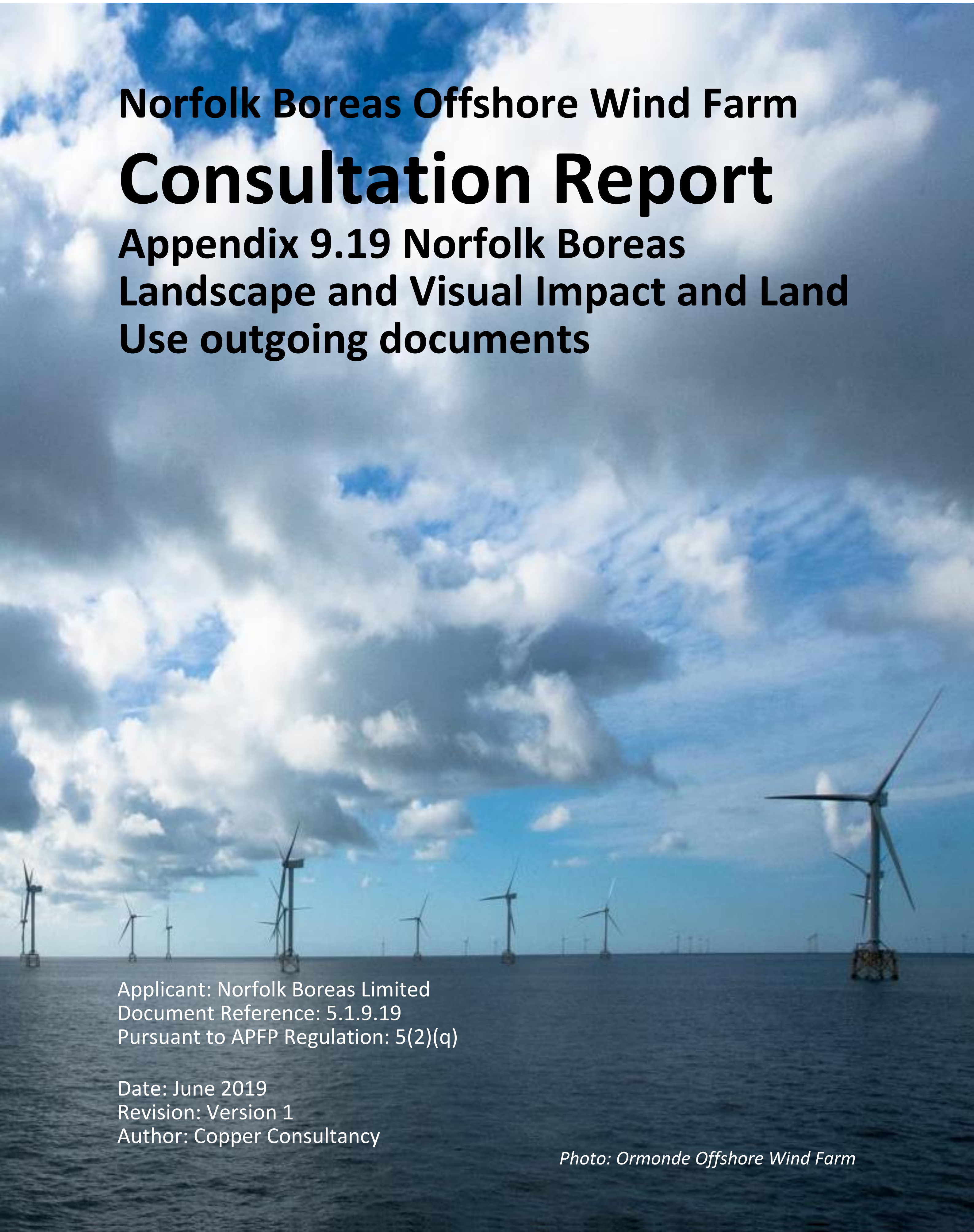

Norfolk Boreas Offshore Wind Farm

Consultation Report

Appendix 9.19 Norfolk Boreas Landscape and Visual Impact and Land Use outgoing documents

Applicant: Norfolk Boreas Limited
Document Reference: 5.1.9.19
Pursuant to APFP Regulation: 5(2)(q)

Date: June 2019
Revision: Version 1

Author: Copper Consultancy

Photo: Ormonde Offshore Wind Farm

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Norfolk Boreas Offshore Wind Farm

Environmental Impact Assessment

Landscape and Visual Impact Assessment Method Statement

Document Reference:PB5640-004-021

Author: Optimised environments ltd
Applicant: Norfolk Boreas Ltd
Date: January 2018

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
21/11/2017	01D	Internal RHDHV review	JPh	LT	AD
19/12/2017	02D	2nd Draft for RHDHV review	JPh	LT	DT/AD
21/12/2017	02D	Issue for client	JPh	DT	JL
18/01/2018	03D	Revised following client review	JPh	CD	JL
24/01/2018	01F	Issue for Consultation	JPh	CD	JL

This method statement has been prepared by Royal HaskoningDHV on behalf of Norfolk Boreas Limited in order to build upon the information provided within the Norfolk Boreas Environmental Impact Assessment (EIA) Scoping Report. It has been produced following a full review of the Scoping Opinion provided by the Planning Inspectorate. All content and material within this document is draft for stakeholder consultation purposes, within the Evidence Plan Process.

Many participants of the Norfolk **Boreas** Evidence Plan Process will also have participated in the Norfolk **Vanguard** Evidence Plan Process. This document is presented as a standalone document, however in order to maximise resource and save duplication of effort, the main areas of deviation from what has already been presented through the Norfolk Vanguard Evidence Plan Process and PEIR or in the Norfolk Boreas Scoping Report are presented in orange text throughout this document.

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Glossary of Acronyms

AIS	Air Insulated Switchgear
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
CA	Conservation Area
CIA	Cumulative Impact Assessment
DCO	Development Consent order
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
GIS	Gas Insulation Switchgear
GIS	Geographical Information System
GLVIA	Guidelines for the Assessment of Landscape and Visual Impacts
HDD	Horizontal Directional Drilling
HE	Historic England
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LCA	Landscape Character Assessment
LCT	Landscape Character Types
LCU	Landscape Character Units
LI	Landscape Institute
LIDAR	Light Detecting and Ranging
LVIA	Landscape and Visual Impact Assessment
NCA	National Character Areas
NP	National Park
NPPF	National Planning Policy Framework
NPS	National Policy Statement
OS	Ordnance Survey
PEIR	Preliminary Environmental Information Report
PMA	Primary mobilisation areas
PRoW	Public Rights of Way
RPG	Registered Park and Garden
SMA	Secondary mobilisation areas
SNH	Scottish Natural heritage
SUDS	Sustainable Urban Drainage System
WCS	Worst Case Scenario
ZTV	Zone of Theoretical Visibility

1 INTRODUCTION

1. The purpose of this method statement is to build upon the information provided within the Norfolk Boreas Environmental Impact Assessment (EIA) Scoping Report, in outlining the proposed approach to be taken and considerations to be made in the assessment of the landscape and visual effects of the proposed development.

2. This method statement and the consultation around it form part of the Norfolk Boreas Evidence Plan Process (EPP). The aim is to gain agreement on this method statement from all members of the Landscape and Visual Impact Assessment Expert Topic Group (ETG), which will be recorded in the agreement log.

3. This method statement has been produced following a full review of the Scoping Opinion provided by the Planning Inspectorate, responses to Norfolk Vanguard PEIR (Royal HaskoningDHV (2017b) and consultation undertaken through the Norfolk Vanguard EPP. **Table 1.1** below sets out a summary of the scoping comments of most relevance to the Landscape and Visual Impact Assessment (LVIA).

4. Information provided in this method statement is a draft for stakeholder consultation only and is provided in confidence. It is recognised that Norfolk Vanguard ETG meetings are being held in January 2018 and that agreements will be made during those meetings which are not reflected here. However due to certain project "Mile Stones" which have been set by the Crown Estate, Norfolk Boreas must progress on a programme which requires consultation on the Norfolk Boreas method statements prior to the conclusion of the Norfolk Vanguard EPP. Therefore, the material provided in this document represents the best available information at the time of writing.

Table 1.1: Summary of Scoping Comments Relating to Landscape and Visual Impact Assessment

Consultee	Comment	Response / where addressed in this document
Secretary of State	*The SoS notes the proposed study areas and that these will be defined by a number of factors as noted in paragraph 1409 of the Scoping Report. The SoS recommends that the ES identifies clearly justified study areas and considers that further justification for their choice - in addition to that within the Scoping Report - could be provided. For example, it is noted that the proposed study areas would be 5km for the substation and 3km for the cable relay station. The SoS notes these structures would be different maximum heights (25m and 8m respectively), however the Scoping Report does not state whether this has influenced the study areas. Justifications for study areas should make clear reference to the proposed Zones of Theoretical Visibility (ZTVs) and fieldwork to verify actual visibility.*	An explanation of the study areas and how they have been defined is presented in section 1.2.4.
Secretary of State	*The SoS notes the preliminary viewpoint lists in the Scoping Report and welcomes that the final list of viewpoints would be agreed with statutory consultees.*	**Table 1.2** in section 1.2.5 lists the viewpoints used in Norfolk Vanguard and proposed to be used in Norfolk Boreas. **Table** 1.3 lists additional viewpoints which are to be added to the original list.
Secretary of State	*The Scoping Report proposes to scope out landscape, visual and cumulative impacts of offshore components for all phases of the development given the distance from onshore landscape and visual receptors (72km); the relative sensitivity of the offshore receptors; and the existing influence of other offshore development and shipping vessels. The SoS agrees a significant effect is unlikely and that this can be scoped out of the EIA, but welcomes that the potential temporary impacts from the presence of construction vessels close to the coast will be assessed in respect of onshore receptors. The spatial extent of effects close to the coast should be defined i.e. at what distance from the coast they become indiscernible.*	Section 5.1.2 includes construction vessels close to the shore as one of the potential impacts relating to the construction of the landfall.
Secretary of State	*Table 4.4 of the Scoping Report proposes to scope out cumulative landscape and visual impacts of the landfall for all phases of the Proposed Development and of the onshore cable route for operation and decommissioning. The SoS agrees with this approach for operation and decommissioning; however, as the projects to be considered in the CIA have not yet been determined, the SoS does not agree that construction phase cumulative impacts can be scoped out at the landfall at this stage. It cannot be certain that other large developments may not be constructed concurrently in proximity to these elements (including the Norfolk Vanguard project).*	All potential cumulative effects during the construction of the landfall and onshore cable route will be explored and those with potential to give rise to significant cumulative effects will be assessed in detail. Cumulative Impact Scenarios are outlined in Section 2.3.5.
Secretary of State	*The SoS welcomes the consideration of advanced planting to mitigate potential effects. Any proposed mitigation by way of vegetation and planting should be considered within the ecological assessment. The Applicant is advised to submit a draft landscaping plan with their application.*	Plans showing mitigation planting and earthworks will be prepared for the cable relay station, onshore project substation and National Grid substation extension. These will be designed to reduce the potential landscape and visual effects. References to the role of mitigation landscaping are made in Section 2 Project Description.

Consultee	Comment	Response / where addressed in this document
Natural England	*As the proposed wind farm is evidently near the Norfolk Coast Area of Outstanding Natural Beauty (AONB), consideration should be given to the direct and indirect effects upon this designated landscape. In particular consideration should be given the effect upon its purpose for designation, as well as the content of its management plan.*	There will be no direct effects on the Norfolk Coast AONB. It is unlikely that there will be indirect effects owing to the limited extent of theoretical visibility combined with the screening effect of intervening vegetation. The potential for effects will, nonetheless, be considered in the LVIA. Information on AONBs and other designated landscapes is presented in Section 3.1.2.
Natural England	*The EIA should include a full assessment of the potential impacts of the development on local landscape character using landscape assessment methodologies. We encourage the use of Landscape Character Assessment (LCA), based on the good practice guidelines produced jointly by the Landscape Institute and Institute of Environmental Assessment in 2013. LCA provides a sound basis for guiding, informing and understanding the ability of any location to accommodate change and to make positive proposals for conserving, enhancing or regenerating character, as detailed proposals are developed.*	The Landscape Character Units (LCUs) are used as the basis of the assessment of effects on landscape character and have been taken from the relevant Landscape Character Assessments. Information on LCUs is presented in Section 3.1.1.
Natural England	*Natural England supports the publication 'Guidelines for Landscape and Visual Impact Assessment', produced by the Landscape Institute and the Institute of Environmental Assessment and Management in 2013 (3rd edition). The methodology set out is almost universally used for landscape and visual impact assessment.*	Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3) forms the basis of the methodology that will be used in the LVIA. Reference is made to GLVIA3 in Section 4.1.
Norfolk County Council	*Landscape and Visual Assessment Including Impact on Heritage Landscape. For both offshore and any associated onshore development / infrastructure (e.g. work compound, sub-station; relay stations etc) the EIA/PEIR will need to provide:* • *An assessment of the impact of the development on the landscape and seascape character (where visible from onshore), including landscape in neighbouring counties where they fall within the zone of visual influence;* • *An assessment of the visual intrusion caused by the development which should include the preparation of a Zone of Visual Intrusion plan/map;* • *Photomontages illustrating the impact of the development (See also Grid Connection Issues below);* • *An assessment of the cumulative impact of this development taken together with the other (a) operational wind farms, (b) permitted wind farms in the area and (c) development proposals likely to come forward; and* • *An assessment of the impact of the development on the heritage landscape.*	The Landscape Character Units (LCUs) with potential to be affected are listed in Section 5 under the Approach to Assessment for each of the onshore components. Zone of Theoretical Visibility (ZTV) maps will be used in the assessment and these are described in Sections 1.2.4 and 1.2.5 and shown on **Figures 1 to 4**. Photomontages for each of the representative viewpoints will be prepared and these are described in Section 1.2.6. All potential cumulative effects will be considered and those with potential to give rise to a significant cumulative effect will be assessed in detail. An outline of the approach to cumulative effects is presented in Section 2.3.5. The impact of Norfolk Boreas on heritage landscape will be considered throughout the LVIA.

1.1 Background

5. A Scoping Report for the Norfolk Boreas EIA was submitted to the Planning Inspectorate on the 9th May 2017. Further background information on the project can be found in the Scoping Report which is available at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000015-Scoping%20Report.pdf

6. The Scoping Opinion was received on the 16th June 2017 and can be found at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000013-Scoping%20Opinion.pdf

1.2 Norfolk Boreas Programme

7. This section provides an overview of the planned key milestone dates for Norfolk Boreas.

1.2.1 Development Consent Order (DCO) Programme

- EIA Scoping Request submission - 09/05/17 (complete)
- Preliminary Environmental Information (PEI) submission - Q4 2018
- Environmental Statement (ES) and DCO submission - Q2 2019

1.2.2 Evidence Plan Process Programme

8. The Evidence Plan Terms of Reference (Royal HaskoningDHV, 2017a) provides an overview of the Evidence Plan Process and expected logistics, below is a summary of anticipated activity:

- Agreement of Terms of Reference -Q3 2017
- Post-scoping Expert Topic Group consultation Q1 2018
    - Agree method statements
- Expert Topic Group and Steering Group meetings as required TBC- 2018
    - To be determined by the relevant groups based on issues raised
- PEI Report (PEIR) Expert Topic Group and Steering Group meetings - Q4 2018/ - Q1 2019
    - To discuss the findings of the PEI (before or after submission)
- Pre-submission Expert Topic Group and Steering Group - Q1/Q2 2019

meetings

  - To discuss updates to the PEIR prior to submission of the ES

1.2.3 Consultation to Date

9. Norfolk Boreas is the sister project to Norfolk Vanguard (see section 2) for further details). A programme of consultation has already been undertaken for Norfolk Vanguard which is of relevance to Norfolk Boreas and this is listed below:

- EIA Scoping Request submission - 03/10/16
- Receipt of Scoping Opinion - 11/11/16
- Steering Group meeting 21/03/16
- Steering Group meeting - 20/09/16
- Post-scoping Expert Topic Group meetings
  - Discuss method statements and Project Design Statement - Q1 2017
- Post PEIR Expert Topic Group meetings - Q1 2018
  - Discuss comments on the PEIR (results of these discussions have not been taken into account in this Method Statement due to the timescales involved).

10. Responses to the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b) were received in December 2017. This method statement has been updated to incorporate any key comments made that affect the proposed methodology for the Norfolk Boreas EIA.

1.2.4 Study Area

11. The proposed study areas for the onshore components of the project, in respect of the LVIA, would extend to define a limit beyond which professional judgement considers it would be unlikely for significant impacts to arise. This judgement is based on previous working knowledge of similar projects and an understanding of the character of the local landscape and scale of the construction and components of the project. In respect of cable relay station options, the onshore project substation, and National Grid substation extension, for Norfolk Boreas, Zone of Theoretical Visibility (ZTV) maps have been used to inform this process. These are shown on Figures 1 to 4.

12. The study area for the landfall extends to a radius of 1km around the outer extent of the landfall compound zone. The study area for the onshore cable route extends to a continuous band of 1.2km, with 500m on either side of the outer edge of the onshore cable corridor, which is 200m wide. This 1.2km band extends along the

60km length of the onshore cable corridor. The relatively small scale of the onshore cable corridor, the relatively small scale of the plant, and the ground and subterranean level of much of the construction works, notably limits the extent to which the onshore cable route would influence surrounding landscape character and visual amenity. In order to better understand the wider context to the onshore cable corridor, a contextual study area of 6km (3km either side) will be applied as was used in the PEI for Norfolk Vanguard.

13. The study areas for cable relay station search zones extend to a radius of 3km around each site. The ZTVs in **Figure 1 and 2** demonstrate how theoretical visibility would largely be contained within this 3km radius. Furthermore, they show how visibility would typically be concentrated within the first 1 to 1.5km radius and then occur only in localised bands beyond this close range area. While the ZTVs take into account landform and larger woodland blocks, they do not take into account hedgerows and trees which further reduce the extent of actual visibility.

14. In respect of the onshore project substation and National Grid substation extension, a study area of a 3km radius would be applied to both sites. The ZTVs in **Figure 3** and **Figure 4** show how theoretical visibility would largely be contained within this 3km radius. It shows how continuous theoretical visibility would be concentrated within the first 1 to 2km, with visibility to the east, especially restricted by intervening woodland. To the north and west, visibility becomes patchier towards the 3km boundary while to the south, visibility is limited through the valley at a range of 2km, but then resumes onto the ridgeline to the south, extending approximately 0.5km beyond the 3km boundary. Site reconnaissance has shown that while there may be the possibility for actual visibility to occur beyond 3km, the separation distance combined with the extent of intervening tree and hedgerow cover would limit the potential for significant effects to arise.

1.2.5 Survey Programme

15. The onshore infrastructure for Norfolk Boreas and Norfolk Vanguard would be co-located and follows a similar project description (section 2). This means that survey work already undertaken for the Norfolk Vanguard project is also relevant to the Norfolk Boreas project. Much of the information required for the Norfolk Boreas project has already been collected and collated under the Norfolk Vanguard project. This information will be updated where required and used in the LVIA for Norfolk Boreas. Additional survey data regarding the extent of actual visibility and viewpoint photography will be collected and collated where required.

16. The survey work completed to date includes site and study area reconnaissance in respect of the landfall, cable relay station, onshore cable corridor, onshore project

substation and Necton National Grid substation extension, during which data relating to landscape elements, landscape character and visual amenity has been collected. OS maps and data sheets have been used to collect survey data on landscape character and principal visual receptors, and photography has been taken to represent a series of selected viewpoints.

17. The viewpoints presented in **Table 1.2** have been agreed through Norfolk Vanguard's Evidence Plan Process (EPP) and used as the basis of the visual assessment in the Norfolk Vanguard PEIR. These will be used as the basis for the Norfolk Boreas LVIA.

Table 1.2: Norfolk Vanguard Viewpoint List

Onshore infrastructure	Viewpoint	Name	Representative
Cable Relay Station 5a	1	Ridlington Barn	Residents
Cable Relay Station 5a	2	Back Lane / Happisburgh Road	Road-users
Cable Relay Station 5a	3	Nash's Lane	Road-users / Residents
Cable Relay Station 5a	4	Ridlington Street	Road-users / Residents at Carrside
Cable Relay Station 5a	5	PRoW Witton FP5	Walkers
Cable Relay Station 5a	6	B1159 / PRoW Witton FP14	Road-users / Walkers
Cable Relay Station 5a	7	St Mary's Happisburgh	Church visitors
Cable Relay Station 6a	1	Munn's Lane	Walkers
Cable Relay Station 6a	2	Fox Hill	Residents
Cable Relay Station 6a	3	PRoW East Ruston BR35	Walkers
Cable Relay Station 6a	4	Old School Road	Road-users
Cable Relay Station 6a	5	Nash's Lane	Road-users / Residents
Substation	1	Ivy Todd Road west	Road-users
Substation	2	Lodge Lane south	Walkers
Substation	3	Lodge Lane north	Walkers
Substation	4	A47, Necton Substation	Road-users
Substation	5	A47, Spicer's Corner	Road-users
Substation	6	A47, Top Farm	Road-users
Substation	7	Ivy Todd Road east	Road-users
Substation	8	Chapel Road, Necton	Residents

18. **Table 1.3** below presents those viewpoints proposed to be added to the above list based on feedback from the Public Information Days and ongoing Evidence Plan Process for Norfolk Vanguard, along with the rationale for their addition.

Table 1.3: Additional Proposed Viewpoints

Onshore infrastructure	Viewpoint	Name	Representative	Rationale
Cable Relay Station 6a	6	B1159 near Summer's Farm	Road-users	This viewpoint adds an easterly aspect to the existing selection and is representative of the busiest road in this local area.
Substation	9	St Andrews Lane Necton	Residents	This viewpoint is representative of the visibility that may be gained by residents on this north-east edge of the National Grid substation extension.
Substation	10	Holme Hale	Road-users / Residents	This viewpoint is representative of the visibility that may be gained by residents and road-users from this middle range southerly aspect.

19. In addition to those in **Table 1.2** and **Table 1.3** further viewpoints have been suggested for inclusion through the Norfolk Vanguard EPP which are of relevance to the Cultural Heritage Assessment. While these will not be assessed in the LVIA, cross reference will be included where relevant.

20. Viewpoint photography for additional viewpoints would be carried out during winter months when deciduous trees and vegetation are bare, to ensure the worst-case scenario is represented. Any further viewpoints suggested by statutory consultees would be tested through the use of computer modelling to check for theoretical visibility and on-site for actual visibility, and included if considered to be of relevance to the assessment.

21. Zone of Theoretical Visibility (ZTV) maps have been produced for the indicative footprints of Norfolk Boreas as presented in Norfolk Vanguard PEIR and as shown on **Figures 1 to 4**. These comprise two cable relay stations (at sites 5a and 6a), the HVAC and HVDC onshore project substations, and the National Grid substation extension for Norfolk Boreas. The ZTVs for Norfolk Boreas show very similar extents of theoretical visibility to those for Norfolk Vanguard, which helped inform survey work by identifying potential receptors. The ZTVs are based on bare earth landform data with woodland blocks added in at an approximate 10m height. While the ZTVs will correlate with actual visibility to some extent, this will be notably less owing to all the other smaller scale vegetation in the landscape which is not represented on the ZTV.

22. Survey work carried out for Norfolk Vanguard has been used to identify the extent of actual visibility from principal visual receptors, through recording the extent of enclosing vegetation around settlements and along roadsides and Public Rights of

Way (PRoW). By recording the geographical extent represented by each viewpoint, it has been possible to determine the extent of the potential effects in respect of each principal visual receptor. While this information will be largely applicable to Norfolk Boreas, ongoing site work will help fine tune the findings to make them specific to the detailed footprints for Norfolk Boreas. An assessment of the disturbance to PRoWs will be included in the Tourism and recreation chapter (see Tourism and recreation Method Statement PB5640-004-010)

23. Existing and proposed viewpoint photography will be used as the basis for the generation of visualisations for the two options for the cable relay station, HVAC and HVDC onshore project substations and National Grid substation extension. These will incorporate a model of the project. Site visits will then be used to verify the findings of the assessment during the later phases of the programme. This would involve using visualisations, layout plans and Zone of Theoretical Visibility (ZTV) mapping on site to assist judgement regarding the potential magnitude of effect.

24. Details of the proposed data collection exercise are included under section 3.2.

1.2.6 Visualisations

25. The viewpoint assessment will be illustrated by a range of visualisations, including photographs and photomontages, which broadly accord with SNH's Visual Representation of wind farms Version 2.2 (SNH, 2017). In the absence of detailed guidance on the production of photomontages for non-wind farm developments (such as the cable relay station and substation), the Landscape Institute (LI) in its Advice Note 01/11 makes the following comment:

- *"Scottish Natural Heritage's Visual representation of windfarms: good practice guidance states that the guidance may also be applicable to other forms of development or within other locations. The LI endorses this guidance and strongly advises members to follow this where applicable in preference to any other guidance or methodology."*

26. Although the onshore elements of the project do not constitute a wind farm (as they do not include wind turbines), the SNH guidance will be applied in the production of the photomontages because it is commonly held to be the most appropriate for this purpose.

