assessment (EIA), they recommend that a separate WFD compliance assessment is undertaken by the applicant to ensure all aspects of WFD are clearly and overtly considered.

1.3 Report Structure

17. This report is divided into seven sections:

- Section 1 (this section) describes the purpose of this report.
- Section 2 presents the background to the project and provides a brief overview of the project.
- Section 3 presents the WFD compliance assessment methodology that is used in this report.
- Section 4 presents the results of the screening exercise undertaken for Stage 1 of the WFD compliance assessment.
- Section 5 presents the results of the scoping exercise undertaken for Stage 2 of the WFD compliance assessment.
- Section 6 presents the results of the detailed assessment undertaken for Stage 3 of the WFD compliance assessment.
- Section 7 presents a summary of mitigation, improvements and monitoring.

2 Project description

18. As outlined in Chapter 1 Introduction and Chapter 5 Project Description, the Norfolk Boreas site comprises of a 725km^2 area located approximately 73km from the Norfolk coastline within which wind turbines will be located. The offshore wind farm will be connected to the shore by offshore export cables installed within the offshore cable corridor. The project will have a maximum export capacity of 1,800MW.

19. The key offshore components of the project would comprise:

- Offshore wind turbines and their associated foundations;
- Scour protection around foundations as required;
- Offshore electrical platforms supporting required electrical equipment, and possibly incorporating offshore facilities (e.g. accommodation).
- An offshore service platform may be installed to house workers offshore and provide helicopter refuelling facilities as required;
- Subsea cables;
    - Array cables: These cables connect wind turbines with each other and with the offshore electrical platforms;
    - Interconnector cables: Interconnections between the offshore electrical platforms within the Norfolk Boreas site;
    - Project interconnectors: Interconnections between and offshore electrical platform or turbines within the Norfolk Boreas site and an electrical platform within one of the Norfolk Vanguard OWF sites;
    - Offshore export cables: The cables that join the offshore electrical platforms with the landfall area;

- Cable protection on subsea cables as required; and
- Fibre optic cables which may be buried along with some or all of the electrical cables.

- Meteorological masts (met masts) and their associated foundations for monitoring wind speeds during the operational phase (additional to existing met masts within the former East Anglia Zone);
- Monitoring equipment including Light Detection and Ranging (LiDAR) and wave buoys; and
- A number of Navigational buoys around the Norfolk Boreas site which will be determined in consultation with the Maritime and Coastguard Agency (MCA) and Trinity House.

20. The landfall works would comprise:

- Up to two ducts installed under the cliff by Horizontal Directional Drilling (HDD). An additional drill is included in the impact assessment worst case scenarios where applicable, to provide a contingency in the unlikely event of a HDD failure; and
- Up to two onshore transition pits to house the connection between the offshore cables and the onshore cables.

21. For further details on any of the key components of the project please refer to Chapter 5 Project description.

22. As can be seen in Figure 1 the array is not located within or near to a WFD water body. Additionally, in relation to any sediment plumes potentially reaching the coast, information presented in Chapter 9 Marine Water and Sediment Quality (section 9.7.3.1) indicates that due to regional sediment transport directions sediment will be directed along a north-south axis with no east to west component. As a result, there is no pathway for suspended sediment to reach the East Anglian coast and therefore to WFD water bodies within the 1nm boundary. As a result, the only activities relevant to the WFD assessment include the construction and operational aspects of landfall and the offshore export cables (see Figure 1 for locations of these within the WFD water body) and decommissioning where works could be required within the WFD water body.

2.1 Construction

2.1.1 Offshore Export Cable and Landfall

2.1.1.1 Pre-installation works

23. A pre-lay grapnel run would be undertaken to clear any identified debris in advance of any cable installation during each phase. The maximum width of seabed disturbance along the pre- lay grapnel run would be 20m. This is encompassed by

the maximum footprint of cable installation works associated with ploughing (30m disturbance width). For other areas of the export cable corridor, outside of the WFD water body, pre-sweeping may be required.

2.1.1.2 Installation and burial

24. Following the pre-installation works described above, the cables would be installed and buried. The following methods may be used for cable burial and would be dependent on the results of the pre-construction survey and post-consent procurement of the cable installation contractor:

- Ploughing (worst-case scenario with a trench width of 10m and disturbance width of 30m);
- Trenching or cutting; or
- Jetting.

25. The length of the offshore export cables within the Norfolk East water body would be approximately 2 to 6km and there would be a maximum of two cable trenches. Given that pre-sweeping in this area is not anticipated, the worst case footprint would be associated with trenching and would be up to 0.36km^2 (based on a worst case scenario of two trenches of up to 6km within the water body and a disturbance width of 30m).

26. In some cases, normal subsea installation methods cannot be applied and it is necessary to use alternative methods to provide an adequate degree of protection for the cable. Within the nearshore area, cables would be buried to 3m where possible, minimising the requirement for cable protection measures and thus effects on sediment transport. Therefore, it is only expected to be used at the Horizontal Directional Drilling (HDD) exit point (see section 2.1.1.3 below for landfall details). Potential cable protection options include:

- Rock placement - this involves the laying of rocks on top of the cable to provide protection which is effective on crossings and other areas requiring protection.
- Concrete mattresses - these are prefabricated flexible concrete coverings that are laid on top of the cable, are an alternative to rock placement. The placement of mattresses is slow and as such is only be used for short spans. Grout or sand bags may be used as an alternative to concrete mattressing; this method is generally applied on smaller scale applications than concrete mattressing.
- Frond mattresses - this can be used to provide protection by stimulating the settlement of sediment over the cable. This method develops a sandbank over time protecting the cable but is only suitable in certain water conditions. This method may be used in close proximity to offshore structures though experience has shown that storms can strip deposited materials from the frond.

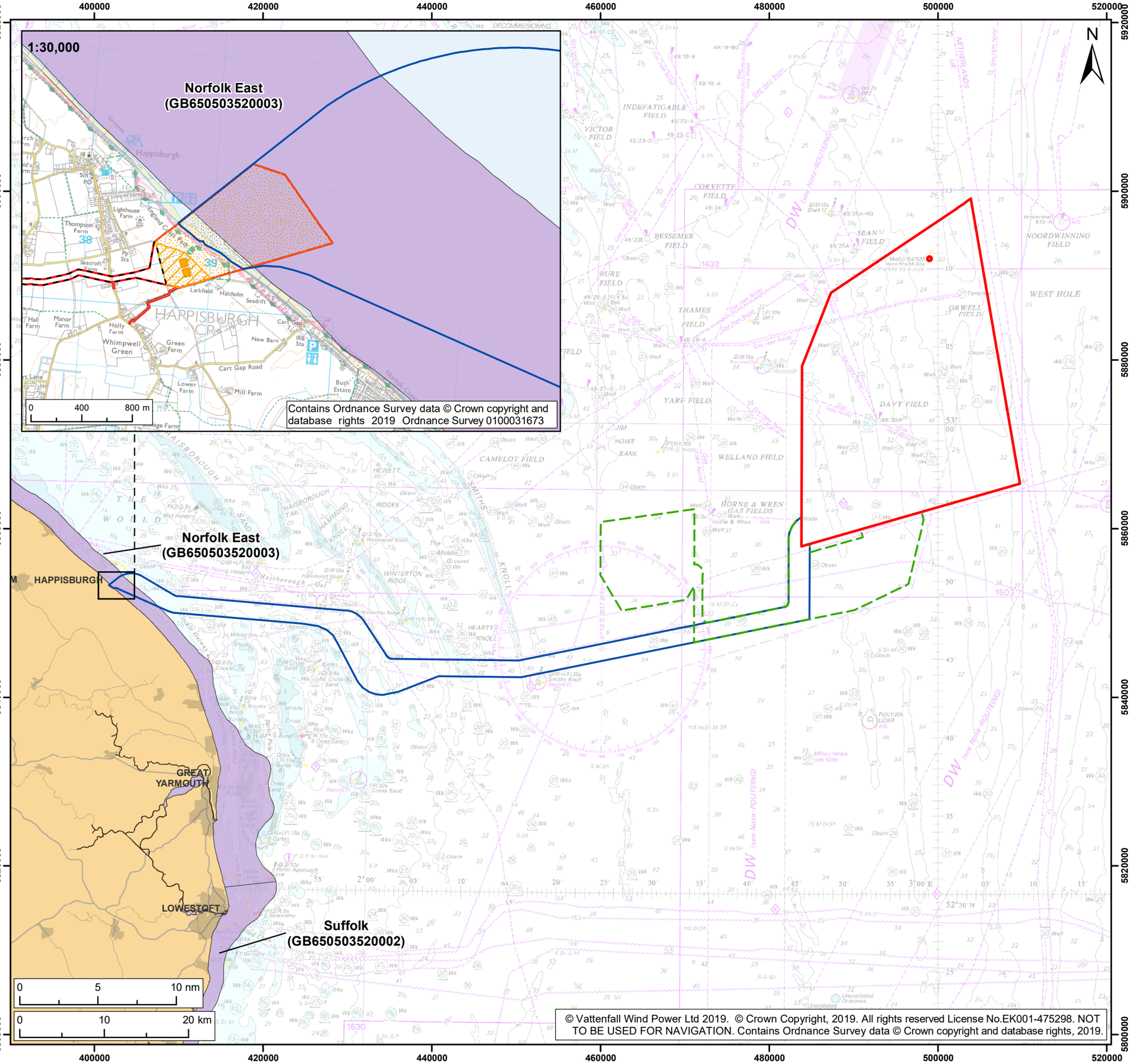
27. Based on the slowest rate of installation and the length of cable in the WFD water body, it is anticipated that the cable installation works will take approximately two months in total to complete the installation of up to four cables (laid as pairs in two trenches) within the WFD water body. Cable installation may be undertaken in one or two phases in line with the build out programme adopted for the offshore wind farm.

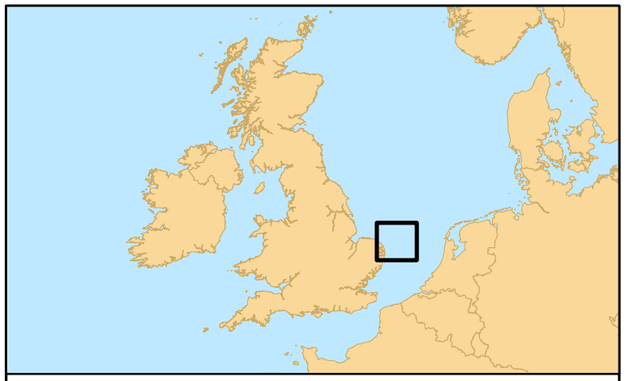
2.1.1.3 Landfall

28. The export cable would make landfall at Happisburgh South using long HDD and duct installation, with cable burial on the seaward side of the drilling exit point. The landfall ducts will exit in the subtidal zone beyond -5.5m LAT but within 1km of the onshore drilling location. Drilling fluid (a combination of water and natural clays such as bentonite) will be employed to lubricate the drilling process and cool the drill head. Fluid pressures will be monitored throughout the process to minimise the potential for breakout of the drilling fluid and an action plan will be developed and procedures adopted during the drilling activity to respond to any drilling fluid breakout.

29. Once the cable is pulled through the landfall ducts, the exposed offshore end is allowed to sink to the seabed and subsequently buried (e.g. using a back-hoe excavator) seaward of the HDD exit point. The trench would then be backfilled using the excavated material.

30. Figure 1 shows the outline area in which the landfall will be sited. However, the effects of landfall construction will occur over a significantly smaller area than that shown in the figure. The parameters for assessment are included within the figures and timescales provide for export cable installation and burial above.





Legend:

- Norfolk Boreas site
- Offshore cable corridor
- Project interconnector search area
- WFD coastal water bodies[1]

Norfolk Boreas onshore project infrastructure (see inset map)

- Norfolk Boreas onshore red line boundary
- Landfall zone
- Landfall compound zone
- Indicative landfall compound
- Onshore cable route
- Operational access

Note: WFD = Water Framework Directive
[1] Environment Agency, 2017.