27. Visualisations of energy developments have a number of limitations when using them to form a judgement on this type of development. These include:

- A visualisation can never show exactly what the energy development will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image;

- The images provided give a reasonable impression of the scale of the energy developments and the distance from the viewpoint, but can never be 100% accurate;
- The viewpoints illustrated are representative of views in the area, but cannot represent visibility at all locations;
- To form the best impression of the impacts of the energy development these images are best viewed at the viewpoint location shown; and
- The visualisations must be printed at the right size to be viewed properly (A1 width) and viewed at a comfortable viewing distance.

28. The photographs used to produce the photomontages have been taken using Canon EOS 5D and 6D Digital SLR cameras, with a fixed lens and a full-frame (35mm negative size) CMOS sensor. The photographs have and will continue to be taken from a tripod with a pano-head at a height of approximately 1.5m above ground. Additional photography will be taken in line with these parameters.

29. To create the baseline panorama, the frames are individually cylindrically projected and then digitally joined to create a fully cylindrically projected panorama using Adobe Photoshop or PTGui software. This process avoids the wide-angle effect that would result should these frames be arranged in a perspective projection, whereby the image is not faceted to allow for the cylindrical nature of the full 360-degree view but appears essentially as a flat plane.

30. Tonal alterations are made using Adobe software to create an even range of tones across the photographs once joined.

31. The Norfolk Boreas EIA will be based on the ‘Rochdale Envelope’ approach, as supported by The Planning Inspectorate Advice Note Nine (The Planning Inspectorate, 2012). The Rochdale Envelope presents the parameters of the project which represent the worst case scenario. This ensures the DCO application covers the maximum extents of the onshore infrastructure. Visualisations will show a Rochdale Envelope marked by a white or black dashed line around the computer-generated model, to indicate the maximum extent of the proposed project, should the layout change.

32. 3D models that illustrate the cable relay station options, onshore project substation and National Grid substation extension within a computer-generated image of the landform will be used in the assessment to predict the theoretical appearance of the project. These are produced with Visual Nature Studio software and are based on a terrain model with a 5m data grid (OST 5). There are limitations in the accuracy of DTM data so that landform may not be picked up precisely and may result in parts of the cable relay stations, onshore project substation or National Grid substation

extension, being more or less visible than is shown, however, the use of OS terrain 5 minimises these limitations. Where descriptions within the assessment identify the extent of onshore infrastructure visible this will refer to the illustrations generated and therefore the reality may differ to a degree from these impressions.

33. Photomontages will be produced for most of the views, using Visual Nature Studio software, to provide a more realistic image of the appearance of the proposal. In most views, these include the introduction of the onshore project substation, National Grid substation extension or cable relay station search zones and associated construction compounds only as these are the elements that create the greatest change in views and are likely to be most visible from the surrounding area. Where there is notable visibility of site infrastructure and where these components of the site infrastructure are of relevance to the assessment, this will be shown in the photomontages.

34. The baseline photographs and 3D model visualisations shown for each viewpoint cover a 90-degree field of view (or in some cases, up to 180-degree), which accords with SNH guidance. These are cylindrically projected images and should be viewed flat at a comfortable arm's length.

35. The photographs and photomontages used in this assessment are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what will be apparent to the human eye. The assessments are carried out from observations in the field and therefore may include elements that are not visible in the photographs.

2 PROJECT DESCRIPTION

2.1 Context and Scenarios

36. Norfolk Boreas is the sister project to Norfolk Vanguard. Vattenfall Wind Power Ltd (VWPL) is developing the two projects in tandem, and is planning to co-locate the export infrastructure for both projects in order to minimise overall impacts. This co-location strategy applies to the offshore and onshore parts of the export cable corridor, the cable landfalls, cable relay stations, and onshore project substations.

37. The Norfolk Boreas project is approximately 12 months behing Norfolk Vanguard in the Development Consent Order (DCO) process. As such, the Norfolk Vanguard team is leading on site selection for both projects. Although Norfolk Boreas is the subject of a separate DCO application, the project will adopt these strategic site selection decisions.

38. In order to minimise impacts associated with onshore construction works for the two projects, VWPL is aiming to carry out enabling works for both projects under the Norfolk Vanguard DCO. This covers the installation of buried ducts along the onshore cable route, from the landfall to the onshore substation, modifications at the Necton National Grid substation, mitigation planting and earthworks, access road construction, utility connections (water, electricity and phone) and site drainage.

39. However, Norfolk Boreas need to consider the small possibility that the Norfolk Vanguard project would not be constructed. In order for Norfolk Boreas to stand up as an independent project, this scenario must be provided for within the Norfolk Boreas DCO. Thus, there are two alternative scenarios to be considered in the context of the EIA and this method statement:

- **Scenario 1:** Norfolk Vanguard consents and constructs transmission infrastructure which would be used by Norfolk Boreas. This includes, cable ducts, access routes to jointing pit locations, extension of the Necton National Grid substation, overhead line modification at the Necton National Grid substation and any site drainage, landscaping and planting schemes around co-located infrastructure. Under Scenario 1 Norfolk Boreas will seek to consent the Horizontal Direction Drilling (HDD) at landfall, jointing and transition pits onshore project substation, cable relay station and the installation of cables in the ducts through a process of cable pulling'.

- **Scenario 2:** Norfolk Vanguard is not constructed and therefore Norfolk Boreas will seek to consent and construct all required project infrastructure including: HDD at landfall, jointing pits, transition and jointing pits, cable ducts, cable installation, cable relay station (if required), onshore project substation, 400kV interface works (between the onshore project substation and the Necton National Grid substation), extension to the Necton National Grid substation, overhead line modification and any site drainage and landscape and planting schemes. For the sake of clarity, the Norfolk Boreas project would, under Scenario 2, involve the construction and installation of all onshore infrastructure necessary for a viable project.

40. **Appendix 1** contains a set of figures showing the current proposed onshore infrastructure locations and **Appendix 2** contains a detailed comparison of what is included in the two different scenarios across all elements of the project. Both of these appendices are provided in separate documents.

41. Norfolk Boreas limited are proposing to employ a construction strategy whereby there are multiple moving work fronts which complete the majority of all construction works in each area before moving on. This reduces overall construction time as most works are completed in one pass and allows flexibility for areas to be avoided at sensitive times and to minimise impact through scheduling of works.

2.2 Site Selection Update

42. A detailed programme of site selection work has been undertaken by VWPL to refine the locations of the onshore infrastructure for both the Norfolk Vanguard and Norfolk Boreas projects. The Norfolk Vanguard EIA Scoping Report presented search areas for the onshore infrastructure which were identified following constraints mapping to avoid or minimise potential impacts (e.g. noise, visual, landscape, traffic, human health and socio-economic impacts). Further data review has been undertaken to understand the engineering and environmental constraints within the search areas identified. This process has been informed by public drop in exhibitions (October 2016, March and April 2017), along with the Scoping Opinion for Norfolk Vanguard and the feedback from the Expert Topic Groups. Details of the site selection process are provided in Chapter 4 of the Norfolk Vanguard Preliminary Environmental Information Report (Royal HaskoningDHV, 2017b) with summaries provided below:

2.2.1 Landfall Zone

43. The Norfolk Boreas Scoping report presented three potential landfall locations. Data was reviewed on a broad range of environmental factors, including existing industrialised landscape, the presence of the Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ), coastal erosion and archaeology alongside statutory and non-statutory consultation.

44. After publication of the scoping report, VWPL concluded, taking account of all engineering and environmental factors, as well as public feedback, that the most suitable landfall location would be Happisburgh South. The decision to go to

Happisburgh south was presented to the Norfolk Vanguard Evidence Plan Expert Topic groups in June and July 2017 and in the Norfolk Vanguard PEIR (Royal HaskoningDHV 2017b).

45. Happisburgh South also has the benefit of being large enough to accommodate landfall works of both Norfolk Vanguard and Norfolk Boreas, therefore reducing the spatial extent of impacts associated with the two projects.

2.2.2 Cable Relay Station Options

46. The Norfolk Boreas Scoping report presented seven potential cable relay station search zones. A single cable relay station would be required for a High Voltage Alternating Current (HVAC) electrical solution only. No cable relay station would be required for a High Voltage Direct Current (HVDC) electrical solution. The decision between HVDC and HVAC solutions would not be taken until post consent, therefore for the purposes of the EIA, and under the project envelope approach, assessment would be conducted on the basis of the realistic worst case.

47. Following the scoping opinion, further work has been completed and two potential locations are being proposed for the cable relay station (**Appendix 1**). The final siting of the cable relay station on either footprint will have due consideration of existing watercourses, hedgerows, landscaping, archaeology, ecology, noise, access and other known infrastructure/environmental constraints to minimise impacts, along with feedback from statutory and non-statutory consultation.

48. A Norfolk Boreas cable relay station temporary construction compound area has not yet been identified, however a location will have been determined prior to the Norfolk Boreas PEIR being published in Q4 2018.

2.2.3 Onshore Cable Route

49. A 200m wide cable corridor was presented within the Norfolk Boreas scoping report. This corridor, shared with Norfolk Vanguard, is the shortest realistic route between landfall and the Necton National Grid substation (thereby minimising disturbance impacts) whilst also aiming to avoid main residential areas and impacts to landscape, nature conservation designations and other key environmental constraints where possible.

50. The proposed route skirts around the main towns of North Walsham, Aylsham, Reepham and Dereham. Since the Norfolk Boreas scoping report was published further work has been completed (see Royal HaskoningDHV, 2017b for detail) to refine the cable corridor and an indicative cable route has been established suitable for infrastructure for both the Norfolk Vanguard and Boreas onshore export cables (**Appendix 1**).

2.2.4 Onshore Project Substation

51. The Norfolk Boreas scoping report presented an onshore project substation zone within which the onshore project substation was to be located. Following further site selection work (presented in Royal HaskoningDHV, 2017b) a preferred onshore project substation location has been identified. Although the onshore project substation location is now well defined there remains the possibility that its exact location may change slightly following consultation on the Norfolk Vanguard PEIR, therefore an onshore project substation search area has been retained (**Appendix 1).**

52. A Norfolk Boreas Onshore project substation temporary construction compound area has not yet been identified, however a location will have been determined prior to the Norfolk Boreas PEIR being published in Q4 2018.

2.2.5 Extension to the Existing Necton National Grid substation

53. The Norfolk Boreas Scoping report presented a National Grid substation extension zone. Since the publication of that report further work has been undertaken to define the footprint of these extension works (**Appendix 1**). Further detail on this process is presented in Chapter 4 of the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b)

54. Also presented in the Norfolk Boreas Scoping report was an overhead line modification zone within which the overhead lines leading into the Necton National Grid substation would be realigned (section 2.3.1.5). The area within which this work will be undertaken has been refined and is presented in **Appendix 1**. Further detail on the process behind this refinement is provided in the Norfolk Vanguard PEIR chapter 5 site selection and alternatives.

2.3 Indicative Worst Case Scenarios

55. The following sections set out the aspects of the current project description and the current predicated worst case scenarios that are relevant to the Landscape and Visual Impact Assessment (LVIA) for both Scenario 1 and Scenario 2. The Norfolk Boreas PEIR and the ES will provide further detail on the project describing the final project design envelope for the DCO application.

56. Potential impacts during construction would relate to a combination of the emerging presence of the onshore components, the presence of the associated plant, materials and other temporary structures, and the activity associated with the construction process. Generally, the potential impacts associated with the larger components of the cable relay station, onshore project substation, National Grid substation extension and overhead line modification would be greater than those

associated with the predominantly underground components of the landfall and onshore cable route.

57. Each chapter of the PEIR and ES will define the worst case scenario arising from the construction, operation and decommissioning phases of the Norfolk Boreas project for the relevant receptors and impacts. Additionally, each chapter will consider separately the anticipated cumulative impacts of Norfolk Boreas with other relevant projects which could have a cumulative impact on the receptors under consideration.

58. The parameters discussed in this section are based on the best available information for Norfolk Boreas at the time of writing and are subject to change as the project progresses.

2.3.1 Infrastructure Parameters

59. HVAC and HVDC electrical solutions are being considered for Norfolk Boreas. Both electrical solutions would have implications for the required onshore infrastructure. The HVAC solution presents the worst case scenario in respect of the cable relay station, landfall and onshore cable route, while the HVDC solution presents the worst case scenario in respect of the onshore project substation. In respect of the National Grid substation extension, the HVAC solution and HVDC solution would have the same impact.

60. The following key onshore project parameters are considered within this method statement. Explanation of which parameters are considered for Scenario 1 and for Scenario 2 is provided in the following sections. For full detail of what is considered in Scenario 1 and what is considered in Scenario 2 please see **Appendix 2**:

- Landfall (Horizontal Directional Drilling (HDD) and associated compounds);
- Cable relay station (required for HVAC only);
- Cable corridor (with associated trenchless crossing technique areas, construction compounds and mobilisation areas and access);
- Onshore project substation;
- Interface cables connecting the onshore project substation and the Necton National Grid substation; and
- Extension to the existing Necton National Grid Substation, including overhead line modification.

61. Under Scenario 1, The Norfolk Vanguard project would be consented and therefore form part of the baseline. The effects of Norfolk Boreas in conjunction with Norfolk Vanguard would be considered in the main assessment. Other projects which would be considered in the CIA are discussed in section 2.3.5.

2.3.1.1 Landfall

62. The landfall compound zone (**Appendix 1**) denotes the location where up to six Norfolk Boreas offshore export cables would be brought ashore. These would be jointed to the onshore cables in transition pits located within the eastern most "trenchless crossing technique" area shown in **Appendix 1**. Under Scenario 1 Norfolk Boreas would share the landfall area with Norfolk Vanguard at Happisburgh South.

63. Works associated at landfall would be the same under both scenarios. Under Scenario 1, Norfolk Boreas cable ducts will be installed concurrently with the Norfolk Vanguard ducts, the Norfolk Boreas ducts would be installed only on the landward (western) side of the transition pits. Ducts on the seaward side of the transition pits would be installed using Horizontal Directional Drilling (HDD) which is a trenchless installation technique. The HDD would exit at one of the following two locations:

- On the beach, above the level of mean low water spring (classified as "short HDD").
- At an offshore location, seaward the beach (up to 1000m in drill length) (classified as "long HDD").

64. In the case of a short HDD, temporary beach closures would be required during drilling exit and duct installation to maintain public safety. Beach access would be required for an excavator and 4x4 vehicles.

65. Key parameters of works at landfall:

- Installation of a temporary construction compound to accommodate the drilling rig, ducting and associated materials and welfare facilities.
- A total of up to six ducts for the HVAC solution or two ducts for the HVDC solution would be required at the landfall for Norfolk Boreas.
- Temporary footprint of works would be up to 3,000m^2 per compound (up to six compounds).
- For a drill length of 500m, it is anticipated that site establishment, drilling of up to six ducts and demobilisation will take approximately 30 weeks when considering 12 hour (7am-7pm), 7 day shifts. 24 hour operation could be employed for drilling activities, subject to planning and environmental restrictions, and could reduce the installation to approximately 20 weeks. Cable pulling would be undertaken subsequent to the duct installation.
- 24 hour lighting of the temporary footprint would be required throughout construction.
- The site would be fully reinstated upon completion of the landfall works.

66. Each cable circuit would require a separate transition pit to connect the offshore and onshore cables at the landfall which would be grouped together and staggered as necessary to be accommodated within the permanent cable corridor. The transition pit would comprise of an excavated area of 15m x 10m x 5m at the base, per circuit.

67. Link boxes for each of the transition pits would also be required for an HVAC solution and may be required to a lesser degree for the HVDC solution.

2.3.1.2 Cable Relay Station

68. A cable relay station would be required for a HVAC electrical solution but not a HVDC solution. Therefore, the HVAC solution is the worst case scenario for this element of the onshore infrastructure. The cable relay station would be constructed by Norfolk Boreas under both Scenarios 1 and 2 and would be located within one of the sites identified in **Appendix 1**.

69. Key parameters of works at cable relay station are as follows:

- The cable relay station would consist of a three phase reactor per HVAC circuit (a total of six reactors) with associated outdoor GIS (Gas Insulated Switchgear). Each reactor would be installed in concrete bunds to contain oil leakage and prevent damage to the environment. Cables from the landfall and onwards to the onshore substation would be laid in concrete troughs within the cable relay station and terminated at the GIS.
- The maximum height of the reactor and associated GIS equipment would be 8.0m.
- The total cable relay station fenced area would be 73m x 135m, with a perimeter fence height of 2.4m. External to the perimeter fence would be a small control building with associated parking with combined dimensions of 31m x 18m.
- There would be an additional temporary construction area with a maximum temporary footprint of 15,000m^2 during construction of the cable relay station.

70. During construction of the cable relay station the temporary construction compound would be established to support the works. The location of the temporary construction compound has not yet been determined but will be presented within the Norfolk Boreas PEIR being published in Q4 2018. Given construction duration, the compound would likely be tarmacked with some concrete hard standing for heavier plant and equipment. Appropriate access from the B1159 would be provided to permit safe delivery of plant and equipment required for construction (In Scenario 1, this access would be shared with the cable relay station for Norfolk

Vanguard; in Scenario 2, the access would have to be constructed as part of Norfolk Boreas.)

71. The compound would accommodate construction management offices, welfare facilities, car parking, workshops and storage areas. Under Scenario 2 this compound would also serve as a Primary Mobilisation Area (PMA) for cable installation works. Under Scenario 1 PMAs would not be required.

72. The site would be stripped and graded as required by the final design. Under Scenario 2 the stripped material would be reused on site where possible as part of mitigation earthworks as allowed for in the final design. Under Scenario 1 there would be less capacity to do this as landscaping schemes developed to mitigate visual impacts of both Norfolk Vanguard and Norfolk Boreas would have started to mature by the time Norfolk Boreas construction starts. Any excess material would be disposed of at a licenced disposal site.

73. Construction activities would be conducted during working hours of 7am-7pm. Evening or weekend working could be required to maintain programme progress and for specific time critical activities such as transformer oil filling and processing; however these would be kept to a minimum. Perimeter and site lighting would be required during working hours and a lower level of lighting would remain overnight for security purposes.

74. The construction programme for the cable relay station would be 18 months.

2.3.1.3 Onshore cable corridor

75. The onshore cable corridor would contain the final onshore cable route. Currently an indicative cable route has been identified and is displayed in **Appendix 1**.

2.3.1.3.1 Onshore cable route

76. The onshore cable route would contain the main 220kV HVAC or ±320kV HVDC export cables connecting the landfall to the onshore project substation and 400kV HVAC interface cables connecting the onshore project substation with the Necton National Grid substation. A plan of the onshore cable route is shown in **Appendix 1**.

77. The key elements of the onshore cable route for Scenarios 1 and Scenario 2 are detailed in **Appendix 2**, and summarised below.

Scenario 1

78. Norfolk Vanguard would install cable ducts and undertake enabling works (e.g. running track, accesses etc.) for Norfolk Boreas along the entire length of the onshore cable corridor. Therefore, all excavations (except jointing pits and

associated temporary construction compounds) and crossings would have already been undertaken. In addition, all the ducts will be installed and ground reinstated by Norfolk Vanguard.

Scenario 2

79. Norfolk Boreas would be responsible for installing all onshore cable route infrastructure required for the project, including installing ducts along the entire cable route and reinstating land (cable pulling would then happen at a later date see section 2.3.1.3.4). Under this scenario the duct installation would also require:

- Trenches for the cable circuits;
- A running track to deliver equipment to the installation site from mobilisation areas; and
- Storage areas for topsoil and subsoil.

An indicative cable route has been developed to illustrate the area required to install the ducts and cables for the HVAC and HVDC electrical solutions for Norfolk Boreas, see **Plate 2.1** and **Plate 2.2**

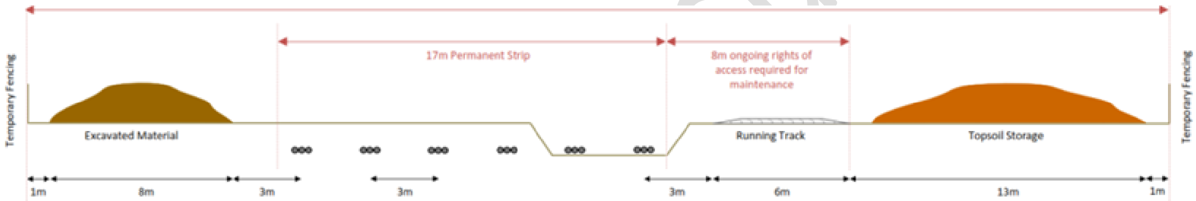

Plate 2.2 below. For each electrical solution the following are illustrated:

- Temporary strip (total land requirement to install the cables)
- Permanent strip (total ongoing land requirement of the installed cables)
- Ongoing right of access strip (temporary area reserved for access for future repair /maintenance activities)

80. Dependant on the land agreement approach taken, the ongoing right of access strip could be absorbed within the permanent easement although they are identified separately at this time.

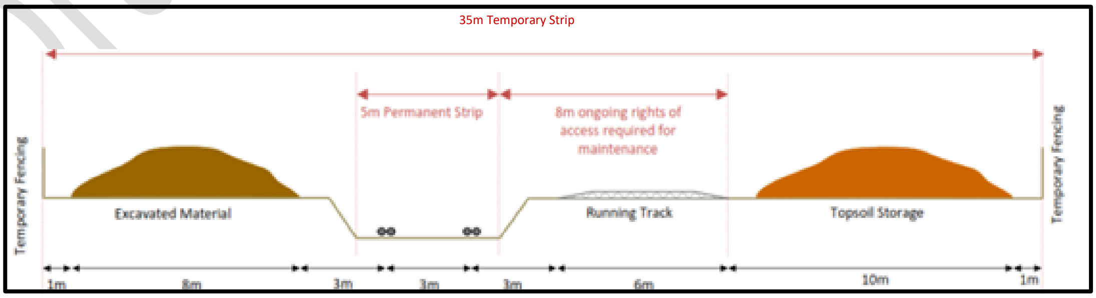

Plate 2.1 Indicative Norfolk Boreas HVDC Onshore Cable Corridor

50m Temporary Strip

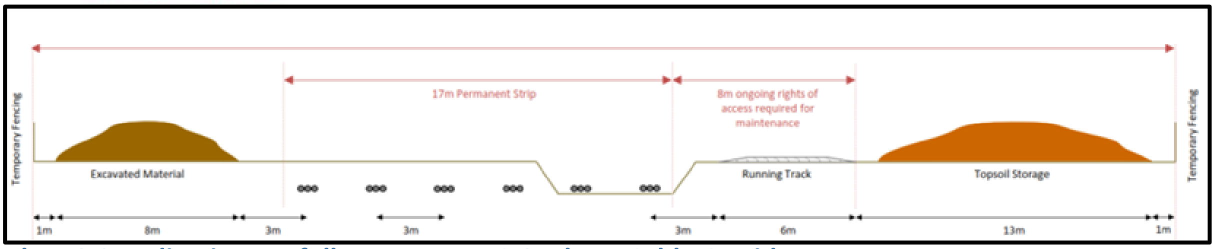

Plate 2.2: Indicative Norfolk Boreas HVAC Onshore Cable Corridor

2.3.1.3.2 Trenching and soil storage

Scenario 1

81. No trenching and soil storage would be required under this scenario for Norfolk Boreas as these works would have been completed under Norfolk Vanguard.

Scenario 2

82. Norfolk Boreas would be responsible for duct installation requiring trenches for cable circuits and storage areas for topsoil and subsoil. The main duct installation method would be through the use of open cut trenching with HDPE ducts installed, soil backfilled and land reinstated. Cables would then be pulled though the pre-laid ducts at a later stage (see section 2.3.1.3.4 for further details).

83. Where the cable route crosses major transport routes or waterways the standard open cut trenching installation technique might not be suitable. The cable burial depth might increase at these crossing locations or an alternative trenchless method may be used. Further details of crossing methodologies are provided below. Where open cut trenching is employed in these locations and associated locations such as hedgerows, the working width could be reduced to the running track and cable trenching areas only (e.g. 25m for HVAC).

2.3.1.3.3 Running track

84. The running track provides safe access for construction vehicles within the onshore cable route. Where used (see scenarios below) the running track could be up to 6m wide and may ultimately extend the full length of the onshore cable route (approximately 60km).

Scenario 1

85. Under Scenario 1 approximately 20% of the Norfolk Vanguard running track would need to be retained or reinstated (reinstated being the worst case scenario) for the cable pulling phases.

Scenario 2

86. Under Scenario 2 running track would be installed along the entire length of the cable route (approximately 60km) to allow safe access from mobilisation areas (see section 2.3.1.3.8) to the duct installation sites.

87. Following topsoil stripping, the running track would be formed of protective matting, temporary metal road or permeable gravel aggregate dependant on the ground conditions, vehicle requirements and any necessary protection for underground services.

88. At drain crossings the running track would be installed over a pre-installed culvert pipe to allow continued access to the cable route. These culverts could remain in place for up to two years.

89. At larger road and water course crossings, temporary bridges may be employed to allow continuation of the running track. At railway and main river crossings where a trenchless crossing solution would be used, the running track would not be continuous. These locations would be 'stop ends' to the construction work fronts.

90. The running track would be extended piece-wise as the work front moves outward from the PMA. When duct installation is completed, the running track would be taken up and the topsoil replaced. All recovered stone and other materials would be removed from site via the PMA (see section 2.3.1.3.8).

91. The running track would be required to remain cleared for the duration of the trenching and ducting activities to allow access along the cable route. Following completion of the duct installation, the all or the majority of the running track would be removed and the topsoil reinstated, although rights would be retained to access the running tracks location should repairs of the cables be required during the lifetime of the project. Approximately 20% of the access track would need to be retained or reinstated for subsequent cable pulling phases.

2.3.1.3.4 Cable Pulling Process

92. A number of aspects of the cable pull process would be the same irrespective of scenario as follows. The onshore cables would be pulled through the installed ducts later in the construction programme in a staged approach, as offshore generating capacity came online. This approach allows the major onshore civil engineering works to be completed in advance of cable delivery.

93. Cable pulling would not require the trenches to be reopened, with the cables pulled through the preinstalled ducts between the jointing pits located along the onshore cable route.

94. The cable pulling and jointing process will take approximately six weeks per 1km of cable length, including installing and removing any temporary hard standing and delivering the cables to the jointing pits. However, any one jointing pit may be open for up to 12 weeks to allow its neighbouring jointing pit to be opened and the cables pulled from one pit to the next, dependant on the level of parallel work being conducted.

95. Access to and from the jointing pits would be required to facilitate the works during this phase of the project. This would be achieved through access to the onshore cable jointing pits directly from the highways network (at crossing locations) or existing local access routes where possible.

96. Under Scenario 1 in some locations, small sections of the running track would be required to be instated to allow access to more remote jointing pit locations (assuming that the entire running track required for the Norfolk Vanguard Project would have been removed). It is considered as a worst case scenario this would require approximately 20% of the running track to be reinstated to facilitate access to jointing pits**.**

97. Under Scenario 2, approximately 20% of running track presented would be left in place from the duct installation works, or required to be reinstated to allow access to more remote jointing pit locations.

2.3.1.3.5 Jointing pits

98. Under both Scenario 1 and 2, the jointing pits would be installed by Norfolk Boreas. Jointing pits would be required along the onshore cable route to allow cable pulling and jointing of two sections of cable.

99. The jointing pits would typically be located at 800m intervals which is the maximum cable length which can be delivered, although site specific constraints may result in shorter intervals where necessary.

100. Construction of jointing pit compounds would differ between scenarios as outlined below:

Scenario 1

101. Under Scenario 1 VWPL are considering the possibility of reusing the same areas as those used to construct jointing pit compounds for Norfolk Vanguard during Norfolk Boreas construction. If at the detailed design phase, the decision is made to do this there would be the possibility of leaving materials used to construct the Norfolk Vanguard jointing pit compounds in situ for use in the Norfolk Boreas jointing pit compounds. If the decision is taken not to use the same as areas for jointing pit

compounds all associated works would be undertaken by Norfolk Boreas. However, as this is yet to be confirmed the worst case is that this will not be possible and all jointing pit construction compounds would be fully constructed by Norfolk Boreas.

Scenario 2

102. Under Scenario 2 all associated works for jointing pit compounds would be undertaken Norfolk Boreas.

2.3.1.3.6 Link boxes

103. Link boxes would be required under both Scenario 1 and Scenario 2.

104. Link boxes would be required for a HVAC connection arrangement to enable the cables to work as efficiently as possible. These would typically be installed in close proximity (within 10m) to jointing pit locations.

105. Link boxes would be placed at every second or third jointing location (~1.0 km – 3.0 km). The number and placement of the link boxes will be determined as part of the detailed design. For the HVDC connection arrangement a smaller number of similar link boxes could be utilised to accommodate these aspects.

106. The link boxes would require periodic access by technicians for inspection and testing. Where possible, the link boxes would be located close to field boundaries and in accessible locations with the exact location to be determined during detailed design phases.

107. There are two options being considered for Link Box installation: Either a box with dimensions 1.5m x 1.5m, per circuit would be buried to ground level within an excavated pit, providing access via a secured access panel or, an above ground link box cabinet with a footprint of 1.0m x 0.5m and a height of 1.0m could be utilised.

2.3.1.3.7 Crossing installation methods

Scenario 1

108. Under this scenario all necessary crossing installation would have been completed by Norfolk Vanguard. No additional works would be required by Norfolk Boreas.

Scenario 2

109. Under this scenario all crossings would be consented and installed by Norfolk Boreas. When crossing some features along the onshore cable route, alternative or amended installation approaches would be required to minimise the impact on the feature or obstacle being crossed as much as reasonably practicable. The following

subsections detail the crossing installation methods available with the type proposed at each crossing fully detailed within the PEIR and ES.

110. When crossing hedgerows the width of the cable route would be reduced to the running track and cable trenches only to minimise the amount of hedgerow removal. Using this technique, the hedgerow removal would be reduced to a maximum of 25m width.

111. Where the onshore cable route crosses roads, tracks and public rights of way, traffic management during the construction phase would be employed to allow these activities to continue safely. It should be noted that trenchless crossing methods could be required at locations where standard traffic management techniques are not deemed to be suitable. Further work to identify these locations is ongoing and details will be provided within the PEIR and ES project description chapters. The works would be conducted within the cable easement with no additional land requirements.

112. Where larger watercourses such as field drains are deeper than 1.5m, culverting might be used. However, the Environment Agency deems this technique to be the least desirable river crossing method. Therefore the use of culverting would be avoided wherever possible. Where culverting is employed, a duct would be installed in the watercourse, suitably sized for necessary water volumes and flows.

113. Culverting would be carried out within the onshore cable route and would have no additional land requirements. The running track would also be required where culverting is undertaken to allow continued cable route access. Culverting may be required temporarily for a width of 6m to allow the running track to cross watercourses during installation works.

114. Cable bridges could also be used to cross larger water courses. A cable bridge structure would be constructed across the feature at a height specified by the feature and its uses. Ducts would be installed along the bridge for the cables to be pulled within. At the entrance/exit of the cable bridge, the ducts would transition from above ground to below ground. During the transition where the installation depth is less than 1.05m, concrete covers would be laid to protect the cables from damage. The bridge would include protective measures to prevent public access to the cables or the bridge.

115. Trenchless installation methods such as HDD, micro tunnelling or auger boring are likely to be used where open cut trenching is not suitable due to the crossing width or the feature being crossed. Trenchless methods will be employed at the River Wensum and River Bure (Special Area of Conservation – SAC, Site of Special Scientific Interest – SSSI) and major infrastructure such as Network Rail to minimise the impact

to the feature being crossed. The locations of these are shown in **Appendix 1** (termed trenchless crossing techniques).

116. With trenchless methods, the depth at which the ducts are installed depends on the topology and geology at the crossing site. Typically, for a river crossing, HDD ducts would be installed 5 to 15m below the floodplain, and at least 2m below the river bed.

117. Where trenchless drilling activities are to be conducted, a temporary work area would be required to store drilling equipment, welfare facilities, ducting and water for the drilling process. The trenchless drilling compounds would typically be of dimensions 50m x 50m for the reception site and 100m x 50m on the launch site, adjacent to the onshore cable route. A temporary bridge might be included to allow continuation of the running track and allow access to both sides of the crossing. Alternatively, a stop end would be used, requiring the inclusion of a turning area for vehicles within the temporary work area.

2.3.1.3.8 Temporary construction compounds

Scenario 1

118. Under Scenario 1 no primary and secondary mobilisation areas would be required as materials will be delivered directly to jointing pits locations.

Scenario 2

119. Primary and secondary mobilisation areas would be required to store equipment and provide welfare facilities. Indicative locations for these are provided in **Appendix 1**. They would be located adjacent to the onshore cable route corridor, accessible from the local highways network suitable for the delivery of cable drums and other heavy and oversized equipment. Each mobilisation area would serve one or two work fronts and would be evenly distributed along the onshore cable route length where possible.

120. The primary mobilisation areas would typically be of 100m x 100m dimensions (or 150m x 100m if combined with a trenchless drilling compound) and the secondary mobilisation areas would be approximately 40m x 40m with specific sizing and dimensions for each location based on site constraints and land boundaries.

121. Hardstanding would likely comprise of permeable gravel aggregate, underlain by geotextile or other suitable material. Site lighting and secure fencing around the perimeter of the mobilisation area would be put in place for safety and security purposes.

122. The mobilisation areas would remain in place for the duration of the onshore duct installation activities, anticipated to be up to two years. Following installation of the ducts, the mobilisation areas would be removed and the land reinstated. During subsequent cable pull phases materials will be delivered directly to the relevant jointing pit locations.

123. The secondary mobilisation areas would serve construction crews working remotely from the primary mobilisation areas to allow close proximity to storage and welfare facilities during installation.

2.3.1.3.9 Cable route side access

124. Small temporary access routes would be required to facilitate the safe ingress and egress from the public highways to the construction locations termed side accesses. The current proposed locations for these are displayed in **Appendix 1** and would be used for the following:

- To gain access to jointing pit locations during cable pulling and jointing phase;
- To gain access to link boxes, and
- To gain access to cables to make repairs during operational phase.

125. Not all of the side accesses would be used for the all of the above a sub set would be used for each of three activities and the extent of the cable route side access would differ between scenarios as outlined below.

Scenario 1

126. Under Scenario 1 some of the side accesses to the cable route would be retained or reinstated from the Norfolk Vanguard project. For the purposes of this Method Statement the worst case scenario would be the reinstatement of these accesses. Detailed traffic and transport assessments are ongoing to refine which side accesses would need to be reinstated under Scenario 1.

Scenario 2

127. Under Scenario 2 side accesses to the cable route would need to be constructed and would be left in place for three years to provide for the cable pulling phases before being removed and land reinstated.

128. Detailed traffic and transport assessments are ongoing to identify where these side accesses are likely to be required and which would need to be retained from the duct installation process thus it is the current proposed locations which are displayed in **Appendix 1**. They link each mobilisation area and intersections between the public highway and cable route, where suitable, to facilitate side access to the running track.

2.3.1.4 Onshore Project Substation

129. The onshore project substation would consist of either an HVAC substation or HVDC substation[1], dependant on the electrical solution utilised. Only one project substation (HVAC or HVDC) would be required for Norfolk Boreas. The proposed onshore project substation location is presented in **Appendix 1**, with dimensions as detailed below.

130. The location of the onshore project substation was determined by an optioneering process which is explained in Chapter 4 site selection and alternatives of the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b).

131. The largest equipment within the HVAC onshore project substation would be the 400/220kV transformers with an approximate height of 10m, all other equipment would not exceed a height of 6m. The total land requirement for the HVAC onshore substation to the perimeter fence is 250m x 300m.

132. The largest equipment within the HVDC onshore substation would be the reactor halls with an approximate height of 19m. The tallest structure would be the lightning protection masts at a height of 25m. All other equipment would not exceed a height of 10m. The total land requirement for the HVDC onshore substation to the perimeter fence would be 250m x 300m.

133. During construction of the onshore project substation, a temporary construction compound would be established to support the works. The compound would be formed of hard standing with appropriate access to the A47 to allow the delivery and storage of large and heavy materials and assets, such as power transformers.

134. The location of the temporary construction compound has not yet been determined but will be presented within the Norfolk Boreas PEIR. The compound would be of dimensions 200m x 100m and would accommodate construction management offices, welfare facilities, car parking, workshops and storage areas.

135. The site would be stripped of soil and soil graded as required by the final design. Stripped material would be reused on site where possible as part of mitigation earthworks as allowed for in the final design. Any excess material would be disposed of at a licenced disposal site.

136. Construction activities would be conducted during working hours of 7am-7pm. Evening or weekend working might be required to maintain programme progress and for specific time critical activities such as transformer oil filling and processing;

[1] Also referred to as a HVDC converter station. For the purposes of consistency both HVAC and HVDC solutions will be referred to as the onshore project substation.

however, these would be kept to a minimum. Perimeter and site lighting would be required during the winter months and a lower level of lighting will remain overnight for security purposes.

137. The construction programme for the onshore substation is 18 months. The enabling works for the onshore project substation would differ between scenarios as outlined below:

Scenario 1

138. Under Scenario 1, a number of enabling works at the onshore project substation would be undertaken by Norfolk Vanguard. These include:

- Landscaping to reduce visual impacts;
- Access roads; and
- Site drainage infrastructure.

Scenario 2

139. Under Scenario 2, all enabling works would be undertaken by Norfolk Boreas.

2.3.1.5 Necton National Grid Substation Extension

140. The existing Necton National Grid substation would be required to be extended to accommodate the Norfolk Boreas and Norfolk Vanguard connection points. The proposed footprint of this extension is provided in Appendix 1.

141. The Necton National Grid substation accommodates the circuit breakers which are the connection points for the Norfolk Boreas and Norfolk Vanguard wind farms with associated busbar structures which allow connection onto the existing 400kV overhead line for generation to be transmitted onto the wider National Grid Electricity Transmission system. In addition to the Necton National Grid substation itself, modifications to the existing overhead lines in parallel to the substation would be required to provide a double turn-in arrangement.

Scenario 1

142. Under Scenario 1 the majority of these works would be undertaken by Norfolk Vanguard for both projects. All extension enabling works would be completed including access roads, earthworks, foundations, buildings and civil works. The Necton National Grid substation would have been extended to provide Air Insulated Switchgear (AIS) bays for Norfolk Vanguard and for Norfolk Boreas. All overhead line modification would also have been carried out under the Norfolk Vanguard project.

143. However the electrical busbar extensions and other electrical equipment required for Norfolk Boreas will be installed under the Norfolk Boreas DCO.

Scenario 2

144. Under Scenario 2 all extension works to Necton National Grid Substation and overhead line modifications would be undertaken by Norfolk Boreas. The substation extension and overhead line modification works will be conducted within the areas identified within **Appendix 1** as National Grid Overhead Line Works, National Grid substation extension and National Grid temporary works.

145. The outdoor busbar would be extended in an east and west direction to an estimated total length 340m with seven Air Insulated Switchgear (AIS) bays installed along the busbar extension for Norfolk Boreas.

146. The maximum height of the outdoor busbar and bays at the substation is estimated to be 15m. The total substation area is estimated to be 150m x 370m (inclusive of existing substation operational area).

147. Two new overhead line towers would be required in close proximity to the existing corner tower (to the north east of the existing Necton Substation) with a maximum height of 67m. The existing corner tower would be demolished and replaced by two new towers, alternatively, the existing corner tower could be modified and one new terminal tower constructed in close proximity. The design approach taken will be confirmed at detailed design phase. No additional land is anticipated for the overhead line modifications.

148. During construction of the Necton National Grid Substation, two temporary construction compounds would be established to support the works. Given project duration, the compounds would likely be tarmacked with some concrete hard standing for heavier plant and equipment. Access to the A47 would be provided utilising the existing access road to the site to permit safe delivery of plant and equipment required for construction.

149. The larger compound would be of dimensions 300m x 150m and the smaller compound 200m x 150m. The compounds would accommodate construction management offices, welfare facilities, car parking, workshops and storage areas.

150. The site would be soil stripped of soil and soil graded as required by the final design. Stripped soil and other material would be reused on site where possible as part of mitigation earthworks as allowed for in the final design. Any excess material would be disposed of at a licenced disposal site.

151. For the overhead line modifications, up to three temporary towers (maximum height 45m) would be constructed in close proximity to the existing towers and the existing circuits transferred over to the temporary towers. The existing towers would be removed and replaced with new towers, each up to 50m in height (or alternatively the existing towers would be modified if possible) and possibly with a slightly larger footprint. The circuits would then be transferred from the temporary towers which would then be removed along with their foundations.

152. It is anticipated that the footprint of the towers would be unchanged from the existing towers; however, the orientation and design of the towers may change to allow for the double turn in arrangement. These works would be undertaken within the National Grid temporary works are displayed in **Appendix 1**.

153. Construction activities would be conducted during working hours of 7am-7pm. Evening or weekend working may be required to maintain programme progress. Perimeter and site lighting would be required during working hours and a lower level of lighting would remain overnight for security purposes. Cranes, excavators and potentially piling equipment would be the main equipment required to construct the towers and extend the substation.

154. The construction programme for the Necton National Grid substation extension and overhead line modification works is 18 months and would be conducted primarily during working hours of 7am to 7pm. Further detail on construction programmes is provided below in section 2.3.2.

2.3.2 Construction Programme

155. Currently it is expected that the Norfolk Boreas project would be constructed in one, two or three phases. **Table 2.1** summarises the main construction activities and sequence associated with installation of the Norfolk Boreas project onshore infrastructure under a 'three-phased' approach (as this represents the worst-case scenario in terms of duration of impact). Separate time lines are discussed for both Scenario 1 and 2.

Table 2.1 Construction Programme

<table>
<tr><th>Date</th><th colspan="2">Scenario 1</th><th colspan="2">Scenario 2</th></tr>
<tr><td>2022</td><td colspan="2" rowspan="2"></td><td rowspan="2">Pre-construction works
Road modifications
Hedge and tree removal (season dependant)
Ecological preparations (e.g. displacement of water voles, fencing of areas for newts, etc.)
Preconstruction drainage (at cable relay station and substation locations)</td><td></td></tr>
<tr><td>2023</td><td></td></tr>
<tr><td>2024</td><td>Pre-construction works
(landfall, cable relay station and onshore project substation only)
Ecological preparations (e.g. displacement of water voles, fencing of areas for newts, etc.)
Preconstruction Drainage at cable relay station and substation locations</td><td rowspan="3">Substation and Cable Relay Station Construction
Main works (drainage, foundations and buildings)</td><td rowspan="2">Main duct installation works
Enabling works
Duct installation
Reinstatement works</td><td rowspan="2">Substation and Cable Relay Station Construction
Main works (drainage, foundations and buildings)</td></tr>
<tr><td>2025</td><td></td></tr>
<tr><td>2026</td><td></td><td rowspan="3">Cable installation
Installed in three phases (2026, 2027 & 2028)</td><td rowspan="3">Substation and Cable Relay Station Construction
Plant installation (to tie in with cable pull)</td></tr>
<tr><td>2027</td><td rowspan="3">Cable pulling
Installed in three phases (2027, 2028 & 2029)</td><td rowspan="3">Substation and Cable Relay Station Construction
Plant installation (to tie in with cable pull)</td></tr>
<tr><td>2028</td></tr>
<tr><td>2029</td><td></td><td></td></tr>
</table>

2.3.3 Operation and Maintenance (O&M) Strategy

156. The cable relay station, onshore project substation and overhead line modification area would not be manned, however access would be required periodically for routine maintenance activities, estimated at an average of one visit per week. During operation, it is not anticipated for the cable relay station and onshore substation to be illuminated under normal operating conditions. Site lighting will be provided during operations and maintenance activities only.

157. There is no ongoing requirement to maintain the onshore cables following installation. Periodic access to installed link boxes (which may be buried or above ground, see section **Error! Reference source not found.** in 2.3.1.3) may be required f or inspection, estimated to be annually. These link boxes will be accessible from ground level and will not require excavation works.

158. Access to the cable easement would be required to conduct emergency repairs if necessary.

2.3.4 Decommissioning

159. No decision has been made regarding the final decommissioning policy for the substation and cable relay station, as it is recognised that industry best practice, rules and legislation change over time. However, the substation and cable relay station equipment will likely be removed and reused or recycled. It is expected that the onshore cables will be removed from ducts and recycled, with the jointing pits and ducts left in situ. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided.

2.3.5 Cumulative Impact Scenarios

2.3.5.1 Norfolk Vanguard

160. Cumulative impacts between Norfolk Boreas and Norfolk Vanguard would only occur in Scenario 1. VWPL are seeking to minimise cumulative impacts between Norfolk Boreas and Norfolk Vanguard through the alignment of onshore cable route and the preference for Norfolk Vanguard to pre-install ducts and undertake other enabling works for Norfolk Boreas. Cumulative impacts between the two sister projects will be assessed within the main assessment of the Norfolk Boreas EIA.

2.3.5.2 Other projects

161. The assessment would consider the potential for significant cumulative impacts to arise as a result of the construction, operation and decommissioning of Norfolk

Boreas in the context of other developments that are existing, under construction, consented or at application stage.

162. Potential projects may include offshore wind farms, coastal defence projects (such as the Bacton landscaping scheme) road or large infrastructure projects (including the dualling of the A47, Sizewell Nuclear Power Station and the Norwich Northern Distributor Road) which have a potential to act together with the construction, operation or decommissioning phases of Norfolk Boreas in a cumulative way.

163. In particular, VWPL are committed to working with Ørsted Energy on identifying the potential interactions between the Norfolk Boreas and Norfolk Vanguard onshore cable corridor with the Hornsea Project 3 Offshore Wind Farm onshore cable route, and assessing and mitigating any potential cumulative effects.

164. Construction and commissioning of the substation for the Dudgeon Offshore Wind Farm is complete and operation is due to commence in 2017. The cumulative impacts during construction are therefore likely to be minimal, however this will be considered further in the CIA.

165. CIA screening will be undertaken in consultation with stakeholders. This will be based on the preliminary list of projects with potential relevance to the CIA presented in Norfolk Vanguard PEIR and in **Table 2.** below (albeit with Norfolk Boreas removed). Norfolk Vanguard has not been included as under Scenario 1 it would be operational and therefore form part of the baseline assessment and in Scenario 2 it will not exist. It is proposed that all projects with potential relevance to the CIA be considered through a preliminary assessment that would be presented in an appendix to the LVIA chapter.

Table 2.2 Summary of projects considered for the CIA in relation to landscape and visual receptors

Project	Status	Development period	Distance from Norfolk Vanguard project (km)	Project definition	Project data status	Included in CIA	Rationale
Hornsea Project Three Offshore Wind Farm	Pre-Application	Expected construction date 2021	32km between substation locations	High	Full PEIR available: http://www.dongenergy.co.uk/en/Pages/PEIR-Documents.aspx	No	The onshore components of Hornsea Project Three Offshore Wind Farm would be sited in distant locations from Norfolk Boreas onshore components with exception of where onshore cable corridors cross.
Dudgeon Offshore Wind Farm	Operation due to commence 2017	Construction completed.	0	Complete/ high	Approved PDS available	No (considered in main assessment)	National Grid substation extension sited adjacent to Dudgeon Substation.
Bacton Gas Terminal Extension	Approved	Approved 20/09/2016. Expires 20/09/2019.	3.1	Complete/ high	Approved PDS available	No	Bacton Gas Terminal Extension would have a limited influence on the cumulative situation owing to existing influence from Bacton Gas Terminal and relative scale of extension.
Bacton Gas Terminal coastal protection	Approved	Approved 18/11/2016. Expires 18/11/2019.	1	Complete/ high	Approved PDS available	No	Bacton Gas Terminal coastal protection would have a limited influence on the cumulative situation in respect of landscape and visual effects.
Bacton Coastal Protection Scheme	Approved	Expected construction date 2018	1	Complete/ high	Approved PDS available	No	Bacton Coastal Protection Scheme would have a limited influence on the cumulative situation in respect of landscape and visual effects.

3 BASELINE ENVIRONMENT

3.1 Desk Based Review

166. The desk based review for Norfolk Vanguard has involved collating data on landscape character, landscape designations, settlements, Public Rights of Way (PRoW), other walking and cycling routes, and visitor attractions. This information is relevant to the desk based review for Norfolk Boreas.

167. The extent of the study area means that data has been obtained from Norfolk County Council and North Norfolk, Broadland and Breckland District Councils.

168. All relevant data and feedback from Norfolk Vanguard will be included when characterising the baseline environment for the Norfolk Boreas Environmental Statement (ES). This will be augmented and updated with new data and information through the EPP, ETG and other relevant sources.

3.1.1 Available Data

169. The data on landscape character is produced by, or on behalf of, the Local Planning Authorities in accordance with guidance set out in 'An Approach to Landscape Character Assessment' (2014).

170. Landscape Character Assessments are produced at the national level by Natural England and at the local level by the relevant County or District Council. These publications categorise the landscape into Landscape Character Types; areas which share a distinct and recognisable set of characteristics and pattern of components.