Project:	Report:
Norfolk Boreas	Water Framework Directive Compliance Assessment: Marine WFD Water Bodies

Title:

Offshore cable corridor and landfall within the WFD water body

Figure: 1 | Drawing No: PB5640-006-0901-001

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: ETRS 1989 UTM Zone 31N **EPSG:** 25831

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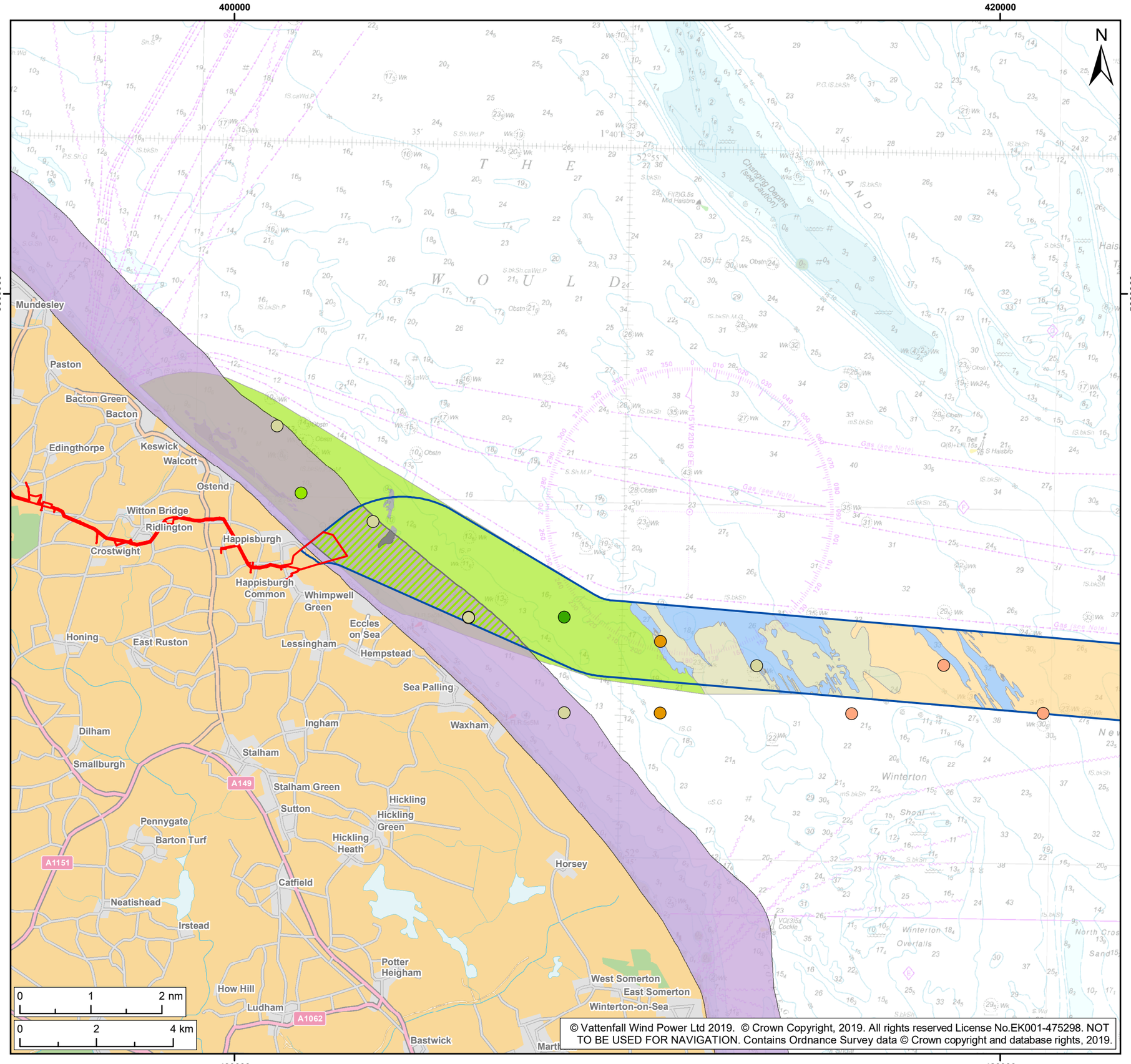

Legend:

- Norfolk Boreas onshore red line boundary
- Offshore cable corridor
- Norfolk East coastal water body[1]

Biotope[2]

- SS.SCS.CCS
- SS.SCS.CCS.Med LumVen
- SS.SCS.CCS.Pken
- SS.SMX.CMx
- SS.SMX.CMx - SS.SBR.PoR.SspiMx - med reef
- No Data

Biotope interpretation[2]

- SS.SCS.CCS
- Potential SS.SCS.CCS.Med LumVen
- SS.SMx.CMx
- Potential SS.SBR.PoR.SspiMx
- Nearshore pitted seafloor
- Outcrop

Area of Biotope interpretation within Norfolk East coastal water body[2]

- SS.SMx.CMx (5.5km²)
- Outcrop (0.1km²)

[1] Environment Agency, 2017.
[2] Fugro Survey B.V, 2016.