171. At a national level, Natural England has classified the English landscape into National Character Areas (NCA), each of which presents characteristics which make it distinct from the other NCAs. This information is documented in the National Character Areas Study and is useful as a background reference to the assessment.

172. The relevant Landscape Character Assessments (LCAs) which cover the onshore study area are listed below and shown on **Figures 5 to 9**.

- North Norfolk Landscape Character Assessment (2009);
- Broadland Landscape Character Assessment (2013); and
- Breckland Landscape Character Assessment (2007).

173. These LCAs classify the different landscape character types in each area. This information will be used as the basis of the assessment of effects on landscape character, supplemented with information collected during study area reconnaissance.

3.1.2 Designated sites

174. There are three types of landscape designation which are of relevance to the LVIA, listed below and shown on **Figures 5 to 9**.

- Areas of Outstanding National Beauty (AONBs);
- National Parks (NPs); and
- Registered Parks and Gardens.

175. AONBs are designated by Natural England and collectively represented by the National Association for AONBs. In general, they remain the responsibility of the local authority by means of a special committee and a dedicated AONB Officer. Their purpose is to conserve and enhance the natural beauty of the landscape. National Planning Policy Framework NPPF (2012) states that AONBs have the same status as NPs in the planning system when it comes to landscape issues. Management plans set out the key issues and strategy for conservation and enhancement.

176. The Norfolk Coast AONB is the only AONB within the vicinity of the proposed project. On **Figure 5** it can be seen to the north of the landfall compound zone, outwith the study area, although partly within the edge of the 3km contextual area. The 2014-2019 Norfolk Coast AONB Management Plan sets out the special qualities of this area, along with the strategy for its protection. The potential impacts on the Norfolk Coast AONB will be considered in the assessment.

177. National Parks (NPs) are managed by National Park Authorities whose role is to carry out the two main objectives:

- To conserve and enhance the natural beauty, wildlife and cultural heritage of the area; and
- To promote opportunities for the understanding and enjoyment of the parks' special qualities by the public.

178. The only NP in the vicinity of the proposed project is The Broads, which lies to the south of the landfall compound zone and onshore cable corridor. On **Figure 5** it can be seen to lie outwith the study area and mostly outwith the 3km contextual area, with the exception of the northern extension along the Hundred Stream to the south of Riddlington Street. The Broads differs from the other NPs in that it was set up by the separately constituted Broads Authority enabled by a special act of parliament. It differs most notably from the other NPs in that its primary statutory objective is to deal with navigation of the waterways rather than conservation of the landscape. The potential impacts on landscape and visual amenity of The Broads NP will be considered in the assessment.

179. The Register of Parks and Gardens is compiled and managed by Historic England. It presents an inventory of all the protected sites in England and Wales. These are considered to be of national significance, and most are associated with stately homes, although many parks or cemeteries are also listed.

180. There are two registered Parks and Gardens in the study area associated with the landfall compound zone and cable relay station search zone, and none in the study area associated with the onshore project substation. The potential impacts on the registered Parks and Gardens will be considered in the assessment.

3.2 Planned Data Collection

181. Planned data collection would include the collection of the following data presented in **Table 3.1.** This is in addition that which is described in section 1.2.5.

Table 3.1 Data sources

Data	Year	Coverage	Data Confidence	Notes
Ordnance Survey 25,000 Raster from Vattenfall	2016	Mapping information	High	N/A
Ordnance Survey 250,000 Raster from OS OPEN data	2016	Mapping information	High	N/A
Ordnance Survey Mastermap from RHDHV	2017	Mapping information	High	N/A
APEM Aerial Imagery	2017	Aerial imagery	High	N/A
LIDAR	2017	Light detection and ranging	High	N/A
North Norfolk Landscape Character Assessment	2009	Classification of North Norfolk landscape into character types	High	Based on Countryside Agency Guidelines
Broadland Landscape Character Assessment	2013	Classification of Broadland landscape into character types	High	Based on Natural England Guidelines
Breckland Landscape Character Assessment	2007	Classification of Breckland landscape into character types	High	Based on Countryside Agency Guidelines
Norfolk Coast AONB	2016	Identification of a landscape of national importance	High	Data downloaded from Natural England
The Broads National Park	2016	Identification of a landscape of national importance	High	Data downloaded from Natural England
Register of Historic Parks and Gardens	2016	Listing of protected Historic Parks and	High	Designation undertaken by Historic England with

Data	Year	Coverage	Data Confidence	Notes
		Gardens in England		process set out on website
Norfolk Vanguard Scoping Report and Consultation Comments	2016	Defining scope of Norfolk Vanguard project	High	Feedback provided by statutory and other consultees on scope of EA.
Consultation with Norfolk County Council	Ongoing	Agreement on issues relevant to Norfolk Vanguard project LVIA	High	Consultation of issues relevant to LVIA with council officers
Guidelines for Landscape and Visual Impact Assessment	2013	Accepted guidance for the production of LVIA	High	Guidelines setting out methodology and approach for LVIA

4 IMPACT ASSESSMENT METHODOLOGY

4.1 Defining Impact Significance

182. The LVIA assesses the potential impacts of Norfolk Boreas on landscape elements, landscape character and visual receptors around the study area. This includes the impacts of the onshore components of the landfall, cable relay station, onshore cable route, onshore project substation, National Grid substation extension, overhead line modification and other associated infrastructure.

183. The assessment will be carried out using a methodology specifically devised by Optimised environments ltd (OPEN) for the landscape and visual assessment of energy developments. This methodology generally accords with GLVIA 3. Where it diverges from specific aspects of the guidance, in a small number of areas, reasoned professional justification for this is provided as follows.

184. GLVIA 3 sets out an approach to the assessment of magnitude of change in which three separate considerations are combined within the magnitude of change rating. These are the size or scale of the impact, its geographical extent and its duration and reversibility. This approach is to be applied in respect of both landscape and visual receptors with reference made in paragraphs 5.48, 5.50 - 5.52, 6.38 and 6.40 - 6.41 of GLVIA 3.

185. OPEN considers that the process of combining all three considerations in one rating can distort the aim of identifying significant impacts of large scale development. For example, an increased magnitude of change, based on size or scale, may be reduced to a lower rating if it occurred in a localised area and for a short duration. This might mean that a potentially significant impact would be overlooked if impacts are diluted down due to their limited geographical extent and/or duration or reversibility. Conversely, a low magnitude of change, based on size or scale, may be increased to a higher rating if it occurred across a wider area or for a longer duration, giving rise to a significant impact despite the inherently low magnitude of change.

186. OPEN has chosen to keep these three considerations separate, by basing the magnitude of change on size or scale to determine where significant and not significant impacts occur, and then describing the geographical extent of these impacts and their duration and reversibility separately.

187. The remainder of this section provides a summary of the specific methodology to be used for the Norfolk Boreas assessment.

4.1.1 Impact category

188. The potential impacts of Norfolk Boreas on the landscape and visual resource are grouped into four categories:

- physical effects,
- effects on landscape character,
- effects on views, and
- cumulative effects.

4.1.1.1 Physical Effects

189. Physical effects are restricted to the area within the site boundary, and are the direct effects on the fabric of the site, such as the removal or addition of trees and alteration to ground cover. The receptors in this case are landscape elements.

4.1.1.2 Effects on Landscape Character

190. Effects on landscape character arise either through the introduction of new elements that physically alter the pattern of elements that makes up landscape character, or through visibility of the project, which may alter the way in which the pattern of elements is perceived. The receptors in this case are landscape character receptors, which are landscape character types and designated landscapes.

4.1.1.3 Cumulative Effects

191. Cumulative effects arise where the study areas for two or more developments overlap so that both developments are experienced at proximity where they may have an incremental effect, or where developments may combine to have a sequential effect, irrespective of any overlap in visibility.

192. The CIA will focus on the most relevant cumulative sites as recommended in the Planning Inspectorate's advice note nine: Rochdale Envelope (2011). **Table 2.2** presents those projects that will be considered in the CIA. Further information on cumulative effects is presented in section 4.2.

4.1.1.3.1 Onshore Project Substation

Scenario 1

193. Under this scenario the cumulative developments of particular relevance to the onshore project substation would include the consented Norfolk Vanguard substation and the extension works to the National Grid substation extension covered by the Norfolk Vanguard DCO application. In combination with the onshore project substation and the extended National Grid Substation, these developments

have the potential to form a 'cluster' to the south of the A47. As it is assumed these would be an operational part of the baseline, the effects will be assessed in the main assessment (rather than the CIA).

Scenario 2

194. There would be no Norfolk Vanguard project substation and therefore there would be no cumulative effects in respect of this project under this scenario.

4.1.1.3.2 Cable Relay Station

Scenario 1

195. The cumulative development of particular relevance to the cable relay station search zones would be the operational Norfolk Vanguard cable relay station 5a or 6a.

Scenario 2

196. There would be no Norfolk Vanguard cable relay station and therefore there would be no cumulative effects in respect of this project under this scenario.

4.1.2 Sensitivity

197. Sensitivity is the ability of the landscape or visual receptor to accommodate the proposed project. The sensitivity of a landscape or visual receptor is evaluated as high, medium-high, medium, medium-low or low. It is determined by a combination of the value of the receptor and the susceptibility of the receptor to the change that Norfolk Boreas would have on the landscape element, landscape character or the view. The criteria used to assess value and susceptibility in respect of landscape and visual receptors differs as described below. The basis for the assessments is made clear using evidence and professional judgement in the evaluation of each receptor.

4.1.3 Value

198. The value of a landscape element is a reflection of its importance in the pattern of elements which constitute the landscape character of the area. If a landscape element is rare, its value is likely to be increased.

199. The value of a landscape character receptor is determined through its importance in terms of any designations that may apply, as well as its scenic quality, sense of place, rarity and representativeness. The value is also determined by the experience of the landscape in relation to perceptual responses, cultural associations, its iconic status, its recreational value, and the contribution of other values such as nature conservation or archaeology.

200. The value of a view reflects the recognition and importance attached either formally through identification on mapping or being subject to planning designations, or informally through the value which society attaches to the landscape or view(s).

201. The value of the landscape or visual receptor is evaluated as high, medium-high, medium, medium-low or low. The basis for the assessments is made clear using evidence and professional judgement in the evaluation of each receptor.

202. Example definitions of the value levels for a generic receptor are given in **Table 4.1** below.

Table 4.1 Definitions of value levels for landscape and visual receptors

Value	Definition
High	Landscape or visual receptor regarded to be of high importance owing to the quality of the landscape or view and the recognition of this through national or regional designation or other formal status, such as it being identified on an OS plan.
Medium	Landscape or visual receptor regarded to be of medium importance owing to the quality of the landscape or view and the recognition of this through local designation or recognised local value.
Low	Landscape or visual receptor with limited importance owing to absence of designations or formal status and limited local value.
Negligible	Landscape or visual receptor not regarded to be of particular importance.

4.1.4 Susceptibility

203. Susceptibility, in respect of the LVIA, relates to the ability of the landscape or visual receptor to accommodate the changes that would occur as a result of the addition of Norfolk Boreas to the baseline situation.

204. The susceptibility of a landscape element is a reflection of the degree to which the element can be restored, replaced or substituted.

205. In respect of landscape receptors, considerations include the specific nature of the project, its size, scale, location, context and characteristics, the degree to which the receptor may accommodate the influence of Norfolk Boreas and the extent to which it would influence the character of the landscape receptors across the study area.

206. In respect of visual receptors, considerations include the nature of the viewer experiencing the view and how susceptible they are to the potential effects of Norfolk Boreas. Professional judgement is used based on the occupation or activity which viewers are engaged in at the viewpoint or series of viewpoints, the principal visual characteristics: those features which define the view, and the experience of the visual receptor in relation to the extent to which their focus is directed towards

the view, the duration and clarity of the view and whether it is a static or transitory view.

207. The susceptibility of the landscape or visual receptor is evaluated as high, medium-high, medium, medium-low or low. The basis for the assessments is made clear using evidence and professional judgement in the evaluation of each receptor. Example definitions of the susceptibility levels for a generic receptor are given in **Table 4.2** below.

Table 4.2 Definitions of susceptibility levels for landscape and visual receptors

Susceptibility	Definition
High	Landscape or visual receptor has very limited capacity to accommodate the changes associated with Norfolk Boreas.
Medium	Landscape or visual receptor has limited capacity to accommodate the changes associated with Norfolk Boreas.
Low	Landscape or visual receptor has some capacity to accommodate the changes associated with Norfolk Boreas.
Negligible	Landscape or visual receptor generally has capacity to accommodate the changes associated with Norfolk Boreas.

4.1.5 Magnitude

208. The magnitude of change, in respect of the LVIA, differs in respect of landscape and visual receptors. The differences are set out below.

209. The magnitude of change on landscape character receptors is an expression of the scale of the change that would result from Norfolk Boreas, and is dependent on variables relating to the size or scale of the change and its geographical extent.

210. The basis for the appraised level is made clear using evidence and professional judgement, based on the following criteria:

- The extent of existing landscape elements that would be lost, the proportion of the total this represents and the contribution of that element to the character of the landscape;
- The degree to which the pattern of elements that makes up the landscape character would be altered by Norfolk Boreas, by removal or addition of elements in the landscape;
- The extent to which the effects change the key characteristics of the landscape, identified in the baseline study, which may be critical to the distinctive character of the landscape receptor being assessed;

- The distance between the landscape character receptor and Norfolk Boreas. Generally, the greater the distance, the lower the scale of change; and
- The proportion of the- project that would be seen.

211. The geographic area over which landscape effects would be experienced is defined separately in the assessment. It is used to explain the extent of the landscape over which a certain magnitude of change would be experienced.

212. The duration and reversibility of the change to landscape receptors, are also considered separately, and are categorised as short, medium or long term, and reversible or irreversible. Short term is defined as 0 to 2 years, medium term as 3 to 5 years, and long term as 5 years and more.

213. **Table 4.3** summarises the definitions of magnitude that have been used for the landscape receptors.

Table 4.3 Definitions of magnitude levels for landscape receptors

Magnitude	Definition
High	A major alteration to the baseline characteristics, providing the prevailing influence and/or introducing elements that are substantially uncharacteristic in the receiving landscape.
Medium	A moderate alteration to the baseline characteristics, providing a readily apparent influence and/or introducing elements that may be prominent or uncharacteristic in the receiving landscape.
Low	A minor alteration to the baseline characteristics, providing a slightly apparent influence and/or introducing elements that are characteristic in the receiving landscape.
Negligible	A negligible alteration to the baseline characteristics, providing a barely discernible influence and/or introducing elements that are substantially characteristic in the receiving landscape.

214. Intermediate levels may also be included such as medium-high or medium-low, where the change falls between the definitions.

215. The magnitude of effect on views is made clear using evidence and professional judgement, based on the following criteria:

- The distance between the visual receptor and Norfolk Boreas; generally, the greater the distance, the lower the magnitude of effect;
- The scale and character of the context within which Norfolk Boreas would be seen, as this would determine the degree to which Norfolk Boreas can be accommodated in the existing outlook. The scale of the landform/buildings and the patterns of the landscape, the existing land use and vegetation cover,

and the type and form of development seen in the baseline view would all be relevant;

- The extent of Norfolk Boreas that would be seen. Visibility of Norfolk Boreas may range from the full height of the buildings to just the upper parts;
- The position of Norfolk Boreas in relation to the principal orientation of the receptor. If Norfolk Boreas is seen in a specific, directional vista from a receptor the magnitude of effect would generally be greater; and
- The width of the view available and the proportion of the view that is affected by Norfolk Boreas. Generally, the more of a view that is affected, the higher the magnitude of effect.

216. The geographic area over which landscape effects would be experienced is defined separately in the assessment. It is used to explain the extent of the landscape over which a certain magnitude of change would be experienced.

217. The duration and reversibility of the change to landscape receptors, are also considered separately, and are categorised as very short, short, medium or long term, and reversible or irreversible. Short term is defined as 0-2 years, medium term as 3-5 years, and long term as 5 years and more.

218. Levels of magnitude of effect for visual receptors are defined in **Table 4.4** below.

219. Intermediate levels may also be included such as medium-high or medium-low, where the change falls between the definitions.

Table 4.4 Definitions of magnitude levels for visual receptors

Magnitude	Definition
High	A major alteration to the baseline view, providing the prevailing influence and/or introducing elements that are substantially uncharacteristic in the view.
Medium	A moderate alteration to the baseline view, providing a readily apparent influence and/or introducing elements that may be prominent or uncharacteristic in the view.
Low	A minor alteration to the baseline view, providing a slightly apparent influence and/or introducing elements that are characteristic in the view.
Negligible	A negligible alteration to the baseline view, providing a barely discernible influence and/or introducing elements that are substantially characteristic in the view.

4.1.6 Impact significance

220. The broad objective in assessing the effects is to determine, as required by the EIA Regulations, what the predicted significant effects of Norfolk Boreas on the landscape and visual resource will be. In the LVIA, effects will be assessed to be either significant or not significant.

221. The significance of effects is assessed through a combination of two considerations; (i) the sensitivity of the landscape element, landscape character receptor, view or visual receptor, and (ii) the magnitude of change that will result from the introduction of Norfolk Boreas.

222. OPEN's methodology for assessing energy developments is not reliant on the use of a matrix to determine the significance of landscape and visual effects, nor does it define levels of significance. It is, however, considered useful to include a matrix in the methodology to illustrate how combinations of sensitivity and magnitude of change can give rise to a significant effect and to provide an understanding as to the threshold at which significant effects may arise. **Table 4.5** below provides this illustration.

Table 4.5 Impact significance matrix

Sensitivity	Magnitude of change					
	High	Medium/ High	Medium	Medium/ Low	Low	Negligible
High	*Significant*	*Significant*	*Significant*	*Significant/Not significant*	*Not significant*	*Not significant*
Medium/ High	*Significant*	*Significant*	*Significant/Not significant*	*Significant/Not significant*	*Not significant*	*Not significant*
Medium	*Significant*	*Significant/Not significant*	*Significant/Not significant*	*Not significant*	*Not significant*	*Not significant*
Medium/ Low	*Significant/Not significant*	*Significant/Not significant*	*Not significant*	*Not significant*	*Not significant*	*Not significant*
Low	*Significant/Not significant*	*Not significant*	*Not significant*	*Not significant*	*Not significant*	*Not significant*

223. Effects that are assessed within the red boxes in the matrix are assessed to be significant in terms of the requirements of the EIA Regulations. Those effects that are assessed within the yellow boxes may be **significant**, or **not significant**, depending on the specific factors and effect that is assessed in respect of a particular landscape or visual receptor. Those effects that are assessed within the white boxes are assessed to be not significant. In accordance with GLVIA3, experienced professional judgement is applied to the assessment of all effects and reasoned argument is presented in respect of the findings in each case.

224. Definitions of significance are presented in **Table 4.6** below.

Table 4.6 Impact significance definitions

Impact Significance	Definition
Significant	A significant impact would occur where the project has a defining impact on the landscape receptor or visual receptor.
Not significant	An impact is not significant where the project does not have a defining impact on the landscape receptor or visual receptor.
No change	No change occurs where the project has no impact on the landscape receptor or visual receptor.

225. Embedded mitigation would be developed as part of the overall proposal through the final site selection for the cable relay station, detailed positioning of all onshore infrastructure and detailed design of components where possible. The iterative design process has involved the consideration of the sensitivity of the landscape and visual receptors with the aim to mitigate the effects on those more sensitive receptors, especially where visual amenity of residents is a concern.

4.1.7 Nature of effect

226. The landscape and visual appraisal will identify 'beneficial', 'neutral' and 'adverse' effects by considering these under the term 'nature of effect'. The nature of effect is defined in relation to specific definitions for beneficial, neutral or adverse effects as follows:

227. Beneficial effects contribute to the landscape and visual resource through the enhancement of desirable characteristics or the introduction of new, positive attributes. The removal of undesirable existing elements or characteristics can also be beneficial, as can their replacement with more appropriate components;

228. Neutral effects occur where Norfolk Boreas neither contributes to nor detracts from the landscape and visual resource or where the effects are so limited that the change is hardly noticeable. A change to the landscape and visual resource is not considered to be adverse simply because it constitutes an alteration to the existing situation. Neutral effects may arise where the effect of Norfolk Boreas is neither overtly beneficial or adverse, where it achieves a suitable relationship with the landscape or view, all things considered; and

229. Adverse effects are those that detract from or weaken the landscape and visual resource through the introduction of elements that contrast with the existing characteristics of the landscape and visual resource, or through the removal of elements that are key in its characterisation.

230. Judgements on the nature of effect are based on professional experience and reasoned opinion informed by best practice guidance. The nature of effects relating to the landscape and visual impacts of Norfolk Boreas would be likely to be adverse. This is to be assumed unless otherwise stated in the assessment.

4.2 Cumulative Impact Assessment

231. The objective of the CIA for the LVIA is to describe, visually represent and assess the ways in which Norfolk Boreas would have additional impacts when considered together with other existing, consented or proposed energy developments and to identify related significant cumulative impacts arising as a result of the addition of Norfolk Boreas. **Table 2.2** provides a list of all projects which are currently proposed to be considered within the CIA. The guiding principle in preparing the CIA is to '*focus on the likely significant impacts and in particular those which are likely to influence the outcome of the consenting process*', in accordance with Scottish Natural Heritage (SNH) guidance.

232. Potential cumulative impacts are most likely to relate to the Norfolk Vanguard cable relay station options, Norfolk Vanguard onshore project substation, and National Grid substation extension works associated with the Norfolk Vanguard DCO application, although as it is assumed under Scenario 1, that these onshore components will be operational as part of the baseline, the assessment of cumulative effects will, therefore, be covered in the main assessment. In respect of Scenario 2 there will be no cumulative effect with Norfolk Vanguard as in this Scenario it will not have been consented.

4.3 Inter-topic Relationships

233. The LVIA for the PEIR will be progressed in parallel with the PEIR chapters on Ecology and Cultural Heritage. The overlap in respect of ecology will relate primarily to the removal and reinstatement of agricultural land, hedgerows and trees on the sites of the onshore infrastructure, as well as the mitigation planting, specifically associated with the cable relay station, onshore project substation and National Grid substation. The overlap in respect of cultural heritage will relate primarily to effects on the historic landscape, and in particular, the landscape setting of cultural heritage assets. These three PEIR chapters will include appropriate cross referencing between them.

5 POTENTIAL IMPACTS

5.1 Potential Impacts during construction

234. The LVIA for Norfolk Boreas will consider two Scenarios for construction, as described in detail in section 2.

235. In Scenario 1, Norfolk Vanguard consents and constructs transmission infrastructure which would be used by Norfolk Boreas. In Scenario 2, Norfolk Vanguard is not constructed and therefore Norfolk Boreas will seek to consent and construct all required project infrastructure. In Scenario 1, Norfolk Vanguard forms part of the baseline to the assessment of Norfolk Boreas, whilst in Scenario 2 it does not. These two different Scenarios will give rise to different potential impacts and different effects on landscape and visual receptors.

236. It is anticipated that Scenario 1 will generally have a lesser impact on landscape and visual receptors than Scenario 2 and, therefore, will give rise to comparatively fewer significant effects than Scenario 2. In Scenario 1, as some of the transmission infrastructure to be used for Norfolk Boreas would already be constructed by Norfolk Vanguard, the potential impacts would be reduced in the following ways;

- The reduction in construction works as a result of no open-cut trenching being required for the onshore cable route.
- The reduction in construction works as a result of no access routes being required into jointing pits along the onshore cable route.
- The reduction in the construction works as a result of reduced works being required for the National Grid substation extension and no modification of the overhead lines being required.
- Mitigation planting and earthworks would be implemented through Norfolk Vanguard in advance of Norfolk Boreas construction, such that this would be advanced planting that would help screen the construction and operational phases of Norfolk Boreas.

237. In Scenario 1, there would be a cumulative effect, but it would be addressed in the main assessment, as the assumption would be that the consented Norfolk Vanguard would be operational and, therefore, form part of the baseline. In Scenario 2, as Norfolk Vanguard would not be consented and therefore not be operational, then it would not form part of the cumulative assessment.

238. The other options which have a bearing on the LVIA include considering the potential impacts of two different electrical solutions, the option of two different cable relay station search zones, landfall compound zone and a 200m wide onshore cable corridor within which the onshore cable route will be located.

239. The LVIA assesses two electrical solutions for the project, HVAC and HVDC. Only one of these solutions will be taken forward in the final design but this will not be determined until post-consent. The two different solutions have different requirements in respect of most of components of the onshore infrastructure, with the exception of the National Grid substation extension and overhead line modification, which would be the same for both HVAC and HVDC solutions.

240. The worst case scenario is considered in the LVIA and for some components this relates to the HVAC solution, while for others it relates to the HVDC solution.

- The HVAC solution for the landfall and onshore cable route would give rise to a greater impact because it would require a wider easement;
- The HVAC solution for the cable relay station would give rise to a greater impact because a cable relay station would not be required under the HVDC solution;
- The HVDC solution for the onshore project substation would give rise to a greater impact than the solution for the HVAC solution, because the structures would be taller;

241. There are currently two options for the location of the cable relay station search zones, referred to as cable relay station 5a and 6a (see **Appendix 1** for their locations). It is anticipated that only one site will be taken forward for PEI.

242. The landfall compound zone and an onshore cable corridor will be considered in the LVIA, despite both these areas being larger than technically required. The impacts of these onshore components will be assessed with the understanding that the final footprint may be placed anywhere within these areas.

5.1.1 Impact: Landscape and Visual Impacts at Landfall

Scenario 2

243. Under Scenario 2 all works will be undertaken by Norfolk Boreas, including enabling works, installation ducts, transition pits and HDD compounds. The impact of the landfall during the construction phase would relate principally to the following features of the construction process:

- The effect on the landscape element of agricultural land owing to up to six 3,000m^2 surfaced compound, the 6 x 150m^2 (15m x 10m) transition jointing pits and the temporary access road connecting to the B1159.
- The effect on the landscape elements of coastal cliffs and beach owing to the construction of access onto the beach and the activity of 4 x 4 construction vehicles accessing the beach.

- The effect on landscape character and visual amenity owing to the construction associated with the access road, compound, six transition pits, installation of the ducts and pulling through of cables.
- The effect on landscape character and visual amenity owing to the presence of the surfaced and fenced compound, security and task lighting, and the presence of the drilling rig, ducting materials and welfare facilities.
- The effect on the visual amenity of walkers on the coastal path owing to the concentration of construction vessels close to the shore.
- The duration of a 30 week construction period.
- The reinstatement of ground at the construction compound, transition pits, onshore cable corridor and access road at the end of the construction period.

Scenario 1

244. In Scenario 1, enabling works undertaken by Norfolk Vanguard would include the construction of access roads and site drainage infrastructure associated with the landfall. Norfolk Boreas will undertake the installation of ducts, transition pits and HDD compounds.

245. Under Scenario 1 the impact of the landfall during the construction phase would include all the features of the construction process listed above, with the exception of the following:

- There would be no loss of agricultural land owing to the construction of the temporary access road connecting to the B1159, as this would already be in place.
- There would be no effect on the landscape elements of coastal cliffs and beach owing to the construction of access onto the beach, as this would already be in place.

5.1.1.1 Approach to assessment

246. The potential effects of the landfall construction on landscape and visual receptors will be assessed in respect of Scenario 1 and Scenario 2 (as set out above). The impacts associated with Scenario 1 would be notably reduced by the enabling works carried out under the Norfolk Vanguard DCO. As the preferred location has not yet been identified, the LVIA will consider the effects of constructing the landfall within the extent of the landfall search area at Happisburgh South. It is anticipated that the landfall area will be refined for PEIR but a defined site may not be available.

247. The receptors that will be assessed under both Scenarios include the following;

- The landscape elements of agricultural land, cliffs and beach;

- The landscape character of the *Bacton to Sea Palling* Landscape Character Unit (LCU) of the *Coastal Plain* Landscape Character Type (LCT) and Happisburgh Manor designed landscape.
- The visual amenity of walkers on the Norfolk Coast Path, Public Right of Way (PRoW) Happisburgh RB22 and Happisburgh beach, and residents in Happisburgh and Eccles-on-Sea.

248. The value of the landscape and visual receptors combined with their susceptibility to the proposed development would be assessed to determine the overall sensitivity.

249. Assessment will be made on site to determine the magnitude of change, considering the size and extent of the layout and the construction processes that would be undertaken. Mapping showing the extent and layout of the landfall components, associated construction compound and access roads, would be considered on site to understand the potential magnitude of the influence on each landscape and visual receptor, considering the screening effect of existing built form, landform, vegetation and any proposed mitigation planting. This would be combined with the rating for sensitivity to determine the significance of the effect on each receptor.

5.1.2 Impact: Cable Relay Station

250. The cable relay station would be required only if the HVAC solution were selected. It would be located in the rural landscape to the west of the landfall. While the intention is to take only one site forward for PEIR and DCO application, the two potential cable relay station search zones will be considered until this decision is made (**Appendix 1**).

Scenario 2

251. In Scenario 2 all construction works will be undertaken at the cable relay station by Norfolk Boreas including; enabling works, SUDs, mitigation planting and earthworks, construction of the cable relay station and associated control building and parking.

252. Under Scenario 2 the impact of the landfall during the construction phase would relate principally to the following features of the construction process:

- The effect of the loss of agricultural land owing to the instalment of the 1,500m^2 (100m x 150m) construction compound, 9,885m^2 (73m x 135m) cable relay station, 558m^2 (31m x 18m) control building and parking site, and access roads.
- The effect on landscape character and visual amenity owing to the construction of the fenced and surfaced compound, the cable relay station, control building and parking, and access roads.

- The effect on landscape character and visual amenity owing to the construction of the compound, plant, materials and welfare facilities.
- The effect on landscape character and visual amenity owing to the presence of the compound with plant, materials and welfare facilities, emerging cable relay station with electrical infrastructure up to 8m in height and the control building and parking.
- The duration of an 18 month construction period.
- The reinstatement of ground at the compound, onshore cable route and access roads, reinstatement of hedgerow and trees, at the end of construction and implementation of mitigation planting and earthworks.

Scenario 1

253. In Scenario 1, at the cable relay station the enabling works undertaken by Norfolk Vanguard would include the construction of access roads, construction compound, SUDs and mitigation planting and earthworks. Therefore, no enabling works would be undertaken by Norfolk Boreas.

254. Under Scenario 1 the impact of the landfall during the construction phase would include all the features of the construction process listed above, with the exception of the following:

- There would be no loss of agricultural land owing to the instalment of the 1,500m^2 (100m x 150m) construction compound and access road, as these would already be in place.
- There would be no loss of hedgerows and trees owing to the excavation of the onshore cable routes where they access and egress the cable relay station, as these would already be removed.
- The effect on landscape character and visual amenity owing to the activity associated with the construction of the compound and access road, as this would already have been constructed.

5.1.2.1 Approach to assessment

255. The potential effects of the cable route construction on landscape and visual receptors will be assessed in respect of Scenario 1 and Scenario 2. The impacts associated with Scenario 1 would be notably reduced by the enabling works carried out under the Norfolk Vanguard DCO. As the preferred site has not yet been selected, the assessment will consider the effects of the two options for the cable relay station search zones (cable relay station 5a and 6a **Appendix 1).** It is anticipated that a single site will be taken forward for PEIR.

256. The receptors that will be assessed under both Scenarios for cable relay station 5a include the following;

- The landscape elements of the agricultural land and hedgerows;
- The landscape character of the *Bacton to Sea Palling* Landscape Character Unit (LCU) of the *Coastal Plain* Landscape Character Type (LCT).
- The visual amenity of walkers on PRoWs Happisburgh FP14 and Witton FP5, road-users on the B1159, Happisburgh Road, Nash's Lane and Ridlington Street and residents of Ridlington, Ridlington Street and Carrside.

257. The receptors that will be assessed under both Scenarios for cable relay station 6a include the following;

- The landscape elements of the agricultural land and hedgerows;
- The landscape character of the Bacton to Sea Palling LCU of the Coastal Plain LCT and the Stalham LCU of the Low Plains Farmland LCT:
- The visual amenity of walkers on PRoWs East Ruston BR35, road-users on the B1159, Nash's Lane and Old School Road, and residents of Fox Hill.

258. Assessment will be made on site to determine the potential impact of the two cable relay station search zones, considering the location of each layout, its size and extent and the construction processes that would be undertaken. Mapping showing the extent and layout of the cable relay station would be considered on site, along with initial visualisations and ZTVs (shown on Figures 1 to 4) using the maximum parameters of the electrical equipment. This information would be used to understand the potential magnitude of the influence on each landscape and visual receptor, considering the screening effect of existing built form, landform, vegetation and any proposed mitigation planting. This would be combined with the rating for sensitivity to determine the significance of the effect on each receptor.

5.1.3 Impact: Onshore Cable Route

Scenario 2

259. In Scenario 2, ducts would need to be installed using mostly open-cut trenching along the length of the onshore cable corridor from landfall to onshore project substation with some use of trenchless crossings in more environmentally sensitive or technically difficult sections. Scenario 2 would also require the construction of jointing pits, access roads, running tracks, construction compounds and trenchless crossings. Primary and secondary mobilisation areas would be constructed at intervals to service the construction process. While these would largely comprise an open area of hardstanding, there would also be welfare buildings, storage of materials and topsoil and containment by 2.4m high perimeter fencing.

Construction activity would not occur continuously along the length of the onshore cable route, but would move along sections as stages of laying and pulling through were completed. Access roads from the existing road network into the mobilisation areas would be required and a running track along the length of the onshore cable route would be constructed to provide access during the construction phase.

260. Under Scenario 2 the impact of the onshore cable route during the construction phase would relate principally to the following features of the construction process:

- The effect on agricultural land and hedgerows owing to the excavation of the onshore cable route, construction of trenchless crossings, jointing pits and running track.
- The effect on agricultural land and hedgerows owing to the construction of the temporary PMAs (100m x 100m), SMAs (40m x 40m), trenchless drilling compounds (up to 100m x 50m launch and 50m x 50m reception) and jointing pits.
- The effect on landscape character and visual amenity owing to the presence of the temporary surfaced and fenced PMAs, SMAs and trenchless drilling compounds, and their content of plant, materials and welfare facilities.
- The effect on landscape character and visual amenity owing to the activity associated with the construction of trenchless crossings, jointing pits, running track and instalment of the PMAs, SMAs, trenchless drilling compounds, duct installation and cable pull through.
- The duration of a 10 week construction period for open cut trenching of each 1km section, within an overall 2 year period (cable pull through would occur at a later date in line with proposed project phasing).
- The reinstatement of ground and hedgerows at the PMAs, SMAs, trenchless drilling compounds and access road, and the implementation of mitigation planting and earthworks.

261. In Scenario 2 the HVAC option would require up to six ducts, compared to up to two for the HVDC option. This means the onshore cable corridor would be wider for the HVAC option and would therefore have more of an impact, albeit marginal (35m compared 50m respectively; see **Plates 2.1 and 2.2**). The HVAC and HVDC options would follow the same route. This route has been selected to ensure key landscape features are avoided.

Scenario 1

262. In Scenario 1, the ducts for the Norfolk Boreas onshore cable route would already have been installed as part of the Norfolk Vanguard project, along with access roads, running tracks and trenchless crossings. The potential impact would, therefore, only

relate to the installation of the cables into the existing ducts and the construction of jointing pits and temporary construction compounds.

263. Under Scenario 1 the impact of the onshore cable route during the construction phase would include all the features of the construction process listed above, with the exception of the following:

- There would be no effect on agricultural land, trees or hedgerows owing to the excavation of the onshore cable route, laying of ducts, construction of trenchless crossings and running track, as these landscape elements would already have been removed during Norfolk Vanguard construction.
- The effect on landscape character and visual amenity owing to the activity associated with the duct installation, construction of running track and temporary haul roads as these components would already have been constructed.
- There would be no mitigation planting or earthworks as these would have been implemented under Norfolk Vanguard.

5.1.3.1 Approach to assessment

264. The potential effects of the cable route construction on landscape and visual receptors will be assessed in respect of Scenario 1 and Scenario 2. As a geo-referenced footprint has not yet been identified, the assessment will consider the effects of constructing the onshore cable route within the 200m wide onshore cable corridor. However this may be available for the PEIR and therefore a more focused assessment (on a 100m wide route) would be made.

265. The receptors that will be assessed under both Scenarios for the onshore cable route include the following;

- The landscape elements of the agricultural land, trees and hedgerows;
- The landscape character of the LCUs that occur along the 60km length of the onshore cable route and the designed landscapes at Salle Park and Blickling Hall.
- The visual amenity of walkers on PRoWs, road-users on main and minor roads and residents of settlements within the vicinity of the onshore cable corridor.

266. Assessment will be made on site to determine the potential impact of the onshore cable route considering the more extensive construction works required for Scenario 2 compared to Scenario 1. Mapping showing the extent and layout of the onshore cable route components would be considered on site to understand the potential magnitude of change on each landscape and visual receptor, considering the screening effect of existing built form, landform, vegetation and any proposed

mitigation planting. This would be combined with the rating for sensitivity to determine the significance of the effect on each receptor.

5.1.4 Impact: Onshore Project Substation and National Grid substation extension

267. The Norfolk Boreas onshore project substation would be located south-east of the existing Necton 400kv National Grid Substation and Dudgeon Substation. The HVAC and HVDC options both require a site of approximately 250 x 300m. The HVAC electrical equipment would be set in the open and up to 10m in height, making it smaller in scale than the HVDC equipment which would be up to 19m in height with 25m high lightning protection masts.

268. While the landscape is relatively well contained, the scale and extent of the Norfolk Boreas onshore project substation and National Grid substation extension would lead to significant impacts on landscape character and visual amenity and the area within which this may occur would be determined through the assessment.

Scenario 2

269. In Scenario 2, all construction works will be undertaken by the Norfolk Boreas project including the construction of access roads, construction compounds, the onshore project substation, the National Grid substation extension, modifications to the overhead line and the implementation of mitigation planting.

270. Under Scenario 2 the impact of the onshore project substation during the construction phase would relate principally to the following features of the construction process:

- The effect on agricultural land, trees and hedgerows owing to the instalment of the 20,000m^2 (200m x 100m) compound and the 75,000m^2 (250m x 300m) onshore project substation site, access road and new junction on A47.
- The effect on landscape character and visual amenity owing to the construction and presence of the surfaced and fenced compound with its content of plant, materials and welfare facilities, and access road.
- The effect on landscape character and visual amenity owing to the presence of the emerging onshore project substation with electrical infrastructure up to 19m in height for buildings (up to 25m for lightning protection masts).
- The duration of an 18 month construction period.
- The reinstatement of ground at the compound and haul road, and reinstatement of hedgerow and trees, at the end of construction.
- The implementation of mitigation planting and earthworks.

271. Under Scenario 2, the impact of the National Grid substation extension during the construction phase would relate principally to the following features of the construction process:

- The effect on the loss of agricultural land owing to the instalment of the 444,709m^2 compound and 47,850m^2 (145m x 130m and 145m x 200m) substation extension site and 9,250m^2 (90m x 75m and 50m x 50m) OHL towers site.
- The effect on landscape character and visual amenity owing to the construction and presence of the surfaced and fenced compound, with its content of plant, materials and welfare facilities, and access road.
- The effect on landscape character and visual amenity owing to the construction and presence of the emerging substation extension with electrical infrastructure up to 15m in height and temporary towers (45m) and replacement towers (50m).
- The duration of an 18 month construction period.
- The reinstatement of ground at the compound and haul road, and reinstatement of hedgerow and trees, at the end of construction.
- The implementation of mitigation planting and earthworks.

Scenario 1

272. In Scenario 1, the access road, construction compound and most of the mitigation planting and earthworks for the onshore project substation would already have been installed as part of Norfolk Vanguard project. The civil engineering works and a large part of the National Grid substation extension works would also be complete along with modifications to the overhead line. Under Scenario 1, the Norfolk Boreas project would, therefore, comprise the construction of the onshore project substation and a further extension to the National Grid substation comprising a 130m busbar extension and other electrical equipment.

273. Under Scenario 1 the impact of the onshore project substation during the construction phase would include all the features of the construction process listed above, with the exception of the following:

- There would be no effect on agricultural land, hedgerows or trees relating to the instalment of the 20,000m^2 (200m x 100m) compound and the access road, as these would already be in place.
- There would be no effect on landscape character and visual amenity relating to the activity associated with the construction of the compound, access road and new junction on the A47 as these would already have been constructed.

- There would be no mitigation planting and earthworks as these would have been implemented under Norfolk Vanguard.

274. Under Scenario 1, the impact of the National Grid substation extension during the construction phase would include all the features of the construction process listed above, in exception of the following:

- There would be no loss of agricultural land, trees and hedgerows relating to the instalment of the 444,709m^2 compound, a large part of the National Grid substation extension and the access road as these would already be in place.
- There would be no effect on landscape character and visual amenity owing to the construction and presence of the compound, a large part of the National Grid substation extension and the access road, as these would already have been constructed.
- There would be no mitigation planting and earthworks as these would have been implemented under Norfolk Vanguard.

5.1.4.1 Approach to assessment

275. The landscape receptors susceptible to potential impact would include the landscape character areas within which the substation would be located. Reference would be made to the baseline character of these landscapes and an assessment of their value and susceptibility to the proposed development would be made to determine their overall sensitivity. There are no designated landscapes within the study area of the onshore project substation and National Grid substation extension.

276. The visual receptors susceptible to potential impacts would include residents in nearby Necton and other villages, rural properties and farmsteads, pedestrians and horse-riders using PRoWs and other paths, and road-users on residential and rural roads, whose views have the potential to be affected.

277. Assessment will be made on site to determine the potential impact of the onshore project substation and National Grid substation extension considering the detailed location and layout of the converter halls or electrical equipment, the location, size and content of the construction compounds and the construction processes that would be undertaken. Mapping and visualisations showing the extent and layout of the substation, associated construction compound and access roads, would be considered on site to understand the potential magnitude of the influence on each landscape and visual receptor, considering the screening effect of existing built form, landform, vegetation and any proposed mitigation planting. This would be combined with the rating for sensitivity to determine the significance of the effect on each receptor.

5.2 Potential Impacts during Operation and Maintenance

278. The potential impacts during the operational and maintenance phase would be largely limited to the presence of the above ground onshore components and their influence on landscape and visual receptors.

279. The underground location of most the landfall and onshore cable route, means that their potential impact on landscape and visual receptors would be very limited. Visible components would be limited to link boxes with a greater number of these required for the HVAC electrical solution than the HVDC solution. Regardless of electrical solution these would be small in scale and intermittent, and possibly even buried in the ground. In terms of associated activity, inspection visits to installed link boxes or test units would occur approximately annually and access to the cable routes would be required only if emergency repairs would be required. The potential impact of the landfall and onshore cable route would therefore be very limited and regardless of whether HVAC or HVDC is used.

280. In the Norfolk Boreas Scoping Opinion, the Secretary of State agreed that the operational impacts of the landfall and onshore cable route could be scoped out of the assessment (**Table 1.1**). However this was based on a recommendation that consideration would be required of the impact of vegetation loss and the mitigation measures implemented through replanting.

281. The cable relay station, substation and National Grid substation extension would have a more notable potential impact during operation and maintenance phases owing to the presence of the components and their large scale relative to the predominantly rural context. These would have an influence on landscape character and visual amenity. This influence would differ in respect of the HVAC and HVDC options as the type, size and layout of the components would differ.

282. A cable relay station would be needed in respect of the HVAC solution but not in respect of the HVDC solution. There would therefore be no impact in respect of the HVDC option. For the HVAC solution, the presence of the cable relay station would appear at variance with the predominantly rural character of the landscape and the scale of the typically small scale and traditional rural properties and farmsteads. While there are no landscape designations close to the cable relay station search zones, the potential impact on sensitive landscapes will be considered in the LVIA.

283. The key visual receptors with potential to be affected by the cable relay station would include residents of surrounding rural properties and farmsteads, road-users on the surrounding minor roads and walkers and horse-riders on surrounding PRoWs and other paths.

284. The presence of the onshore project substation, National Grid substation extension and associated access roads and perimeter fencing would have an influence on the landscape character area it occupies, as well as other adjacent landscape character areas. Susceptibility would relate to the existing influence of the Necton National Grid Substation and Dudgeon substation. The visual influence of the onshore project substation and National Grid substation extension could be ascertained using ZTVs (**Figure 4**) but would need to be verified on site where built form, existing and proposed planting may reduce actual visibility. There are no landscape designations within the study area of the onshore project substation and National Grid substation extension that could be affected.

5.3 Potential Impacts during Decommissioning

285. No decision has been made regarding the final decommissioning policy for Norfolk Boreas. By the time decommissioning would take place, it is likely that relevant legislation, policy and industry best practice will have changed.

286. The approach to decommissioning would be determined later in the project lifetime with a full EIA carried out to assess the potential impacts. It is anticipated that decommissioning would take approximately 18 months and would include the dismantling and removal of electrical equipment, the removal of cabling and any building services equipment, demolition of the buildings and removal of fences and the landscaping and reinstatement of the site.

5.4 Potential Cumulative Impacts

287. Potential cumulative impacts will consider other large-scale energy developments which create a cumulative context in which the addition of Norfolk Boreas has the potential to give rise to cumulative impacts. Cumulative impacts will occur primarily in and around the substation location where there is already the National Grid substation, the Dudgeon offshore windfarm substation and potentially onshore project substations for Norfolk Vanguard and Norfolk Boreas. Furthermore, the additional substations will require an extension to the existing National Grid substation.

288. Other major developments that lie near the onshore project substation would also be considered where they would have a notable bearing on the cumulative assessment. The scope of these developments and the extent of their inclusion would need to be agreed with the statutory consultees.

289. Cumulative impacts also have the potential to arise in respect of the Norfolk Boreas cable relay station, the main cumulative influence would most likely be the Norfolk Vanguard cable relay station, which would potentially be built on the adjacent site.

290. In the Secretary of State's Scoping Opinion on Norfolk Boreas, it was agreed that cumulative impacts would not arise in respect of the operational or decommissioning phases of the landfall and onshore cable route, but that they may arise in relation to the construction phase. These cumulative impacts will be considered in the LVIA.

5.5 Supplementary documentation

291. Supplementary documentation relating to the Norfolk Boreas DCO Application will include the Design and Access Statement (DAS) and the Outline Landscape and Ecology Management Strategy (OLEMS). The DAS will present an explanation of how Norfolk Boreas has responded to the sites and settings of each component of the onshore infrastructure. The OLEMS will set out the strategy for the re-establishment of ground and planting, excavated or removed during construction, as well as the proposals for mitigation panting and earthworks, designed to reduce the potential effects of the onshore infrastructure.

6 REFERENCES

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Norfolk Boreas Offshore Wind Farm

Environmental Impact Assessment

Land Use Method Statement

Document Reference: PB5640-004-006

Author: Royal HaskoningDHV
Date: January 2018
Client: Norfolk Boreas Ltd

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
08/08/17	01D	First draft for internal review.	EH	JM	AD
20/11/17	02D	Second draft for internal review	EH	DT/CD	AD
05/01/18	02D	Issue to Vattenfall review.	EH	CD	JL
23/01/18	01F	Issue to consultees	EH	CD	JL

This method statement has been prepared by Royal HaskoningDHV on behalf of Norfolk Boreas Limited in order to build upon the information provided within the Norfolk Boreas Environmental Impact Assessment (EIA) Scoping Report. It has been produced following a full review of the Scoping Opinion provided by the Planning Inspectorate. All content and material within this document is draft for stakeholder consultation purposes, within the Evidence Plan Process.

Many participants of the Norfolk **Boreas** Evidence Plan Process will also have participated in the Norfolk **Vanguard** Evidence Plan Process. This document is presented as a complete and standalone document however in order to maximise resource and save duplication of effort, the main areas of deviation from what has already been presented through the Norfolk Vanguard Evidence Plan Process and PEIR or in the Norfolk Boreas Scoping Report are presented in orange text throughout this document.

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Figures

Glossary of Acronyms

ALC	Agricultural Land Classification
AC	Alternating Current
BMV	Best and most versatile
CRS	Cable relay station
CoCP	Code of Construction Practice
CEMP	Construction Environment Management Plan
CIA	Cumulative Impact Assessment
CRoW	Countryside and Rights of Way Act 2000
DC	Direct Current
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
EMF	Electro-magnetic fields
ELS	Entry Level Stewardship
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ESS	Environmental Stewardship Scheme
ETG	Expert Topic Group
GIS	Gas Insulated Switchgear
HDD	Horizontal Directional Drilling
HLS	Higher Level Stewardship
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICNIRP	International Commission on Non-Ionizing Radiation Protection
kV	Kilovolts
MAFF	Ministry of Agriculture, Fisheries and Food
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NSRI	National Soil Resources Institute
NSIP	Nationally Significant Infrastructure Project
OELS	Organic Entry Level Stewardship
PEI	Preliminary Environmental Information
PEIR	Preliminary Environmental Information Report
PDS	Project Design Statement
PMA	Primary Mobilisation Area
PRoW	Public Right of Way
SMA	Secondary Mobilisation Area
SoS	Secretary of State
SMP	Soils Management Plan

1 INTRODUCTION

1. The purpose of this method statement is to build upon the information provided within the Norfolk Boreas Environmental Impact Assessment (EIA) Scoping Report, in outlining the proposed approach to be taken and considerations to be made in the assessment of onshore land use effects of the proposed development.