Project:	Report:
Norfolk Boreas	Water Framework Directive Compliance Assessment: Marine WFD Water Bodies

Title:

Habitats within the offshore cable corridor and landfall

Figure: 2 | Drawing No: PB5640-006-0901-002

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Co-ordinate system: ETRS 1989 UTM Zone 31N **EPSG:** 25831

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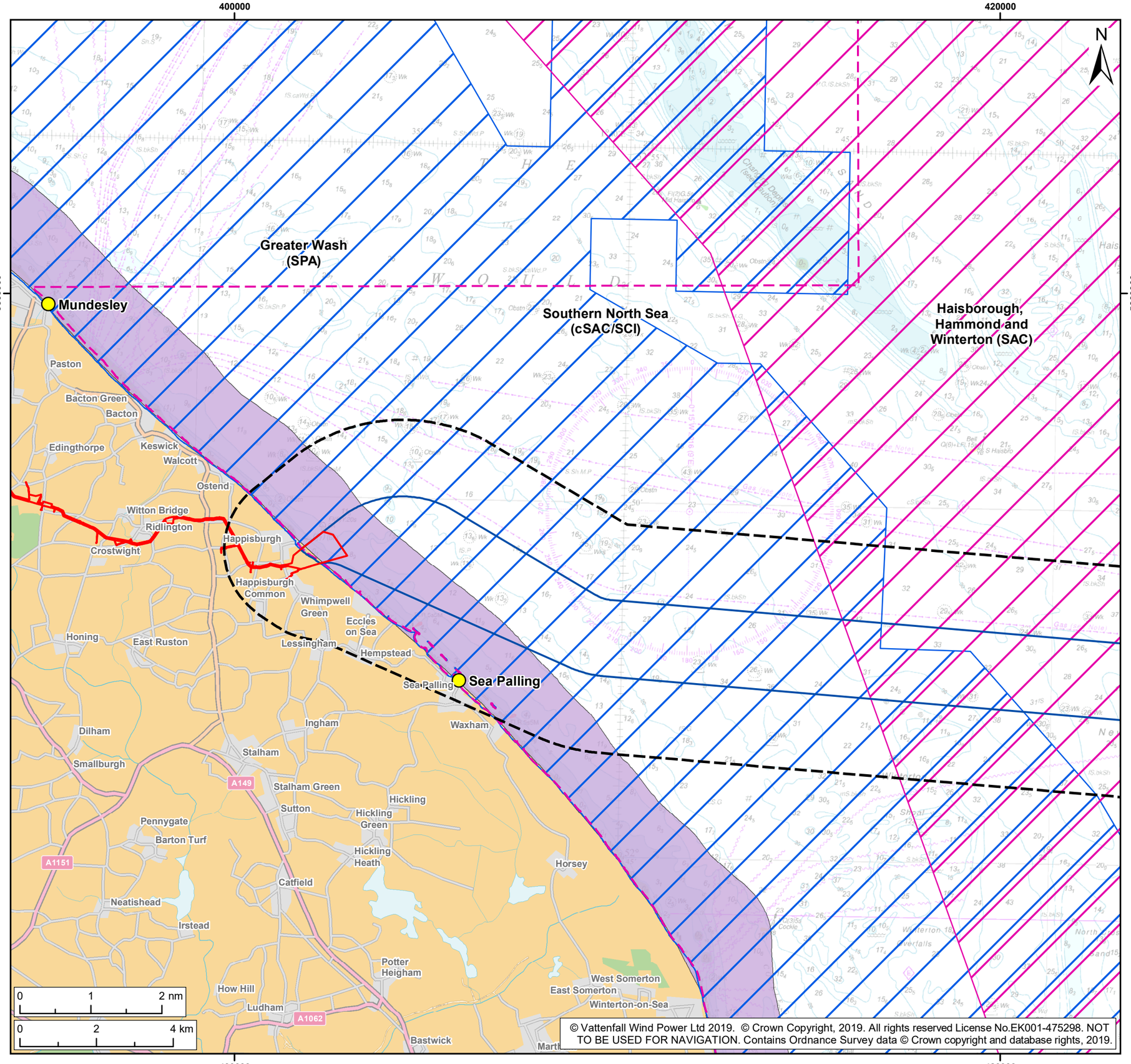

Legend:

- Norfolk Boreas onshore red line boundary
- Offshore cable corridor
- 2km buffer zone
- Bathing Water monitoring location[1]
- Norfolk East coastal water body[2]
- Special Protection Area (SPA)[3]
- Special Area of Conservation (SAC)[3]
- Canditate Special Area of Conservation (cSAC)/Site of Community Importance (SCI)[3]

[1] Environment Agency, 2018.
[2] Environment Agency, 2017.
[3] Natural England/JNCC, 2018.

Project:	Report:
Norfolk Boreas	Water Framework Directive Compliance Assessment: Marine WFD Water Bodies

Title:

Offshore cable corridor in relation to WFD water bodies and other designated sites

Figure:	Drawing No:
3	PB5640-006-0901-003

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: ETRS 1989 UTM Zone 31N **EPSG:** 25831

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2.2 Operation and maintenance phase

2.2.1 Presence of cable protection

31. As outlined above, cable protection is only anticipated to be required at the HDD exit point. Here one mattress (6m length x 3m width x 0.3m height) plus rock dumping (5m length x 5m width x 0.5m height) at each exit point for the two cable pairs is anticipated. This equates to an area of 36m^2.

2.2.2 Maintenance activities

32. Maintenance activities required throughout the operational period will be subject to individual WFD compliance assessments as the need arises and therefore are not considered further here.

2.3 Decommissioning phase

33. The scope of the decommissioning works would be determined by the relevant legislation and guidance at the time of decommissioning and would most likely involve the accessible installed components. Within the WFD water body this is likely to include removal of some or all of offshore export cables. Cable protection would likely be left in-situ.

34. The decommissioning methodology cannot be finalised until immediately prior to decommissioning and given that the likely effects will be within the scale anticipated for construction, decommissioning is not considered further within this assessment.

3 Assessment Method

35. This section sets out the approach for each of the key stages in the WFD compliance assessment process for the WFD compliance assessment. For each stage, a description of the procedure is provided, together with initial, relevant information that may facilitate decision-making at this early stage of the process.

3.1 The Approach to Assessing WFD Compliance

36. This assessment has been carried out in line with the 'Clearing the Waters for All' guidance (Environment Agency, 2016a) found at: https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters and takes into account Advice Note 18: The WFD (Planning Inspectorate, 2017), which provides an overview of the WFD and provides an outline methodology for considering WFD as part of the DCO process.

37. The assessment process therefore follows the following three stages:

- Stage 1: Screening;

- Stage 2: Scoping; and
- Stage 3: Detailed compliance assessment.