2. This method statement and the consultation around it form part of the Norfolk Boreas Evidence Plan Process (EPP). The aim is to gain agreement on this method statement from all members of the Land use Expert Topic Group (ETG), which will be recorded in the agreement log.

3. This land use method statement has been produced following a full review of:

- Scoping Opinion provided by the Planning Inspectorate;
- The Norfolk Vanguard Expert Topic Group meetings (where land use has been discussed); and
- Responses to the Norfolk Vanguard PEIR

4. The EIA Scoping Opinion comments received that relate to onshore land use are summarised in **Table 1.1**.

5. Information provided in this Method Statement is a draft for stakeholder consultation only and is provided in confidence. It is recognised that Norfolk Vanguard ETG meetings are being held in January 2018 and any agreements will be made during those meetings which are not reflected here. However due to certain project "Mile Stones" which have been set by The Crown Estate, Norfolk Boreas must progress on a programme which requires consultation on the Norfolk Boreas Method Statements prior to the conclusion of the Norfolk Vanguard EPP. Therefore, the material provided in this document represents the best available information at the time of writing. It is a commitment across both projects that, wherever possible, the approach taken to the development of the EIA for Norfolk Vanguard and Norfolk Boreas will be as consistent as possible.

Table 1.1 Scoping opinion responses

Consultee	Comment	Response / where addressed in this document
Secretary of State	The Applicant's attention is drawn to the responses of Anglian Water, National Grid and the Health and Safety Executive (see Appendix 3 of this Opinion) which have provided comments relating to the water infrastructure, major hazard sites, electricity and gas infrastructure within the onshore scoping area.	Section 3.2 summarises the completed and planned data collection
Secretary of State	Safeguarded operational, permitted and allocated sand and gravel extraction sites in the onshore scoping area should be identified and considered within the ES.	Section 3.1.5 includes mineral extraction sites. These will be assessed within the PEIR
Secretary of State	Careful consideration should be given to the siting of the onshore infrastructure in relation to agricultural land; the potential temporary and permanent loss of ALC land should be assessed and quantified within the ES. Limited information is provided around the approach to the assessment of significance of temporary and permanent loss of agricultural land. The SoS recommends reference to NE's guidance note on the protection of best and most versatile agricultural land (TIN049) in addition to the references citied in paragraph 1092 of the Scoping Report.	Section 5.1.1.1 and 5.1.1.3 discuss the assessment of impacts to ALC land. Natural England's Guidance Note has been used and is referenced within this document.
Secretary of State	The potential for sterilisation of land along the cable route should be assessed within the ES, including interrelated socioeconomic effects. The SoS does not agree that the effects of diversions of PRoW during construction can be scoped out of the assessment given the nature and duration of the proposed works as well as the potential cumulative effect with Norfolk Vanguard. The SoS does recognise that this is scoped in as part of section 4.4 of the Scoping Report (tourism). Cross referencing should be made between these topics as appropriate. Similarly, the SoS notes the applicant's proposal to scope out loss of land during construction with no justification for doing so. The SoS does not agree that this can be scoped out of the assessment (even on the basis that this assessment could be captured as part of the operational loss of land) as the SoS understands the areas of land take associated with construction and operation to be different.	Section 4.3.2.3 includes impact of potential sterilisation and loss of land. The socio-economics impacts of this are discussed in the Socio-Economics, Tourism and Recreation Method Statement and are cross referenced in this document where appropriate. The PEIR and ES chapters will clearly state where these impacts are assessed.
Secretary of State	The Scoping Report identifies the Norfolk Coast Path, Public Rights of Way and Cycle Trails. Norfolk County Council's response (see Appendix 3 of this Opinion) identifies a number of long distance trails which should be acknowledged e.g. Paston Way and the Weavers Way. Appropriate cross reference should be made to the tourism and recreation chapter of the ES.	The socio-economics impacts of this are discussed in the Socio-Economics, Tourism and Recreation Method Statement.
Secretary of State	The potential effects on soil quality should be considered and relevant mitigation measures proposed. The SoS therefore welcomes the proposal for a Soils Management Plan and recommends a draft is provided with the DCO application. The relationship with and role of this plan alongside other relevant plans should also be	The Impact Assessment methodology (Section 4) The assessment will assume that any primary and tertiary mitigation measures incorporated into

Consultee	Comment	Response / where addressed in this document
	specified (e.g. if it is to be appended to any CoCP, CEMP or similar and there is to be a separate Materials Management Plan (MMP) as is implied in paragraph 924 of the Scoping Report). These plans should set out sufficient detail as to how the land will be reinstated so as to understand the extent to which they have been relied upon in mitigating potential effects.	the scheme design will be in place. For example a Code of Construction Practice (CoCP) will be employed during site works to ensure that all appropriate good practice guidelines are followed
National Grid	We request that the following information be included in the (Environmental Statement) ES: method statement for land reinstatement.	Land reinstatement is summarised in Section 2.2.7.3.1 for the onshore cable route.
National Grid	Statutory electrical safety clearances must be maintained at all times. Any proposed buildings must not be closer than 5.3m to the lowest conductor. National Grid recommends that no permanent structures are built directly beneath overhead lines. These distances are set out in EN 43 – 8 Technical Specification for "overhead line clearances Issue 3 (2004) available at: http://www.nationalgrid.com/uk/LandandDevelopment/DDC/devnearohl_final/appendixIII/appIII-part2	The project will be designed in accordance with National Grid recommendations. Vattenfall Wind Power Limited are working with National Grid to design and consent the Necton National Grid substation extension. Section 3.2 summarises the completed and planned data collection to identify the location of all National Grid apparatus. Further detail of the project design will be provided in the PEIR.
National Grid	If any changes in ground levels are proposed either beneath or in close proximity to our existing overhead lines then this would serve to reduce the safety clearances for such overhead lines. Safe clearances for existing overhead lines must be maintained in all circumstances.	See above response
National Grid	The relevant guidance in relation to working safely near to existing overhead lines is contained within the Health and Safety Executive's (http://www.hse.gov.uk/) Guidance Note GS 6 "Avoidance of Danger from Overhead Electric Lines" and all relevant site staff should make sure that they are both aware of and understand this guidance.	See above response
National Grid	Plant, machinery, equipment, buildings or scaffolding should not encroach within 5.3 metres of any of our high voltage conductors when those conductors are under their worse conditions of maximum "sag" and "swing" and overhead line profile (maximum "sag" and "swing") drawings should be obtained using the contact details above.	See above response
National	If a landscaping scheme is proposed as part of the proposal, we request that only slow and low growing	See above response

Consultee	Comment	Response / where addressed in this document
Grid	species of trees and shrubs are planted beneath and adjacent to the existing overhead line to reduce the risk of growth to a height which compromises statutory safety clearances.	
National Grid	We would request that the potential impact of the proposed scheme on National Grid's existing assets as set out above is considered in any subsequent reports, including the Environmental Statement, and as part of any subsequent application. Where any diversion of apparatus may be required to facilitate a scheme, National Grid is unable to give any certainty with the regard to diversions until such time as adequate conceptual design studies have been undertaken by National Grid. Where the promoter intends to acquire land, extinguish rights, or interfere with any of National Grid apparatus, protective provisions will be required in a form acceptable to it to be included within the DCO. National Grid requests to be consulted at the earliest stages to ensure that the most appropriate protective provisions are included within the DCO application to safeguard the integrity of the apparatus and to remove the requirement for objection.	The project will be designed as far as possible to avoid or mitigate any impacts to National Grid assets. Impacts of the project on National Grid Assets will be assessed in the PEIR and ES and should any interference with National Grid apparatus protective provisions will be included within the DCO following consultation with National Grid.

1.1 Background

23. A Scoping Report for the Norfolk Boreas Environmental Impact Assessment (EIA) was submitted to the Planning Inspectorate on the 9th May 2017. Further background information on the project can be found in the Scoping Report which is available at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000015-Scoping%20Report.pdf

24. The Scoping Opinion was received on the 16th June 2017 and can be found at:

https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000013-Scoping%20Opinion.pdf

1.2 Norfolk Boreas Programme

25. This section provides an overview of key milestone dates for Norfolk Boreas.

1.2.1 Development Consent Order (DCO) Programme

- Scoping Request submission - 09/05/17
- Preliminary Environmental Information (PEI) submission - Q4 2018
- Environmental Statement (ES) and DCO submission - Q2 2019

1.2.2 Evidence Plan Process Programme

26. The Evidence Plan Terms of Reference (Royal HaskoningDHV, 2017a) provides an overview of the Evidence Plan Process and expected logistics, below is a summary of anticipated meetings:

- Agreement of Terms of Reference - Q3 2017
- Post-scoping Expert Topic Group consultation -Q1 2018
  - Discuss method statements and Project Design Statement
- Expert Topic Group and Steering Group meetings as required - 2018
  - To be determined by the relevant groups based on issues raised
- PEI Report (PEIR) Expert Topic Group and Steering Group meetings - Q4 2018/ - Q1 2019
  - To discuss the findings of the PEI (before or after submission)
- Pre-submission Expert Topic Group and Steering Group meetings - Q1/Q2 2019
  - To discuss updates to the PEIR prior to submission of the ES

1.2.3 Consultation to Date

27. Norfolk Boreas is the sister project to Norfolk Vanguard (see section 2 for further details). A programme of consultation has already been undertaken for Norfolk Vanguard which is of relevance to onshore Land Use for Norfolk Boreas. This is summarised below:

• Norfolk Vanguard EIA Scoping Request submission	- 03/10/16
• Receipt of Norfolk Vanguard Scoping Opinion	- 11/11/16
• Norfolk Vanguard Steering Group meeting	- 21/03/16
• Norfolk Vanguard Steering Group meeting	- 20/09/16
• Submission of Norfolk Vanguard Land Use Method Statement (Document Reference PB4476-003-030)	-13/01/17
• Norfolk Vanguard Post-scoping Expert Topic Group meeting	- 24/01/17
• Submission of Norfolk Vanguard Preliminary Environmental Information Report (PEIR)	-27/10/17
• Public Information Days held in Norfolk (Necton, Dereham, Reepham, North Walsham, Great Yarmouth, Norwich and Aylsham where the PEIR was available for inspection, and where questions/comments from local communities and landowners were discussed.	07/11/17-16/11/17
• Receipt of stakeholder feedback on Norfolk Vanguard PEIR	11/12/17
• Discussions with landowners	Ongoing
• Norfolk Vanguard Expert Topic Group meetings to discuss feedback on PEIR	22/01/18-25/01/18

28. Responses to the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b) were received in December 2017. This method statement has been updated to incorporate any key comments made that affect the proposed methodology for the Norfolk Boreas EIA.

1.2.4 Survey Programme

29. The land use assessment will be undertaken by desk based assessment; no surveys are currently proposed.

2 PROJECT DESCRIPTION

2.1 Context and Scenarios

30. Norfolk Boreas is the sister project to Norfolk Vanguard. Vattenfall Wind Power Ltd (VWPL) is developing the two projects in tandem, and is planning to co-locate the export infrastructure for both projects in order to minimise overall impacts. This co-location strategy applies to the offshore and onshore parts of the export cable route, the cable landfalls, cable relay stations, and onshore substations.

31. The Norfolk Boreas project is approximately 12 months behind of Norfolk Vanguard in the Development Consent Order (DCO) process. As such, the Norfolk Vanguard team is leading on site selection for both projects. Although Norfolk Boreas is the subject of a separate DCO application, the project will adopt these strategic site selection decisions.

32. In order to minimise impacts associated with onshore construction works for the two projects, VWPL is aiming to carry out enabling works for both projects under the Norfolk Vanguard DCO. This covers the installation of buried ducts along the onshore cable route, from the landfall to the onshore substation, modifications at the Necton National Grid substation, visual screening works access road construction, utility connections (water, electricity and phone) and site drainage.

33. However, Norfolk Boreas need to consider the possibility that the Norfolk Vanguard project may not be constructed. In order for Norfolk Boreas to stand up as an independent project, this scenario must be provided for within the Norfolk Boreas DCO. Thus, there are two alternative scenarios to be considered in the context of the EIA and this method statement:

- **Scenario 1:** Norfolk Vanguard consents and constructs transmission infrastructure which would be used by Norfolk Boreas. This includes, cable ducts, access routes to jointing pit locations, extension of the Necton National Grid substation, overhead line modification at the Necton National Grid substation and any site drainage, landscaping and planting schemes around co-located infrastructure. Under Scenario 1 Norfolk Boreas will seek to consent the Horizontal Directional Drilling (HDD) at landfall, the creation of the jointing and transition pits, onshore project substation, cable relay station (if required) and the installation of cables in the ducts through a process of cable pulling.
- **Scenario 2:** Norfolk Vanguard is not constructed and therefore Norfolk Boreas will seek to consent and construct all required project infrastructure including: HDD at landfall, creation of transition and jointing pits, installation of cable ducts, cable installation, cable relay station (if required), onshore project substation, 400kV

interface works (between the onshore project substation and the Necton National Grid substation), extension to the Necton National Grid substation, overhead line modification and any site drainage and landscape and planting schemes. For the sake of clarity, the Norfolk Boreas project would, under Scenario 2, involve the construction and installation of all onshore infrastructure necessary for a viable project.

34. **Appendix 1** contains a set of figures showing the onshore infrastructure and **Appendix 2** contains a detailed comparison of what is included in the two different scenarios across all elements of the project.

35. Norfolk Boreas Limited are proposing to employ a construction strategy whereby there are multiple moving work fronts which complete the majority of all construction works in each area before moving on. This reduces overall construction time as most works are completed in one pass and allows flexibility for areas to be avoided at sensitive times and to minimise impact through scheduling of works.

2.2 Site Selection Update

36. A detailed programme of site selection work has been undertaken by VWPL to refine the locations of the onshore infrastructure for both the Norfolk Vanguard and Norfolk Boreas projects. The Norfolk Vanguard EIA Scoping Report presented search areas for the onshore infrastructure which were identified following constraints mapping to avoid or minimise potential impacts (e.g. noise, visual, landscape, traffic, human health and socio-economic impacts). Further data review has been undertaken to understand the engineering and environmental constraints within the search areas identified. This process has been informed by public drop in exhibitions (October 2016, March and April 2017), along with the Scoping Opinion for Norfolk Vanguard and the feedback from the Expert Topic Groups. Details of the site selection process are provided in Chapter 4 of the Norfolk Vanguard Preliminary Environmental Information Report (Royal HaskoningDHV, 2017b) with a summaries provided below:

2.2.1 Landfall Zone

37. The Norfolk Boreas Scoping report presented three potential landfall locations. Data was reviewed on a broad range of environmental factors, including existing industrialised landscape, the presence of the Cromer Shoal Chalk Beds Marine Conservation Zone (MCZ), coastal erosion and archaeology alongside statutory and non-statutory consultation.

38. After publication of the scoping report, VWPL concluded, taking account of all engineering and environmental factors, as well as public feedback, that the most suitable landfall location would be Happisburgh South. The decision to go to Happisburgh south was presented to the Norfolk Vanguard Evidence Plan Expert Topic groups in June and July 2017 and in the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b).

39. Happisburgh South also has the benefit of being large enough to accommodate landfall works of both Norfolk Vanguard and Norfolk Boreas, therefore reducing the spatial extent of impacts associated with the two projects.

2.2.2 Cable Relay Station Options

40. The Norfolk Boreas Scoping report presented seven potential cable relay station search zones. A single cable relay station would be required for a High Voltage Alternating Current (HVAC) electrical solution. No cable relay station would be required for a High Voltage Direct Current (HVDC) electrical solution. The decision between HVDC and HVAC solutions is not expected to take place until post consent, therefore for the purposes of the EIA, and under the project envelope approach, assessment would be conducted on the basis of the realistic worst case.

41. Following the scoping opinion further work has been completed and two potential locations are being proposed for the cable relay station (**Appendix 1**). The final siting of the cable relay station on either footprint will have due consideration for of existing watercourses, hedgerows, landscaping, archaeology, ecology, noise, access and other known infrastructure/environmental constraints to minimise impacts, along with feedback from statutory and non-statutory consultation.

42. A Norfolk Boreas cable relay station temporary construction compound area has not yet been identified, however a location will have been determined prior to the Norfolk Boreas PEIR being published in Q4 2018.

2.2.3 Onshore Cable Route

43. A 200m wide cable corridor was presented within the Norfolk Boreas scoping report. This corridor, shared with Norfolk Vanguard, is the shortest realistic route between landfall and the Necton National Grid substation (thereby minimising disturbance impacts) whilst also aiming to avoid main residential areas and impacts to landscape, nature conservation designations and other key environmental constraints where possible.

44. The proposed route skirts around the main towns of North Walsham, Aylsham, Reepham and Dereham. Since the Norfolk Boreas scoping report was published

further work has been completed (see Royal HaskoningDHV, 2017b for detail) to refine the cable corridor and an indicative cable route has been established suitable for infrastructure for both the Norfolk Vanguard and Boreas onshore export cables (**Appendix 1**).

2.2.4 Onshore Project Substation

45. The Norfolk Boreas scoping report presented an onshore project substation zone within which the onshore project substation was to be located. Following further site selection work (presented in Royal HaskoningDHV, 2017b) a preferred onshore project substation location has been identified. Although the onshore project substation location is now well defined there remains the possibility that its exact location may change slightly following consultation on the Norfolk Vanguard PEIR, therefore an onshore project substation search area has been retained (**Appendix 1**).

46. A Norfolk Boreas Onshore project substation temporary construction compound area has not yet been identified, however a location will have been determined prior to the Norfolk Boreas PEIR being published in Q4 2018.

2.2.5 Extension to the Existing Necton National Grid substation

47. The Norfolk Boreas Scoping report presented a National Grid substation extension zone. Since the publication of that report further work has been undertaken to define the footprint of these extension works (**Appendix 1**). Further detail on this process is presented in Chapter 4 of the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b).

48. Also presented in the Norfolk Boreas Scoping report was an overhead line modification zone within which the overhead lines leading into the Necton National Grid substation would be realigned (section 2.3.1.5). The area within which this work will be undertaken has been refined and is presented in **Appendix 1**. Further detail on the process behind this refinement is provided in the Norfolk Vanguard PEIR (Royal HaskoingDHV, 2017b) chapter 5 site selection and alternatives.

2.3 Indicative Worst Case Scenarios

49. The following sections set out the current project description and predicted worst case scenarios for land use. The Norfolk Boreas PEIR and the ES will provide further detail on the Project Description describing the final project design envelope for the DCO application.

50. The parameters discussed in this section are based on the best available information for Norfolk Boreas at the time of writing and are subject to change as the project progresses.

51. Each chapter of the PEIR and ES will define the worst case scenario arising from the construction, operation and decommissioning phases of the Norfolk Boreas project for the relevant receptors and impacts. Additionally, each chapter will consider separately the anticipated cumulative impacts of Norfolk Boreas with other relevant projects which could have a cumulative impact on the receptors under consideration.

2.3.1 Infrastructure Parameters

52. HVAC and HVDC electrical solutions are being considered for Norfolk Boreas. Both electrical solutions would have implications for the required onshore infrastructure. Typically the HVAC solution involves a greater area of land take and additional infrastructure, and as such the HVAC solution is assumed as the worst case in the remainder of this section. Where the worst case assumes the HVDC solution, this is stated in the text.

53. The following key onshore project parameters are considered within this method statement. Explanation of which parameters are considered for Scenario 1 and for Scenario 2 is provided in the sections below. For full detail of what is considered in Scenario 1 and what is considered in Scenario 2 please see **Appendix 2**:

- Landfall (Horizontal Directional Drilling (HDD) and associated compounds);
- Cable relay station (required for HVAC only);
- Cable corridor (with associated trenchless crossing technique areas, construction compounds mobilisation areas and access);
- Onshore project substation;
- Interface cables connecting the onshore project substation and the Necton National Grid substation; and
- Extension to the existing Necton National Grid Substation, including overhead line modification.

54. Under Scenario 1, The Norfolk Vanguard project would be considered within the Cumulative Impact Assessment (CIA), together with the parameters of Norfolk Boreas (as listed in the bullets points above). Other projects which would be considered in the CIA are discussed in section 2.3.5.

2.3.1.1 Landfall

55. The landfall compound zone (**Appendix 1**) denotes the location where up to six Norfolk Boreas offshore export cables would be brought ashore. These would be jointed to the onshore cables in transition pits located within the eastern most "trenchless crossing technique" area shown in **Appendix 1**. Under Scenario 1

Norfolk Boreas would share the landfall area with Norfolk Vanguard at Happisburgh South.

56. Works associated at landfall would be the same under both scenarios. Under Scenario 1, if Norfolk Boreas cable ducts will be installed concurrently with the Norfolk Vanguard ducts, the Norfolk Boreas ducts would be installed only on the landward (western) side of the transition pits. Ducts on the seaward side of the transition pits would be installed using Horizontal Directional Drilling (HDD) which is a trenchless installation technique. The HDD would exit at one of the following two locations (impacts of the HDD exit point will be considered in the offshore assessments including the Marine Geology, Oceanography and Physical Processes and the Benthic and Intertidal Ecology impact assessment):

- On the beach, above the level of mean low water spring (classified as "short HDD").
- At an offshore location, seaward the beach (up to 1000m in drill length) (classified as "long HDD").

57. In the case of a short HDD, temporary beach closures would be required during drilling exit and duct installation to maintain public safety. Beach access would be required for an excavator and 4x4 vehicles.

58. Key parameters of works at landfall:

- Installation of a temporary construction compound to accommodate the drilling rig, ducting and associated materials and welfare facilities.
- Temporary footprint of works would be up to 3,000m^2 per compound (up to six compounds).
- For a drill length of 500m, it is anticipated that site establishment, drilling of up to six ducts and demobilisation will take approximately 30 weeks when considering 12 hour (7am-7pm), 7 day shifts. 24 hour operation could be employed for drilling activities, subject to planning and environmental restrictions, and could reduce the installation to approximately 20 weeks. Cable pulling would be undertaken subsequent to the duct installation.
- 24 hour lighting of the temporary footprint would be required throughout construction.
- The site would fully reinstated upon completion of the landfall works.

59. Each cable circuit would require a separate transition pit to connect the offshore and onshore cables at the landfall which would be grouped together and staggered as necessary to be accommodated within the permanent cable corridor. The transition pit would comprise of an excavated area of 15m x 10m x 5m at the base, per circuit,

with a reinforced concrete floor to allow winching during cable pulling and a stable surface to allow jointing.

60. A temporary compound would be assembled to provide a controlled environment to be maintained during jointing activities. Joints would be buried to a depth of 1.2m using stabilised backfill, pre-excavated material or a concrete box. The remainder of the jointing pit would be backfilled with the pre-excavated material and returned to the pre-construction condition, so far as is reasonably possible.

61. Link boxes for each of the transition pits would also be required for an HVAC solution and may be required to a lesser degree for the HVDC solution.

2.3.1.2 Cable Relay Station

62. A cable relay station would be required for a HVAC electrical solution. No cable relay station would be required for a HVDC solution. Therefore the HVAC solution is the worst case scenario for this element of the onshore infrastructure. The two proposed sites for the cable relay stations are presented in **Appendix 1**.

63. Under Scenario 1 the Norfolk Boreas cable relay station would occupy some the site which had been used for the Norfolk Vanguard construction compound, therefore under this scenario some of the ground preparation would have already been undertaken by Norfolk Vanguard. Under Scenario 2 all ground preparation work would be undertaken by Norfolk Boreas.

64. Key parameters of works at cable relay station are as follows:

- The cable relay station would consist of a total of six reactors with associated outdoor GIS (Gas Insulated Switchgear). Each reactor would be installed in concrete bunds to contain oil leakage and prevent damage to the environment. Cables from the landfall and onwards to the onshore substation would be laid in concrete troughs within the cable relay station and terminated at the GIS.
- The maximum height of the reactor and associated GIS equipment would be 8.0m.
- The total cable relay station fenced area would be up to 73m x 135m, with a perimeter fence height of 2.4m. External to the perimeter fence would be a small control building with associated parking with combined dimensions of 31m x 18m.
- There would be an additional temporary construction area with a maximum temporary footprint of 15,000m^2 during construction of the cable relay station.

65. During construction of the cable relay station the temporary construction compound would be established to support the works. The location of the temporary construction compound has not yet been determined but will be presented within the Norfolk Boreas PEIR being published in Q4 2018. Given construction duration, the compound would likely be tarmacked with some concrete hard standing for heavier plant and equipment. Appropriate access to the B1159 would be provided to permit safe delivery of plant and equipment required for construction (In Scenario 1, this access would be shared with the cable relay station for Norfolk Vanguard; in Scenario 2, the access would have to be constructed as part of Norfolk Boreas.)