38. These stages are described in more detail in Table 3.1.

Table 3.1 Stages and descriptions of the WFD compliance assessment

Stage 1	Screening	Initial screening to identify relevant water bodies in the study area. Water bodies will be selected for inclusion in the early stages of the compliance assessment using the following criteria, with reference to the 2015 Anglian River Basin Management Plan (RBMP) (as presented in the online Catchment Data Explorer)
Stage 2	Scoping	Identifies whether there is potential for deterioration in water body status or failure to comply with WFD objectives for any of the water bodies identified in Stage 1. This stage considers potential non-temporary impacts and impacts on critical or sensitive habitats. This scoping assessment is undertaken separately for each water body and each activity and adheres to the scoping questions detailed within the Environment Agency's Guidance Clearing the Waters For All (2016a). In all cases, the water body and activity under assessment will be progressed to further assessment (Stage 3) if the answer to one or more of the scoping questions is 'Yes', but only for those quality elements that could potentially be impacted. Conversely, if the answer to a scoping question is 'No' or enough information can be provided at this stage to scope the issue out, the quality element is scoped out of further assessment. Note that activities will only be scoped out if there is clear, definitive evidence that they will not adversely affect a particular quality element.
Stage 3	Further assessment	The Stage 3 assessment determines whether the activities and/or project components that have been put forward from the Stage 2 scoping assessment will cause deterioration and whether this deterioration will have a significant non-temporary effect on the status of one or more WFD quality elements at water body level. For priority substances, the process requires the assessment to consider whether the activity is likely to cause the quality element to achieve good chemical status. If it is established that an activity and/or project component is likely to affect status at water body level (that is, by causing deterioration in status or by preventing achievement of WFD objectives and the implementation of mitigation measures for HMWBs), or that an opportunity may exist to contribute to improving status at a water body level, potential measures to avoid the effect or achieve improvement must be investigated. This stage considers such measures and, where necessary, evaluates them in terms of cost and proportionality. Note that this stage is referred to as a WFD Impact Assessment in the Planning Inspectorate (2017) guidance.

39. In the unlikely event that no suitable measures can be identified to mitigate the potential adverse impacts of the project, it may be necessary to undertake an Article 4.7 assessment (noting that the overall ethos of the project is to prevent deterioration in water body status and avoid the need for an application for an exemption under Article 4.7 of the WFD). To determine the scope of this assessment, consultation with the Environment Agency will be required and will include:

- An assessment of whether the project can be classified as being of imperative overriding public interest and if the benefits to society resulting from the project outweigh the local benefits of WFD implementation;
- An assessment of whether all practicable steps to avoid adverse impacts have been taken. These steps are defined as those that are technically feasible, not disproportionately costly, and compatible with the overall requirements of the project; and
- An assessment of whether the project can be delivered by an alternative, environmentally better option. This option will need to be technically feasible and not disproportionately costly to be feasible.

3.1.1 Determination of deterioration

40. Any deterioration identified must be considered within the context of the water body, in terms of the scale and magnitude of the impact as well as the timescales over which the impact would occur.

41. There is currently no guidance from the Environment Agency on how deterioration in the status of water bodies should be assessed. Expert judgement based on the information provided in the appropriate technical chapters of the Environmental Statement (ES) (including Chapter 8 Marine Physical Processes, Chapter 9 Marine Water and Sediment Quality, Chapter 10 Benthic and Intertidal Ecology and Chapter 11 Fish and Shellfish Ecology) will therefore be used to determine whether any deterioration could occur.

42. Since the Environment Agency's policy of no deterioration applies to WFD compliance assessments, it is important to consider all levels of deterioration from short term impacts to potentially long term changes to water body status classifications. The assessment will therefore consider the potential for between class, within class and temporary deterioration in water body status. Where deterioration is not predicted, the activity will also be considered against the water body objectives to ensure status objectives (i.e. GES or GEP) will not be prevented.

3.2 Consultation

43. To date, consultation regarding topics relevant to the WFD Compliance assessment has been conducted through the Scoping process (Royal HaskoningDHV, 2017), the publication of the Preliminary Environmental Information Report (PEIR) and through the Evidence Plan Process (EPP) which has consisted of Expert Topic Group meetings (ETGs) (an explanation of the ETGs and EPP is provided in Chapter 7 Technical Consultation). No specific issues regarding the WFD Compliance Assessment were raised through these processes.

4 Stage 1: Screening

4.1 Purpose of this Section

44. This section describes the baseline characteristics of the WFD water body against which potential impacts on WFD compliance will be assessed. The section also identifies the individual activities that could potentially impact on WFD compliance parameters.

4.2 Identification of Water Bodies

45. As shown on Figure 1 the marine WFD water body within which some construction activities would occur is the Norfolk East Coastal Water body (GB650503520003).

46. Data for assessment for this water body was obtained from the second River Basin Management Plan status objectives published by the Environment Agency in February 2016, as presented in the online Catchment Data Explorer and the 'Cycle 2 Extended Water Body Summary Report' produced for each water body by the Environment Agency (Environment Agency, 2016b) and is presented in Table 4.1. Figure 2 shows the habitats present within the vicinity of the activities under consideration and Figure 3 shows Protected Areas within 2km of the proposed activities.

Table 4.1 Summary of information in relation to the Norfolk East Coastal WFD water body

Parameter	Detail
WFD water body name	Norfolk East
Water body ID	GB650503520003
River basin district name	Anglian
Water body type (estuarine or coastal)	Coastal
Water body total area (km^2)	211.1677
Overall water body status (2015)	Moderate
Ecological status	Moderate
Chemical status	Good
Target water body status and deadline	Moderate by 2015
Hydromorphology status of water body	Not assessed
Heavily modified water body and for what use	Yes heavily modified. Coastal Protection and Flood Protection
Higher sensitivity habitats	Chalk reef (2893.73ha), Polychaete reef (40.09ha). See Figure 2 for habitats

Parameter	Detail
present	within the vicinity of the activities
Lower sensitivity habitats present	Cobbles, gravel and shingle (12971.88ha), Intertidal soft sediment (718.96ha), Subtidal rocky reef (2019.66ha), Subtidal soft sediments (7840.13ha). See Figure 2 for habitats within the vicinity of the activities
Phytoplankton status	Good
History of harmful algae	Not monitored
WFD protected areas within 2km	See Figure 3. It can be seen that the cable corridor is within 2km of the bathing water Sea Palling but the landfall is greater than 3km away. There are also several European Designated Sites within the 2km buffer. These are not however considered further within this assessment as they will be considered within the Habitats Regulations Assessment which will be submitted as part of the DCO application, planned for June 2019.

4.3 Identification of activities to be considered

4.3.1 Control Measures

47. In a WFD context, the term 'mitigation measures' is used specifically to refer to measures identified by the Environment Agency in the RBMPs to address pressures in A/HMWBs. The term "control measures" is therefore used in this assessment to refer to additional measures used to mitigate the impacts of the project. These control measures are analogous to the 'mitigation measures' referred to in the ES.

48. Norfolk Boreas Limited is committed to the use of best practice techniques and due diligence regarding the potential for pollution throughout all construction, operation and maintenance, and decommissioning activities through development of a Project Environmental Management Plan (PEMP) (and outline of which is submitted as document 8.14 of this application). Given the commitment to the PEMP, no further consideration is given to accidental leaks or spills within this assessment. Identified activities for consideration.

49. Table 4.2 summaries the activities screened in and the potential risks to WFD compliance parameters.

Table 4.2 Summary of activities for consideration and WFD parameters at risk

Phase	Activity	Detail	WFD compliance parameter potentially at risk
Construction	Landfall and offshore export cable installation	Potential temporary impact associated with resuspension of sediment as a result of ploughing and jetting activities	Physico-chemistry and biology (habitats and fish).
Operation	Presence of offshore	Potential hydrodynamic impacts associated with the presence of the	Hydromorphology and biology (habitats)

Phase	Activity	Detail	WFD compliance parameter potentially at risk
	cable protection	offshore cable protection. Potential loss of marine habitat associated with the presence of the offshore cable.	

5 Stage 2: Scoping

5.1 Purpose of this Section

This section presents the scoping assessment undertaken on the WFD coastal water body identified in section 4.2 of this report. The assessment has been split into the construction phase (Table 5.1) and operational phase (Table 5.2).

Table 5.1 Outcome of scoping exercise for construction activities; Landfall and offshore export cable installation

WFD Parameter	Scoping question	Yes	No	Notes
Hydromorphology	Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status		✓	The water body is not at high status.
	Could significantly impact the hydromorphology of any water body		✓	No. The activity will have a small localised temporary effect with no risk to hydromorphology
	Is in a water body that is heavily modified for the same use as your activity		✓	No – the water body is heavily modified for coastal and flood protection.
Biology (Habitats)	Is the footprint of the activity 0.5km^2 or larger	✓(export cable installation only)		The offshore cable corridor covers an area of approximately 6.5km^2. However, the actual cable installation area will be much smaller once the route within the corridor is determined (worst case 0.36km^2). Using the dredge area calculation of multiplying the dredge area by 1.5, the activity could be greater than 0.5km^2
	Is the area of either activity greater than 1% or more of the water body's area		✓	Area of WFD water body is 211.1677km^2. Area of offshore export cable installation is 0.36km^2. Using the dredge area calculation of multiplying the area by 1.5, this equates to 0.25% of the water body. The activity would not be greater than 1% of the total water body area
	Within 500m of any higher sensitivity habitat		✓	The habitats within the areas are an outcrop which is considered to be closest to rocky reef and biotope SS.SMx.CMx Circalittoral mixed sediment which is considered to be closest to cobbles, gravel and shingle. These habitats are not considered to be higher sensitivity habitats according to the guidance (Environment Agency, 2016a). The activity is not within 500m of a higher sensitive habitat.
	1% or more of any lower sensitivity habitat		✓	The offshore export cable corridor includes two habitats: an outcrop which is considered to be closest to rocky reef and biotope SS.SMx.CMx Circalittoral mixed sediment which is considered to be closest to cobbles, gravel and shingle listed in the WFD guidance (Environment Agency, 2016a). 129.7188km^2 of this habitat is considered to be present within the WFD water body. Given that the total area of disturbance is 0.36km^2 the percentage

WFD Parameter	Scoping question	Yes	No	Notes
				impacted equates to 0.41% of the cobble and shingle habitat. Regarding the rocky reef habitat, the cable corridor only passes through a very small area. Given that the total area of this habitat is 20.1966km^2 of the WFD water body, the disturbance of this very small area is unlikely to be the equivalent of 1%. The activity would not impact on 1% or more of the lower sensitivity habitat.
Biology (Fish)	Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary		✓	There could be a temporary effect associated with resuspension of sediment but since the activity will be short-lived, this effect will not last longer than several hours after cessation of the cable burial. Chapter 8 Marine Geology, Oceanography and Physical Processes considers the output of previous modelling studies and summaries the conclusions as follows: a. Sand-sized material (which represents the majority of the disturbed sediment) would settle out of suspension within less than 1km from the point of installation within the export cable corridor and persist in the water column for less than a few tens of minutes. b. Mud-sized material (which represents only a very small proportion of the disturbed sediment) would be advected a greater distance and persist in the water column for hours to a few days. c. In shallow water depths nearer to shore (less than 5m LAT) the potential for dispersion is more limited and therefore the concentrations are likely to be greater, approaching 400mg/l at their peak. However, these plumes would be localised to within less than 1km of the location of installation and would persist for no longer than a few hours. e. After 180 hours following cessation of installation activities any plume would have been fully dispersed.
	Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)		✓	The area of construction work within the water body would be small scale (worst case 0.36km^2) and would occur in an open area of coastline, therefore the would not create a physical barrier. Noise impacts of the project on fish have been assessed in Chapter 11 Fish and Shellfish Ecology. Modelling of underwater noise as a result of piling indicates that impacts would not be experienced by fish within the water body (Figures