66. The compound would accommodate construction management offices, welfare facilities, car parking, workshops and storage areas. Water, sewerage and electricity services would be required at the site and supplied either via mains connection or mobile supplies such as bowsers, septic tanks and generators. Under Scenario 2. This compound would also serve as a Primary Mobilisation Area (PMA) for cable installation works. Under Scenario 1 PMAs are not required and so the compound could be decommissioned after the cable relay station (CRS) is constructed and commissioned.

67. Surface water drainage requirements would be dictated by the final drainage study and would be designed to meet the requirements of the National Planning Policy Framework (NPPF). Foul drainage would be collected through a mains connection to existing local authority sewer system if available or septic tank located within the development boundary. The specific approach would be determined during detailed design with consideration for the availability of mains connection and the number of visiting hours for site attendees during operation.

68. The site would be stripped and graded as required by the final design. Under Scenario 2 the stripped material would be reused on site where possible as part of bunding and shielding as allowed for in the final design. Under Scenario 1 there would be less capacity to do this as landscaping schemes developed to mitigate visual impacts of both Norfolk Vanguard and Norfolk Boreas would have started to mature by the time Norfolk Boreas construction starts. Any excess material would be disposed of at a licenced disposal site. Excavations and laying of foundations, trenches and drainage would commence after grading is complete.

69. Construction activities would be conducted during working hours of 7am-7pm. Evening or weekend working could be required to maintain programme progress and for specific time critical activities; however these would be kept to a minimum. Perimeter and site lighting would be required during working hours and a lower level of lighting would remain overnight for security purposes.

70. The construction programme for the cable relay station would be 18 months.

2.3.1.3 Onshore cable corridor

71. The onshore cable corridor would contain the final onshore cable route. Currently an indicative cable route has been identified and is displayed in **Appendix 1**. This will be refined for the PEIR.

2.3.1.3.1 Onshore cable route

72. The onshore cable route would contain the main 220kV HVAC or ±320kV HVDC export cables housed within ducts and 400kV HVAC interface cables connecting the onshore project substation with the Necton National Grid substation. The main onshore cable corridor connects the landfall to the onshore project substation. A plan of the onshore cable corridor is shown in **Appendix 1**.

73. The key elements of the onshore cable route for Scenarios 1 and 2 are detailed in **Appendix 2**, and summarised below.

Scenario 1

74. Norfolk Vanguard would install cable ducts and undertake enabling works for Norfolk Boreas along the entire length of the onshore cable corridor. Therefore, all excavations (except jointing pits and associated temporary construction compounds) and crossings would have already been undertaken. In addition, all ducts would be installed and ground reinstated by Norfolk Vanguard.

Scenario 2

75. Norfolk Boreas would be responsible for installing all onshore cable route infrastructure required for the project, including installing ducts along the entire cable route and reinstating land (cable pulling would then happen at a later date see section 2.3.1.3.4). Under this scenario duct installation would also:

- Trenches for the ducts;
- A running track to deliver equipment to the installation site from mobilisation areas; and
- Storage areas for topsoil and subsoil.

76. An indicative cable route has been developed to illustrate the cable corridor required to install the ducts and cables for the HVAC and HVDC electrical solutions for Norfolk Boreas, see **Plate 2.1** and **Plate 2.2** below. For each electrical solution the following are illustrated:

- The total temporary strip (total land requirement to install the cables);

- Permanent strip (total ongoing land requirement of the installed cables) ; and
- Ongoing right of access strip (temporary area required to be reserved for access for future repair or maintenance activities).

77. Dependant on the land agreement approach taken, the ongoing right of access strip could be absorbed within the permanent easement, however, they are identified separately at this time.

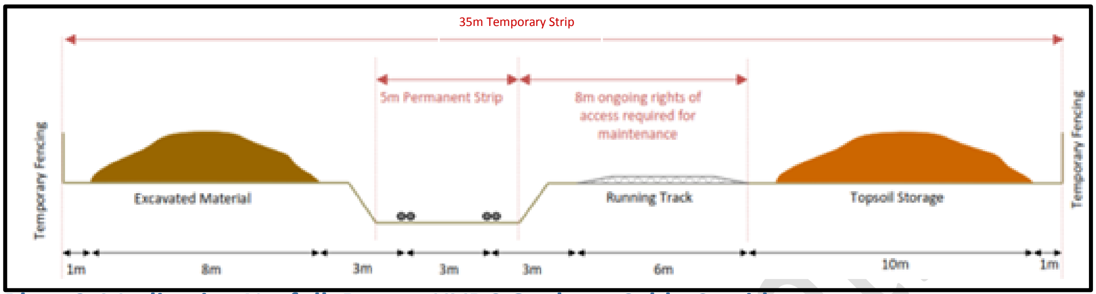

Plate 2.1 Indicative Norfolk Boreas HVDC Onshore Cable Corridor

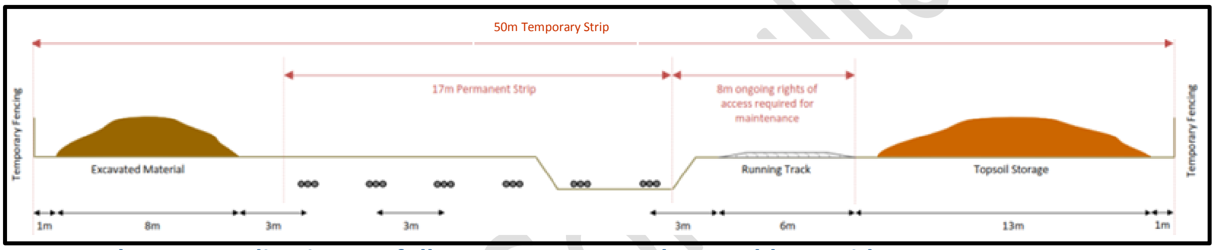

Plate 2.2: Indicative Norfolk Boreas HVAC Onshore Cable Corridor

2.3.1.3.2 Trenching and soil storage

Scenario 1

78. No trenching and soil storage would be required under this scenario for Norfolk Boreas as these works would have been completed under Norfolk Vanguard.

Scenario 2

79. Norfolk Boreas would be responsible for duct installation requiring trenching and storage for topsoil and subsoil. The main duct installation method would be through the use of open cut trenching with ducts installed, soil backfilled land reinstated. Cables would then be pulled though the pre-laid ducts at a later stage (see section 2.3.1.3.4 for further detail).

80. The ducts would be installed to a depth of 1.05m (to top of duct), in a trench of approximate 1m width. This depth would allow the ducts and the cables within them (and protective tiles and tape) to be laid below the level of typical field drainage pipes and other underground services to minimise impact and interaction.

81. Where the cable route crosses major transport routes or waterways the standard open cut trenching installation technique might not be suitable. The cable burial depth might increase at these crossing locations or an alternative trenchless method may be used. Further details of crossing methodologies are provided below. Where open cut trenching is employed in these locations and associated locations such as hedgerows, the working width could be reduced to the running track and cable trenching areas only (e.g. 25m for HVAC) with soil storage areas retained immediately before and after the feature crossing.

82. Topsoil would be stripped from the entire width of the onshore cable route for the length of route to be worked on at any one time and stored and capped to minimise wind and water erosion within the onshore cable route as shown in **Plate 2.1** and **Plate 2.2**.

83. The profile of the soil would be carefully maintained during the storage process. The cable trenches would then be excavated, typically utilising tracked excavators. The excavated subsoil would be stored separately from the topsoil, capped and the profile of the soil maintained during the storage process. The stored topsoil would be replaced upon the backfilled subsoil to reinstate the trench to pre-construction condition, so far as reasonably possible. It is noted that there is likely to be surplus subsoil derived as the cable replaces the space in the backfill. This will be recovered and reused as far as possible to avoid unnecessary disposal. However some material will need to be removed from site. Calculations for the likely quantities to be removed will be provided within the PEIR.

84. A pre-construction drainage plan would be developed and implemented to minimise water within the trench and ensure ongoing drainage of surrounding land. Where water enters the trenches during installation, this would be pumped via settling tanks or ponds to remove sediment, before being discharged into local ditches or drains via temporary interceptor drains.

2.3.1.3.3 Running track

85. A running track would provide safe access for construction vehicles within the onshore cable route. Where used (see Scenarios below) the running track could be up to 6m wide with a separation of 2m from the edge of the running track and the trench for safety and duct storage prior to pulling in the duct sections. Speed limits on the running track would be limited to 20mph.

Scenario 1

86. Under Scenario 1 approximately 20% of the Norfolk Vanguard running track would need to be retained or reinstated (reinstated being the worst case scenario) for the cable pulling phases.

Scenario 2

87. Under Scenario 2 running track would be installed along the entire length of the cable route (approximately 60km) to allow safe access from mobilisation areas (see section 2.3.1.3.8) to the duct installation sites.

88. Following topsoil stripping, the running track would be formed of protective matting, temporary metal road or permeable gravel aggregate dependant on the ground conditions, vehicle requirements and any necessary protection for underground services. Monitoring of the subsoil would be conducted to minimise long term damage and higher grade protection will be applied if deemed necessary.

89. At drain crossings the running track would be installed over a pre-installed culvert pipe to allow continued access to the cable route. The pipe would be installed in the drain bed so as to avoid upstream impoundment, and would be sized to accommodate reasonable 'worst-case' water volumes and flows. These culverts could remain in place for up to two years.

90. At larger road and water course crossings, temporary bridges may be employed to allow continuation of the running track. At railway and main river crossings where a trenchless crossing solution would be used, the running track would not be continuous. These locations would be 'stop ends' to the construction work fronts. The running track would be extended piece-wise as the work front moves outward from the PMA. When duct installation is completed, the running track would be taken up and the topsoil replaced. All recovered stone and other materials would be removed from site via the PMA (see section 2.3.1.3.8).

91. Following completion of the duct installation, the all or the majority of the running track would be removed and the topsoil reinstated, although rights would be retained to access the running tracks location should repairs of the cables be required during the lifetime of the project. Approximately 20% of the access track would need to be retained or reinstated for subsequent cable pulling phases.

2.3.1.3.4 Cable Pulling Process

92. A number of aspects of the cable pull process would be the same irrespective of scenario as follows. The onshore cables would be pulled through the installed ducts

later in the construction programme in a staged approach, as offshore generating capacity came online. This approach allows the major onshore civil engineering works to be completed in advance of cable delivery.

93. Cable pulling would not require the trenches to be reopened, with the cables pulled through the preinstalled ducts between the jointing pits located along the onshore cable route.

94. To facilitate the cable pull and jointing, the jointing pit would be exposed to access the cable ducts and cable drums would be delivered by HGV low loader to the open jointing pit locations. A winch would then pull the cable off the drum and through the duct. The cable would be installed in sections, and then joined together to form a single export cable.

95. The cable pulling and jointing process would take approximately six weeks per 1km of cable length, including installing and removing any temporary hard standing and delivering the cables to the jointing pits. However, any one jointing pit may be open for up to 12 weeks to allow its neighbouring jointing pit to be opened and the cables pulled from one pit to the next, dependant on the level of parallel work being conducted.

96. Access to and from the jointing pits would be required to facilitate the works during this phase of the project. This would be achieved through access to the onshore cable jointing pits directly from the highways network (at crossing locations) or existing local access routes where possible.

97. Under Scenario 1 in some locations, small sections of the running track would be required to be instated to allow access to more remote jointing bay locations (assuming that the entire running track required for the Norfolk Vanguard Project would have been removed). It is considered as a worst case scenario this would require approximately 20% of the running track to be reinstated to facilitate access to jointing pits.

98. Under Scenario 2, approximately 20% of running track presented would be left in place from the duct installation works, or required to be reinstated to allow access to more remote jointing bay locations.

2.3.1.3.5 Jointing pits

99. Jointing pits would be required along the onshore cable route to allow cable pulling and jointing of two sections of cable. Under both Scenario 1 and 2, the jointing pits would be installed by Norfolk Boreas for pulling cables through.

100. Under Scenario 1 VWPL are considering the possibility of reusing the same areas as those used to construct jointing pit compounds for Norfolk Vanguard during Norfolk Boreas construction. If at the detailed design phase the decision is made to do this there would be the possibility of leaving materials used to construct the Norfolk Vanguard jointing pit compounds in situ for use in the Norfolk Boreas jointing pit compounds. However, as this is yet to be confirmed the worst case is that this will not be possible and all jointing pit construction compounds would be fully constructed under the Norfolk Boreas consent.

101. The jointing pits would typically be located at 800m intervals, the maximum cable length which can be delivered, although site specific constraints may result in shorter intervals where necessary. Therefore there would be up to 80 jointing pit locations each consisting of up to six jointing pits. The jointing pits will be of a similar design and installed in a similar approach to the transition jointing pits detailed in section 2.3.1.1.

102. Access to and from jointing pits would be required for the cable pull through. These would be retained or reinstated from those used by Norfolk Vanguard in Scenario 1, and would be retained or reinstated from the duct installation phase (see sections 2.3.1.3.1 to 2.3.1.3.3) in Scenario 2. Under either Scenario the land on which the access route had been established would be reinstated to its pre-construction state.

2.3.1.3.6 Link boxes

103. Link boxes would be required for a HVAC connection arrangement to enable the cables to work as efficiently as possible and works would be the same for each scenario. These would be installed within 10m of the jointing pit locations. The number and placement of the link boxes would be determined as part of the detailed design. A smaller number of similar link boxes could be utilised for a HVDC connection arrangement to accommodate these aspects.

104. The link boxes would require periodic access by technicians for inspection and testing. Where possible, the link boxes would be located close to field boundaries and in accessible locations with the exact location to be determined during detailed design phases.

105. There are two options being considered for Link Box installation: Either a box with dimensions 1.5m x 1.5m, per circuit, would be buried to ground level within an excavated pit, providing access via a secured access panel or, an above ground link box cabinet with a footprint of 1.0m x 0.5m and a height of 1.0m could be utilised.

2.3.1.3.7 Crossing installation methods

Scenario 1

106. Under this scenario all necessary crossing installation would have been completed by Norfolk Vanguard. No additional works would be required by Norfolk Boreas.

Scenario 2

107. Under this scenario all crossings would be consented and installed by Norfolk Boreas. When crossing some features along the onshore cable route, alternative or amended installation approaches would be required to minimise the impact on the feature or obstacle being crossed as much as reasonably practicable. The following subsections detail the crossing installation methods available with the type proposed at each crossing fully detailed within the PEIR and ES.

108. When crossing hedgerows, the width of the cable route would be reduced to the running track and cable trenches only to minimise the amount of hedgerow removal. Using this technique, the hedgerow removal would be reduced to a maximum of 25m width.

109. Where underground services are identified, manual trench excavation would be employed within 1m (or the stipulated distance requirement of the asset owner if applicable) of these locations to uncover the services in a controlled and safe manner. The works would be conducted within the cable route with no additional land requirements. The running track could require reinforcement in these locations to minimise the risk to services damage. Soil segregation and storage and re-instatement of the trench would be conducted in line with the main cable route installation.

110. Where the onshore cable route crosses roads, tracks and public rights of way (PROWs), traffic management during the construction phase would be employed to allow these activities to continue safely. Where appropriate, single lane operation of roads would be utilised during installation with signal controls to allow movements to continue. The detailed installation method for each crossing utilising traffic management would be agreed with the relevant highways authority or landowner prior to works beginning. It should be noted that trenchless crossing methods could be required at locations where standard traffic management techniques are not deemed to be suitable. Further work to identify these locations is ongoing and details will be provided within the PEIR and ES project description chapters. The works would be conducted within the cable easement with no additional land requirements. Soil storage and re-instatement of the trench would be conducted in

line with the main cable route installation and the road surface would be reinstated to its pre-excavation condition, so far as reasonably possible.

111. Where small scale watercourses such as field drains, which are shallower than 1.5m are to be crossed, temporary damming and diverting of the watercourse could be employed. The suitability of this method would be advised at the detailed design stage following consent from the relevant land owners as part of the agricultural design process; larger water courses may also require consent from internal drainage boards and flood management agencies.

112. The works would be conducted within the cable route with no additional land requirements. The running track may require culverting or temporary bridging in these locations to allow continued cable route access. The running track would be removed once cable installation is complete.

113. Where larger watercourses are deeper than 1.5m, culverting might be used, but only where strictly necessary and agreed by the Environment agency.

114. Where culverting is employed, a pipe would be installed in the watercourse, suitably sized for necessary water volumes and flows. The pipe would be backfilled or encased in concrete to a depth of 2m. The cable ducts would subsequently laid perpendicular and backfilled to ground level creating a culverted watercourse.

115. Culverting would be carried out within the onshore cable route and would have no additional land requirements. The running track would also be required where culverting is undertaken to allow continued cable route access. Culverting may be required temporarily for a width of 6m to allow the running track to cross watercourses during installation works.

116. Cable bridges could also be used to cross larger water courses. A cable bridge structure would be constructed across the feature at a height specified by the feature and its uses. Ducts would be installed along the bridge for the cables to be pulled within. At the entrance/exit of the cable bridge, the ducts would transition from above ground to below ground. During the transition where the installation depth is less than 1.05m, concrete covers would be laid to protect the cables from damage. The bridge would include protective measures to prevent public access to the cables or the bridge.

117. Trenchless installation methods such as HDD, micro tunnelling or auger boring are likely to be used where open cut trenching is not suitable due to the crossing width or the feature being crossed. Trenchless methods will be employed at various locations including the River Wensum and River Bure (Special Area of Conservation – SAC, Site of Special Scientific Interest – SSSI) and major infrastructure such as

Network Rail to minimise the impact to the feature being crossed. The locations of these are shown in **Appendix 1** (termed trenchless crossing techniques).

118. With trenchless methods, the depth at which the ducts are installed depends on the topology and geology at the crossing site. Typically, for a river crossing, HDD ducts would be installed 5 to 15m below the floodplain, and at least 2m below the river bed.

119. Where trenchless drilling activities are to be conducted, a temporary work area would be required to store drilling equipment, welfare facilities, ducting and water for the drilling process. The trenchless drilling compounds would typically be of dimensions 50m x 50m for the reception site and 100m x 50m on the launch site, adjacent to the onshore cable route. A temporary bridge might be included to allow continuation of the running track and allow access to both sides of the crossing. Alternatively, a stop end would be used, requiring the inclusion of a turning area for vehicles within the temporary work area.

2.3.1.3.8 Temporary construction compounds

Scenario 1

120. Under Scenario 1 no primary and secondary mobilisation areas would be required as materials will be delivered directly to jointing pits locations.

Scenario 2

121. Primary and secondary mobilisation areas would be required to store equipment and provide welfare facilities. Indicative locations for these are provided in **Appendix 1**. They would be located adjacent to the onshore cable route corridor, accessible from the local highways network suitable for the delivery of cable drums and other heavy and oversized equipment.

122. The primary mobilisation areas would typically be of 100m x 100m dimensions (or 150m x 100m if combined with a trenchless drilling compound) and the secondary mobilisation areas would be approximately 40m x 40m with specific sizing and dimensions for each location based on site constraints and land boundaries.

123. Hardstanding would likely comprise of permeable gravel aggregate to a depth of 0.3m underlain by geotextile or other suitable material would be employed to allow safe storage and movement of vehicles within the area and maintain required drainage. Site lighting and secure fencing around the perimeter of the mobilisation area would be put in place for safety and security purposes. Where possible, the primary mobilisation area would be supplied by existing water, sewerage and

electrical services although the use of bowsers, septic tanks and generators can be employed if necessary.

124. The mobilisation areas would remain in place for the duration of the onshore duct installation activities, anticipated to be up to two years. Following installation of the ducts, the mobilisation areas would be removed and the land reinstated. During subsequent cable pull phases (for Scenario 2 and all work in the cable corridor under Scenario 1), materials will be delivered directly to the relevant jointing pit locations.

2.3.1.3.9 Cable route side access

125. Small temporary access routes would be required to facilitate the safe ingress and egress from the public highways to the construction locations termed side accesses. The current proposed locations for these are displayed in **Appendix 1** and would be used to for the following:

- To gain access to jointing pit locations during cable pulling and jointing phase;
- To gain to access link boxes, and
- To gain access to cables to make repairs during operational phase.

126. Not all of the side accesses would be used for the all of the above a sub set would be used for each of three activities and the extent of construction associated with the cable route side access would differ between scenarios as outlined below.

Scenario 1

127. Under Scenario 1 some of the side accesses to the cable route would be retained or reinstated from the Norfolk Vanguard project. For the purposes of this Method Statement the worst case scenario would be the reinstatement of these accesses. Detailed traffic and transport assessments are ongoing to refine which side accesses would need to be reinstated under Scenario 1.

Scenario 2

128. Under Scenario 2 side accesses to the cable route would need to be constructed and would be left in place for three years to provision for cable pulling phases before being removed and land reinstated.

129. Detailed traffic and transport assessments are ongoing to refine exactly where these side accesses would be required and which would need to be retained from the duct installation process (see section sections 2.3.1.3.1 to 2.3.1.3.3) thus it is the current proposed locations which are displayed in **Appendix 1**. They link each mobilisation areas and intersections between the public highway and cable route, where suitable, to facilitate side access to the running track.

2.3.1.4 Onshore Project Substation

130. The onshore project substation would consist of either an HVAC substation or HVDC substation, dependant on the electrical solution utilised. Only one project substation (HVAC or HVDC) would be required for Norfolk Boreas. The proposed onshore project substation location is presented in **Appendix 1**, with dimensions as detailed below.

131. The location of the onshore project substation was determined by an optioneering process which is explained in Chapter 4 site selection and alternatives of the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b)

132. The largest equipment within the HVAC onshore project substation would be the 400/220kV transformers with an approximate height of 10m, all other equipment would not exceed a height of 6m. The total land requirement for the HVAC onshore substation to the perimeter fence is 250m x 300m.

133. The largest equipment within the HVDC onshore substation would be the reactor halls with an approximate height of 19m. The tallest structure would be the lightning protection masts at a height of 25m. All other equipment would not exceed a height of 10m. The total land requirement for the HVDC onshore substation to the perimeter fence would be 250m x 300m.

134. During construction of the onshore project substation, a temporary construction compound would be established to support the works. The compound would be formed of hard standing with appropriate access to the A47 to allow the delivery and storage of large and heavy materials and assets, such as power transformers.

135. The location of the temporary construction compound has not yet been determined but will be presented within the Norfolk Boreas PEIR. The compound would be of dimensions 200m x 100m and would accommodate construction management offices, welfare facilities, car parking, workshops and storage areas. Water, sewerage and electricity services would be required at the site and supplied either via mains connection or mobile supplies such as bowsers, septic tanks and generators.

136. Surface water drainage requirements for the onshore project substation would be dictated by the final drainage study. Foul drainage would be collected through a mains connection to existing local authority sewer system if available or septic tank located within the development boundary. The specific approach would be determined during detailed design phase with consideration for the availability of mains connection and the number of visiting hours for site attendees during operation.

137. The site would be stripped of soil and soil graded as required by the final design. Stripped material would be reused on site where possible as part of bunding and shielding as allowed for in the final design. Any excess material would be disposed of at a licenced disposal site. Excavations and laying of foundations, trenches and drainage will commence after grading is complete. At this stage it is not known whether the foundations would either be ground-bearing or piled based on the prevailing ground conditions.

138. Construction activities would be conducted during working hours of 7am-7pm. Evening or weekend working might be required to maintain programme progress and for specific time critical activities such as transformer oil filling and processing; however, these would be kept to a minimum. Perimeter and site lighting would be required during the winter months and a lower level of lighting will remain overnight for security purposes.

139. The construction programme for the onshore substation is 18 months. The enabling works for the onshore project substation would differ between scenarios as outlined below:

Scenario 1

140. Under Scenario 1, a number of enabling works would be undertaken by Norfolk Vanguard. These include:

- Landscaping to reduce visual impacts;
- Access roads; and
- Site drainage infrastructure.

141. In Scenario 1, the access road would be shared with the onshore project substation for Norfolk Vanguard.

Scenario 2

142. Under Scenario 2, all enabling works would be undertaken by Norfolk Boreas.

2.3.1.5 Necton National Grid Substation Extension

143. The existing Necton National Grid substation would be required to be extended to accommodate the Norfolk Boreas and Norfolk Vanguard connection points. The proposed footprint of this extension is provided in **Appendix 1**.

144. The Necton National Grid substation accommodates the circuit breakers which are the connection points for the Norfolk Boreas and Norfolk Vanguard wind farms with associated busbar structures which allow connection onto the existing 400kV

overhead line for generation to be transmitted onto the wider National Grid Electricity Transmission system. In addition to the Necton National Grid substation itself, modifications to the existing overhead lines in parallel to the substation would be required to provide a double turn-in arrangement.

Scenario 1

145. Under Scenario 1 the majority of these works would be undertaken by Norfolk Vanguard for both projects. All extension enabling works would be completed including access roads, earthworks, foundations, buildings and all civil engineering works would be completed (see **Appendix 2** for further details). All overhead line modification would also have been carried out under the Norfolk Vanguard project.