WFD Parameter	Scoping question	Yes	No	Notes
				11.21 to 11.30) and fish would need to be within 50m of trenching to be affected by noise created by that activity (Appendix 5.4) Chapter 9 Marine Sediment and Water Quality concludes that the project would have minimal impact on water and sediment quality and therefore the project would not affect fish behaviour through changes in water chemistry. Chapter 8 Marine Geology, Oceanography and Physical processes concludes that there would be no change to seabed morphology as a result of cable installation and therefore the depth would not change nor the flow.
	Could cause entrainment or impingement of fish		✓	No risk
Water Quality	Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)		✓	See summary of conclusions outlined under Fish above
	Is in a water body with a phytoplankton status of moderate, poor or bad		✓	No-status is good
	Is in a water body with a history of harmful algae		✓	No
	Does the activity use or release chemicals? If so are they on the Environmental Quality Standards Directive (EQSD) list		✓	No chemicals to be released during either activity
	Will the activity disturb sediment with contaminants above Cefas Action Level 1		✓	A benthic ecology site characterisation survey was conducted by Fugro between 30 October and 10 November 2016 for the purposes of assessing the cable route sediments as part of the Norfolk Vanguard site characterisation report (Fugro, 2018). This took sediment samples from the offshore cable corridor to determine the potential risk of sediment contamination (note the cable corridor for Boreas is the same). The data is presented in Chapter 9 Marine Sediment and Water Quality and illustrates that sediment

WFD Parameter	Scoping question	Yes	No	Notes
				contamination within the offshore cable corridor is low (i.e. below Cefas Action Level 1). As a result, impacts on chemical contaminant concentrations in the water are not anticipated.
Protected areas	Is the activity within 2km of any WFD protected area		✓	**Landfall** There are no protected areas within 2km of landfall **Offshore export cable installation** Sea Palling designated bathing water is located within 2km of the offshore cable corridor – see Figure 3. However, the potential effects on designated bathing waters have been considered as part of the ES – See Chapter 9: Marine Sediment and Water Quality which concluded there are unlikely to be any significant effects on this bathing water. European Designated Sites will be considered within the HRA which will be submitted as part of the DCO application planned for June 2019. Therefore, they are not considered further here.
Invasive non-native species	Could the activity introduce or spread INNS		✓	The risks of introducing invasive species and proposed mitigation measures have been assessed within Chapter 10 Benthic and Intertidal Ecology of the ES. With mitigation measures in place, this risk is considered to be low.

Table 5.2 Outcome of scoping exercise for the operational activity: Presence of cable protection

WFD Parameter	Scoping question	Yes	No	Notes
Hydromorphology	Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status		✓	The water body is not at high status.
	Could significantly impact the hydromorphology of any water body		✓	The cable protection requirements within the WFD water body are over a very small area, associated with cable interface with the mouth of the landfall duct. Any changes to hydromorphology will therefore be very small and localised to the location of the protection.

WFD Parameter	Scoping question	Yes	No	Notes
	Is in a water body that is heavily modified for the same use as your activity		✓	No – the water body is heavily modified for coastal and flood protection.
Biology (Habitats)	Is the footprint of the activity 0.5km^2 or larger		✓	The footprint of the activity is 36m^2 so would not be greater than 0.5km^2
	Is the area of either activity greater than 1% or more of the water body's area		✓	The footprint of the activity is 36m^2. It would therefore not be greater than 1% of the total water body area
	Within 500m of any higher sensitivity habitat		✓	Potential cable protected sites are not located within 500m of a higher sensitivity habitat (see comments in Table 5.1 above).
	1% or more of any lower sensitivity habitat		✓	No, the area to be affected is very small (36m^2) and therefore unlikely to represent 1% of more of the habitat in the water body in which it is located.
Biology (Fish)	Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary		✓	No – there is no pathway for effect
	Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)		✓	No – the works will cover a very small area and therefore are unlikely to impact on fish behaviour
	Could cause entrainment or impingement of fish		✓	No- pathway for effect not identified
Water Quality	Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)		✓	No – the presence of cable protection will not impact on water quality
	Is in a water body with a phytoplankton status of moderate, poor or bad		✓	No-status is good
	Is in a water body with a history of harmful		✓	No

WFD Parameter	Scoping question	Yes	No	Notes
	algae			
	Does the activity use or release chemicals? If so are they on the Environmental Quality Standards Directive (EQSD) list		✓	No chemicals to be released
	Will the activity disturb sediment with contaminants above Cefas Action Level 1		✓	The presence of cable protection will not impact on sediments
Protected areas	Is the activity within 2km of any WFD protected area		✓	Rock Protection will not occur within 2km of a designated site – the exceptions are European Designated sites. However these sites will be considered within the HRA which will be submitted as part of the DCO application, planned for June 2019.. They are therefore not considered further within this assessment.
Invasive non-native species	Could the activity introduce or spread INNS		✓	The presence of cable protection will not introduce or spread INNS

5.2 Summary of Stage 2

50. The Stage 2 scoping assessment has established that the installation of the offshore export cables could have the potential to cause deterioration in water body status in relation to biological habitats.

51. The potential impact of this activity has therefore been carried forward to the Stage 3 Detailed Compliance Assessment. All other construction stage and operational impacts have been excluded from the assessment at this stage.

6 Stage 3: Detailed Compliance Assessment

6.1 Purpose of this Section

52. This section presents the results of the detailed compliance assessment undertaken on the Norfolk East coastal waterbody in relation for the potential for the installation of the offshore export cable to impact on biological habitats.

53. This assessment determines whether this activity will cause deterioration and whether this deterioration will have a significant non-temporary effect on the status of one or more WFD quality elements at water body level.

6.2 Detailed Assessment: Installation of Offshore Export Cable

6.2.1 Description of Potential Impacts on Water Body Status

54. The potential impacts on the relavant marine ecology features associated with the offshore export cable installation are considered in detail in the ES Chapter 10 Benthic and Intertidal Ecology. Mapping undertaken to inform the chapter does not indicate the presence of higher sensitivity habitats within 500m of the activity (even the likely sediment plume extent - the nearest potential area supporting *Sabellaria* is located several kilometres offshore), therefore this section focusses on the potential for effects to lower sensitivity habitats identified within the WFD water body.

55. The two habitats potentially at risk are as follows:

- Outcrop which is considered to be closest to rocky reef; and
- Biotope SS.SMx.CMx Circalittoral mixed sediment which is considered to be closest to cobbles, gravel and shingle.

56. The sensitivity assessment for this habitat to physical disturbance is shown in Table 6.1.

Table 6.1 Biotope sensitivities to physical disturbance (source: Tyler-Walters, Lear and Allen, 2004; Tillin, 2016)

Biotope code	Biotope description	Tolerance	Recoverability	Overall sensitivity
SS.SMx.CMx	Circalittoral mixed sediment	Intermediate	Medium	Medium

57. The biotope circalittoral mixed sediment is considered to be ubiquitous in the local area. This is supported by the information available for the WFD water body which indicates that there is 12,971.88 hectares (129.72 km^2) of this habitat present in this water body. Additionally, disturbance will be temporary (both in terms of clearance and any associated sediment plume) and habitats will recover following cessation of the works. As a result, a magnitude of low is allocated in the ES Chapter 10 Benthic and Intertidal Ecology with a sensitivity of medium (as shown for the habitat outlined in Table 6.1) above which results in a temporary impact of **minor adverse significance**. This indicates a short term deterioration which is unlikely to be significant enough to cause a permanent deterioration within or between classes for biology compliance parameters.

58. The rocky outcrop covers a very small area within the offshore cable corridor (see Figure 2) and therefore its loss (should it be disturbed) is a very small area of the total rocky reef (20.1966km^2) present within the WFD water body. Again, deterioration in lower sensitivity habitats is therefore not predicted.

6.2.2 Summary of Impacts on Water Body Status

59. Section 6.2.1 demonstrates that installation of the offshore export cable will not result in deterioration in the status of the marine water body or prevent WFD objectives being achieved in this water body in the future.

6.3 Cumulative Impacts

6.3.1 Within project cumulative impacts

60. In terms of potential cumulative impacts within this WFD water body, these are limited given the time over which the activities will occur and spatial extent of the individual activities considered within this assessment. During construction for example, the landfall and cable installation activities could combine to increase the size of any sediment plume however the sediment disturbed during the cable installation is likely to be significantly greater than that created by the landfall activities. Therefore, the likely cumulative impacts are predicted to be of a similar scale as those predicted for cable installation alone.

61. Cumulative impacts between the construction and the operational period could only arise as a result of habitat disturbance and therefore temporary habitat loss

associated with the installation of offshore export cables and habitat loss associated with the presence of cable protection (36m^2). However, given that the habitat disturbed by offshore export cable installation will recover relatively quickly, the loss will not combine with the habitat loss associated with cable protection. As a result, the cumulative effect is predicted to be the same as that for the presence of cable protection alone.

7 Summary of Assessment and Mitigation Requirements

7.1 Purpose of this Section

62. This section summarises the results of the compliance assessment, detailing the activities screened out and those assessed in detail. A description of the proposed control measures that are required to address any impacts, and prevent deterioration in status or failure to meet WFD objectives set for the relevant water bodies is then detailed.

7.2 Summary of Assessment

63. The output of the Stage 1 and Stage 2 assessment is detailed in Table 7.1 below. Following which detailed assessment was carried out on the installation of the offshore export cables in relation to the potential impacts on the WFD parameter biology (habitats).

Table 7.1 Summary of Stage 1 and Stage 2

WFD water body screened in	Activities Screened in	WFD Compliance parameter					
		Hydromorphology	Biology (habitats)	Biology (Fish)	Water Quality	Protected Areas	INNS
Norfolk East Coastal Water Body	Construction: Installation of offshore export cables	No – activity would cause temporary effects on a very localised scale. Following cessation of activities the site would return to pre-activity state	Yes – potential area to be disturbed greater than scoping criteria. Higher sensitivity habitats not within 500m of the proposed works	No – localised and temporary impacts	No – localised and temporary impacts	European Designated Sites will be considered within the HRA which will be submitted with the DCO application. No – Other protected areas within 2km (Sea Palling) but no impact anticipated due to distance of bathing water to main plume	Control measures in place to reduce the risk of transferring INNS
	Operation: Presence of cable protection	Rock protection would only be required in a very small area therefore effects would be very localised to the location. Effects on a water body scale are not anticipated	No – very small area to be impacted which does not exceed scoping criteria	No – presence of cable protection would not impact on fish	No – presence of cable protection would not impact on water quality	European Designated Sites will be considered within the HRA which will be submitted with the DCO application. No pathway for effect on other protected areas	Control measures in place to reduce the risk of transferring INNS

64. The detailed assessment has concluded that the potential impact of offshore export cable installation on habitats would be short term and unlikely to be significant enough to cause a permanent deterioration within or between classes for biology compliance parameters. The potential for cumulative effects was also considered in section 6.3 and concluded that cumulative effects were equal to the individual effects already to be experienced. As a result, no cumulative effects are predicted.

65. The project is therefore considered to be compliant with the requirements of the WFD.

7.3 Summary of control measures

66. The following bullets summarise the control measures to be put in place:

- Implementation of a PEMP.
- Where possible, structures would be transported to site having been pre-assembled or manufactured on land.
- Where grout is required, careful use would be ensured at all times to avoid excess grout being discharged to the environment.
- Appropriate spill plan procedures would also be implemented to appropriately manage any unexpected discharge into the marine environment, these would be included in a Marine Pollution Contingency Plan to be agreed post-consent. Inclusion of control measures such as the requirement to carry spill kits and the requirement for vessel personnel to undergo training to ensure requirements of the PEMP are understood and communicated.
- All work practices and vessels would adhere to the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78; specifically Annex 1 Regulations for the prevention of pollution by oil concerning machine waters, bilge waters and deck drainage and Annex IV Regulations for the prevention of pollution by sewage from ships concerning black and grey waters.
- Commitment to use of cable protection only around the HDD exit zone (within the WFD water body).

8 References

EC Environmental Quality Standards Directive (2008/105/EC)
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