146. However the electrical busbar extensions and other electrical equipment required for Norfolk Boreas would be installed under the Norfolk Boreas DCO.

Scenario 2

147. Under Scenario 2 all extension works to the Necton National Grid Substation and overhead line modification would be undertaken by Norfolk Boreas. The substation extension and overhead line modification works would be conducted within the areas identified within **Appendix 1** as National Grid Overhead Line Works, National Grid substation extension and National Grid temporary works.

148. The outdoor busbar would be extended in an east and west direction to an estimated total length of approximately 340m with seven air-insulated switchgear bays installed along the busbar extension for Norfolk Boreas.

149. The maximum height of the outdoor busbar and bays at the substation is estimated to be 15m. The total extended substation area is estimated to be 150m x 370m (inclusive of existing substation operational area). No additional land is anticipated for the overhead line modifications with existing towers being replaced with new towers.

150. Two new overhead line towers would be required in close proximity to the existing corner tower (to the north east of the existing Necton Substation) with a maximum height of 67m. The existing corner tower would be demolished and replaced by two new towers, alternatively, the existing corner tower could be modified and one new terminal tower constructed in close proximity. The design approach taken will be confirmed at detailed design phase.

151. For the overhead line modifications, up to three temporary towers would be constructed in close proximity to the existing towers and the existing circuits

transferred over to the temporary towers. The existing towers would be removed and replaced with new towers (or alternatively the existing towers would be modified if possible). The circuits would then be transferred from the temporary towers which would then be removed along with their foundations.

152. The tower foundations could be piled or excavated and cast, dependant on the ground conditions and structural requirements. It is anticipated that the footprint of the towers would be unchanged from the existing towers; however the orientation and design of the towers may change to allow for the double turn in arrangement. These works would be undertaken within the National Grid temporary works are displayed in **Appendix 1**.

153. During construction of the Necton National Grid Substation, two temporary construction compounds would be established to support the works. Given project duration, the compounds would likely be tarmacked with some concrete hard standing for heavier plant and equipment. Access to the A47 would be provided utilising the existing access road to the site to permit safe delivery of plant and equipment required for construction.

154. The larger compound would be of dimensions 300m x 150m and the smaller compound 200m x 150m. The compounds would accommodate construction management offices, welfare facilities, car parking, workshops and storage areas. Water, sewerage and electricity services will be required at the site and supplied either via mains connection or mobile supplies such as bowsers, septic tanks and generators.

155. The site would be stripped of soil and soil graded as required by the final design. Stripped soil and other material would be reused on site where possible as part of bunding and shielding as allowed for in the final design. Any excess material would be disposed of at a licenced disposal site. Excavations and laying of foundations, trenches and drainage will commence after grading is complete. At this stage it is not known whether the substation foundations would either be ground-bearing or piled based on the prevailing ground conditions.

156. Construction activities would be conducted during working hours of 7am-7pm. Evening or weekend working may be required to maintain programme progress. Perimeter and site lighting would be required during working hours and a lower level of lighting would remain overnight for security purposes.

157. The construction programme for the Necton National Grid substation extension and overhead line modification works would be 18 months and would be conducted

primarily during working hours of 7am to 7pm. Further detail on construction programmes is provided below in section 2.3.2.

2.3.2 Construction Programme

158. Currently it is expected that the Norfolk Boreas project would be constructed in one, two or three phases. **Table 2.1** summarises the main construction activities and sequence associated with installation of the Norfolk Boreas project onshore infrastructure under a 'three-phased' approach (as this represents the worst-case scenario in terms of duration of impact). Separate time lines are discussed for both Scenario 1 and 2.

2.3.3 Operation and Maintenance (O&M) Strategy

159. The cable relay station, onshore project substation and overhead line modification area would not be manned and it is not anticipated for the cable relay station and onshore substation to be illuminated under normal operating conditions. Site lighting will be provided during operations and maintenance activities only.

160. There is no ongoing requirement to maintain the onshore cables following installation. Periodic access to installed link boxes (which may be buried or above ground, see section 2.3.1.3) may be required for inspection, estimated to be annually. These link boxes will be accessible from ground level and will not require excavation works. Access to the cable easement would be required to conduct emergency repairs if necessary.

2.3.4 Decommissioning

161. No decision has been made regarding the final decommissioning policy for the substation and cable relay station, as it is recognised that industry best practice, rules and legislation change over time. However, the substation and cable relay station equipment will likely be removed and reused or recycled. It is expected that the onshore cables will be removed from ducts and recycled, with the jointing pits and ducts left in situ. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided.

2.3.5 Cumulative Impact Scenarios

2.3.5.1 Norfolk Vanguard

162. Cumulative impacts between Norfolk Boreas and Norfolk Vanguard would only occur in Scenario 1. VWPL are seeking to minimise cumulative impacts between Norfolk Boreas and Norfolk Vanguard through the alignment of onshore cable route and the

preference for Norfolk Vanguard to pre-install ducts and undertake other enabling works for Norfolk Boreas. Cumulative impacts between the two sister projects will be assessed within the Norfolk Boreas EIA.

2.3.5.2 Other projects

163. The assessment would consider the potential for significant cumulative impacts to arise as a result of the construction, operation and decommissioning of Norfolk Boreas in the context of other developments that are existing, consented or at application stage.

164. Potential projects may include offshore wind farms, coastal defence projects (such as the Bacton sandscaping scheme) road or large infrastructure projects (including the dualling of the A47, Sizewell Nuclear Power Station and the Norwich Northern Distributor Road) which have a potential to act together with the construction, operation or decommissioning phases of Norfolk Boreas in a cumulative way. In particular, VWPL are committed to working with Ørsted (formally DONG Energy) on identifying the potential interactions between the Norfolk Boreas and Norfolk Vanguard onshore cable corridor with the Hornsea Project 3 Offshore Wind Farm onshore cable route, and assessing and mitigating any potential cumulative effects.

165. Construction and commissioning of the substation for the Dudgeon Offshore Wind Farm is in operation. The cumulative impacts during construction are therefore likely to be minimal, however this will be considered further in the CIA.

Table 2.1 Construction programme

<table>
<tr><th>Date</th><th colspan="2">Scenario 1</th><th colspan="2">Scenario 2</th></tr>
<tr><td>2022</td><td colspan="2" rowspan="2"></td><td rowspan="2">Pre-construction works
• Road modifications
• Hedge and tree removal (season dependant)
• Ecological preparations (e.g. displacement of water voles, fencing of areas for newts, etc.)
• Preconstruction drainage (at cable relay station and substation locations)</td><td></td></tr>
<tr><td>2023</td><td></td></tr>
<tr><td>2024</td><td>Pre-construction works
(landfall, cable relay station and onshore project substation only)
• Ecological preparations (e.g. displacement of water voles, fencing of areas for newts, etc.)
• Preconstruction Drainage at cable relay station and substation locations</td><td rowspan="3">Substation and Cable Relay Station Construction
• Main works (drainage, foundations and buildings)</td><td rowspan="2">Main duct installation works
• Enabling works
• Duct installation
• Reinstatement works</td><td rowspan="2">Substation and Cable Relay Station Construction
• Main works (drainage, foundations and buildings)</td></tr>
<tr><td>2025</td><td></td></tr>
<tr><td>2026</td><td></td><td rowspan="3">Cable installation
• Installed in three phases (2026, 2027 & 2028)</td><td rowspan="3">Substation and Cable Relay Station Construction
• Plant installation (to tie in with cable pull)</td></tr>
<tr><td>2027</td><td rowspan="3">Cable pulling
• Installed in three phases (2027, 2028 & 2029)</td><td rowspan="3">Substation and Cable Relay Station Construction
• Plant installation (to tie in with cable pull)</td></tr>
<tr><td>2028</td></tr>
<tr><td>2029</td><td></td><td></td></tr>
</table>

3 BASELINE ENVIRONMENT

3.1 Desk Based Review

166. A desk based review of onshore land use receptors was undertaken as part of the scoping report. The Envrionmental Statement (ES) will build upon this information, in conjunction with additional data obtained as part of the Norfolk Vanguard assessment, to thoroughly characterise the baseline environment and identify the receptors that could potentially be impacted by the proposed development.

3.1.1 Available Data

167. Table 3.1 summarises the data sources which will be used to inform the Norfolk Boreas EIA.

Table 3.1 Data sources which will be used to inform Norfolk Boreas EIA

Data	Source	Year	Coverage	Confidence	Notes
‘A’ Roads, Railway Lines and Urban Area.	Ordnance Survey.	2016.	Landfall, onshore cable corridor, substation compound, CRS compound.	High.	N/A.
Datasets on the structure of the agricultural industry.	Defra	2013-2015.	Norfolk.	High.	N/A.
Soil types.	Cranfield University.	2017.	Landfall, onshore cable corridor, substation compound, CRS compound.	High.	N/A.
Invasive species.	Biological records and Phase 1 surveys.	2017.	Landfall, onshore cable corridor, substation compound, CRS compound.	High.	N/A.
The June Survey of Agricultural and Horticultural Activity.	Defra.	2013.	Norfolk.	High.	2016 survey was not broken down into regions, therefore 2013 last detailed information currently

Data	Source	Year	Coverage	Confidence	Notes
					available.
ALC and agri-environment schemes.	Natural England.	2015.	England and Wales.	High.	Locations and details.
Agricultural activities.	Land agents.	2017.	Norfolk.	Medium.	High level qualitative data on agricultural activities in Norfolk and specific to the study area.
Utilities search e.g. high pressure gas pipelines.	EMAP.	2014.	Landfall and partial onshore cable corridor.	High.	Locations and details.
Breckland Adopted Core Strategy and Development Control Policies Development Plan Document.	Breckland Council	2011 and 2016.	Onshore cable corridor, substation compound.	High.	N/A.
Broadland District Development Management Development Plan.	Broadland District Council.	2015.	Onshore cable corridor.	High.	N/A.
North Norfolk Core Strategy (2008) to 2021.	North Norfolk District Council.	2008.	Onshore cable corridor and CRS compound.	High.	N/A.
Joint Core Strategy (Broadland, Norwich and South Norfolk).	Broadland District Council, North Norfolk District Council.	2014.	Onshore cable corridor and CRS compound.	High.	N/A.

168. The assessment to be undertaken as part of the EIA will use the Natural England Agricultural Land Classification (ALC) system. This system grades agricultural land from Grade 1 (best quality) through to Grade 5 (poorest quality) based on factors including climate, nature of the soil and site-based factors, in accordance with Natural England (2012) Technical Information Note TIV049.

169. For clarity, assessments relating to PRoWs will be undertaken in the Socioeconomics and Tourism PEIR and subsequent Tourism and Recreation ES chapter and are therefore not considered further here.

3.1.2 Landfall and cable relay station

170. Following the site selection process, VWPL have confirmed landfall for both Norfolk Boreas and Norfolk Vanguard will be at Happisburgh South, and two potential locations for the onshore cable relay station are presented in **Appendix 1**.

171. The landfall location comprises ALC Grade 1 (excellent quality) agricultural land, with the surrounding areas comprising mainly ALC Grade 2 (very good) agricultural land, as detailed on **Figure 1**.

172. Cable relay station Option 5a search zone is located within land classed as ALC Grade 1 (excellent quality) agricultural land and ALC Grade 2 (very good) agricultural land and Option 6a search zone is located within land that is ALC Grade 2 (very good) agricultural land and ALC Grade 3 (good to moderate quality) agricultural land (see **Figure 1**).

173. A number of footpaths pass near the locations, as well as a regional cycle route and restricted byways. However impacts to these will be assessed within the tourism and recreation chapter of the PEIR. The methodology used for this assessment is provided in the Socio-economic and Tourism and Recreation Method Statement (document reference number PB5640.004.010).

174. While there are no large settlements in the vicinity of the landfall location or the cable relay station, the village of Happisburgh and settlements of Whimpwell Green and Cart Gap are adjacent. There are no A-roads in the surrounding area, but several local roads including the B1159.

3.1.3 Onshore cable corridor area

175. The onshore cable corridor from landfall to the onshore grid connection at the existing Necton 400kV National Grid Substation is approximately 60km long and passes through a number of different grades of agricultural land, primarily ALC Grade 2 at Banningham, Aylsham and Southgate and ALC Grade 3 in the areas between. There is a small area of ALC Grade 4 (moderate to poor quality) agricultural land at Mill Street, which is the proposed location of an HDD area.

176. Although the cable route avoids major urban areas, there are a number of built up urban areas in close proximity to the cable route (North Walsham, Aylsham, Reepham and Dereham). There are also several large waterbodies (River Wensum

near Mill Street and River Bure crossing the cable route north of Aylsham) and an army barracks north of Woodgate.

177. The A47, A1067, A140 and A149 all cross the proposed onshore cable corridor and there are a number of PRoWs as well as National Cycle Routes 1 and 13, and Regional Cycle Route 33 crossing the proposed cable route at various points. The assessment of impacts to Public Rights of Way will be assessed in the Tourism and recreation Chapter of the ES.

178. The Weavers Way and Paston Way long distance trails cross the current onshore cable corridor. The onshore cable corridor runs parallel to the Marriott's Way for several kilometres near to the town of Reepham and twice crosses it. The Bure Valley Way runs from Aylsham to Hoveton but is not intersected by the onshore cable corridor at any point. A number of local footpaths are intersected by the onshore cable corridor throughout.

179. The Sheringham Shoal (from Saxthorpe to Cawston) Offshore Wind Farm underground cables run through the onshore cable route close to halfway along it.

180. There are a number of jointing pits proposed (Section 2.3.1.3.1) along the onshore cable route at approximately equal intervals of 800m. All are located away from major urban areas with the exception of the pit closest to the landfall, which is just north of North Walsham.

3.1.4 Onshore project substation and Necton National Grid

181. The onshore project substation search zone and National Grid substation extension is comprised of ALC Grade 2 (very good quality) and ACL Grade 3 (good to moderate quality) agricultural land (**Figure 2**).

182. The A47 is to the North of the onshore project substation search zone and National Grid substation extension with a number of minor roads located to the south (**Appendix 1**).

183. There are no large urban areas around the grid connection location, with the closest being Dereham over 10km away. There are several villages and settlements including Necton, Little Dunham and Little Fransham, close to but outside, the onshore project substation search zone and National Grid temporary works area (**Appendix 1**).

184. The Dudgeon Offshore Wind Farm underground cable route comes into the substation search zone from the north and it is likely that the 400kv interface cables which connect the Norfolk Boreas onshore project substation and the Necton National Grid substation will cross Dudgeon export cables.

3.1.5 Local planning policies and designations

185. The substation search zone falls within Breckland District (approximately from Necton to Lyng), and therefore is within the remit of the Breckland District Council (2011) emerging Local Plan 2011-2036. The emerging Local Plan sets out strategic planning policies within Breckland (which replaces the Core Strategy and suite of documents that make up the adopted Local Plan).

186. A sections of the onshore cable corridor area that falls within Broadland District (Reepham to Aylsham) and therefore will be covered by the current Local Plan, which includes the Joint Core Strategy (a partnership between Broadland, Norwich and South Norfolk Councils), the Development Management Development Plan Document (Broadland District Council, 2015) and the Site Allocations (to identify areas for housing, employment, retail, recreation etc.).

187. North Norfolk District encompasses the eastern part of the onshore cable corridor. North Norfolk District Council currently has an Emerging Local Plan 2016-2036, providing the context for development across North Norfolk. Within the Local Plan sit the Core Strategy and Site Allocation Plans setting out more detailed, site specific policies.

188. Norfolk County Council is responsible for the planning for how waste produced in Norfolk is dealt with, and how much mineral extraction is needed. The adopted Norfolk Minerals and Waste Development Framework is of relevance and contains the following 3 minerals and waste planning policy documents and a policies map:

- Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026 (adopted September 2011);
- Minerals Site Specific Allocations Development Plan Document (DPD) (adopted October 2013); and
- Waste Site Specific Allocations Development Plan Document (DPD) (adopted October 2013).

3.2 Planned Data Collection

189. The results of the initial desk based review presented above will be used as a basis for a more detailed desk based assessment to characterise the baseline for onshore land use receptors. This desk based assessment will largely follow that which has already been undertaken as part of the Norfolk Vanguard project and presented in the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b). No additional data collection is proposed for the Norfolk Boreas application for land use receptors. Additional extended phase 1 ecology surveys are planned to be undertaken in 2018 in parcels of land where access has now been obtained, and the locations of any

additional invasive species recorded will also inform the land use assessments. These surveys are discussed in detail in the Onshore Ecology and Ornithology Method Statement (document reference number PB5460.004.005).

4 IMPACT ASSESSMENT METHODOLOGY

4.1 Defining Impact Significance

190. Two key groups of impacts have been identified for the purpose of defining receptor sensitivity and impact magnitude in this chapter:

- Land use and tenure: these are the potential impacts on human beings, including landowners, occupiers, local communities and other land users.
- Agriculture: these are potential impacts on the bio-physical elements of soils, the surrounding environment and the productivity of the land. The focus of this Method Statement is on agricultural productivity and soil resource. Geology, ground conditions and contamination are considered in the Onshore Ground Conditions and Contamination Method Statement (document reference number PB5640.004.001).

191. Whilst there are clear links between the two impact groups, the assessment of receptor sensitivity and magnitude of effect will differ and therefore this is identified in **Tables 4.1** and **4.2.**

4.1.1 Sensitivity

192. The sensitivity of receptors is assessed according to the criteria set out in **Table 4.1** below and is based on the capacity of receptors to tolerate change and whether or not increased risks would be acceptable within the scope of the prevailing legislation and guidelines. The degree of change that is considered to be acceptable is dependent on the value of a receptor, which is discussed in section 4.1.2 and the susceptibility of the receptor to the change that Norfolk Boreas would have on the land use.

Table 4.1 Sensitivity criteria for land use receptors

Sensitivity	Land Use	Agriculture and Soils
High	Receptor has <u>no or very limited</u> capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• Higher level ESSs; • Future planning applications for large scale planning uses; • Internationally and nationally designated planning policy areas; or • Land uses that are not possible elsewhere or regionally scarce and cannot be adapted or replaced e.g. the ecosystem service functions of soils.	• ALC Grade 1 or 2 land; • Farming practices with specific requirements; • Land with Notifiable Weeds (risk of spread) • Land with notifiable Scheduled diseases (risk of spread); or • Soil vulnerable to structural damage and erosion or unrecoverable or not adaptable to changes.

Sensitivity	Land Use	Agriculture and Soils
Medium	Receptor has limited capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• Entry level ESS; or • Local designated planning policy areas.	• ALC Grade 3; or • Seasonally susceptible to structural damage or erosion.
Low	Receptor has moderate capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• No designated planning policy areas; • No ESS's but under other environmental management; • Land used for ordinary agriculture or horticulture; or • Large agricultural holdings.	• ALC Grade 4 land; • Arable or pasture grassland; or • Medium to course material, some resistance to structural damage the majority of the year.
Negligible	Receptor generally tolerant of changes to the land use such as loss of land areas, soil degradation etc.	
	• No designated planning policy areas; or • No ESS.	• ALC Grade 5 land; • Non-agricultural and urban, non-arable or pasture grassland; or • Greater resistance to soil structural damage.

4.1.2 Value

193. In this assessment, the value of a receptor is determined by its importance within the area, for example ALC Grade 1 agricultural land. Definitions for the value of land use receptors are provided in **Table 4.2**.

Table 4.2 Criteria for appraisal of value for land use receptors

High	Receptor is a nationally important resource with limited potential for offsetting / compensation. E.g. ALC Grade 1 agricultural land/major motorway.
Medium	Receptor is a regionally important resource with limited potential for offsetting / compensation. E.g. regional cycle routes
Low	Receptor is locally important. E.g. local road or cycle route
Negligible	Receptor is not considered to be an important resource. E.g. ALC Grade 5 agricultural land.

194. It should be noted that high value and high sensitivity are not necessarily linked within a particular impact. A receptor could be of high value (e.g. ALC Grade 1 agricultural land) but have a low or negligible sensitivity to an effect – it is important not to inflate impact significance just because a feature is 'valued'. This is where the narrative behind the assessment is important; the value can be used where relevant as **a modifier** for the sensitivity assigned to the receptor.

4.1.3 Magnitude

195. Potential impacts may be adverse, beneficial or neutral. Impact magnitude on a receptor has been defined with consideration of the spatial extent, duration, frequency and severity of the effect. Impact magnitude is assessed qualitatively according to the criteria defined in **Table 4.3**.

196. The following definitions apply to the time periods used in the magnitude assessment:

- Long term: Greater than 5 years.
- Medium term: 2 to 5 years
- Short term: Less than 2 years.

197. In this instance, for construction-related impacts, short term impact magnitude will relate to impacts that do not extend past the construction period.

Table 4.3 Criteria for appraisal of magnitude of the effect for land use receptors

Magnitude	Land Use	Agriculture and Soils
High	• Permanent (>10 years) / irreversible changes, over the whole receptor, affecting usability, risk, value over a wide area, or certain to affect regulatory compliance.	• Permanent loss of over 20 hectares (ha) of the BMV agricultural land (grades 1, 2 and 3a) or more than 60% total regional resource (Natural England, 2012a); • Full recovery of land would take more than 10 years; or • Existing land use would not be able to continue on more than 5ha of land or the entire landowner/occupiers available land (where smaller) where the land would be rendered unviable for agricultural purposes OR permanent changes to land management would be required.
Medium	• Moderate permanent or long-term (5-10 years) reversible changes, over the majority of the receptor, affecting usability, risk, value over the local area, possibly affecting regulatory compliance; • Existing land use would not be able to continue on less than 5ha of land or • Noticeable changes to the existing land use although it may continue.	• Medium to long term loss of more than 20ha of the BMV agricultural land or more than 60% of the regional resource; • Permanent loss of more than 10ha of ALC (grade 3b) agricultural land; • Full recovery of land is expected within 5 to 10 years; • More than 20ha of soil is temporarily unsuitable for agriculture or • Small areas (<10ha) of any agricultural land permanently lost from agriculture
Low	• Temporary change affecting usability, risk or value over the short-term (<5 years); or • Temporary change affecting usability within the site boundary; measureable permanent change with minimal	• Short term loss of more than 20ha, or permanent loss of more than 10ha of ALC Grade 4 land or more than 10% of regional resource; • Full recovery of land is expected within 5 years; or • Less than 20ha of soil is temporarily unsuitable for agriculture or less than 1Ha is permanently lost from agriculture.

Magnitude	Land Use	Agriculture and Soils
	effect usability, risk or value; no effect on regulatory compliance.	
Negligible	• Minor permanent or temporary change, undiscernible over the medium- to long-term short-term, with no effect on usability, risk or value.	• No material change to the soil resource has been identified or • Small areas <1,000m2 is permanently lost from agriculture

4.1.4 Significance

198. Following the identification of receptor value and sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix as presented in **Table 4.4** will be used wherever relevant.

199. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive, formulaic tool.

Table 4.4 Impact Significance Matrix

		Negative magnitude				Beneficial magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

200. As with the definitions of magnitude and sensitivity, the matrix used for a topic is clearly defined by the assessor within the context of that assessment. The impact significance categories are divided as shown in **Table 4.5.**

Table 4.5 Impact Significance Definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.
No change	No impact, therefore no change in receptor condition.

201. Note that for the purposes of the EIA, **major** and **moderate** impacts are deemed to be ‘significant’. Significant impacts are those which are likely to influence the outcome of the planning application. Adverse significant impacts may require mitigation that is difficult or expensive to achieve, whereas beneficial significant impacts contribute to the case in favour of the Proposed Development.

202. In addition, whilst **minor** impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

203. Embedded mitigation will be referred to and included in the initial assessment of impact. If the impact does not require mitigation (or none is possible) the residual impact will remain the same. If however, mitigation is required there is be an assessment of the post-mitigation residual impact.

4.2 Assessing cumulative impacts

204. This chapter will focus on those cumulative impacts that are specific to land use and agriculture. The approach for assessing impacts on land use and agriculture will be generally in accordance with Natural England, 2006 Environmental Impact Assessment (Agriculture) Regulations. The cumulative impacts will consider the impact from other significant developments within the site and surrounding area.

205. The assessment of cumulative impact will be undertaken as a two stage process; all the impacts from previous sections will be assessed for potential to act cumulatively with other projects. Then the second stage of the CIA is an assessment of whether there is spatial or temporal overlap between the extent of potential effects of the onshore infrastructure and the potential effects of other projects scoped into the CIA upon the same receptors. To identify whether this may occur, the potential nature

and extent of effects arising from all projects scoped into the CIA will be identified and any overlaps between these and the effects will be identified. Where there is an overlap, an assessment of the cumulative magnitude of effect will be provided.

206. Projects identified for potential cumulative impacts with Norfolk Vanguard have been discussed during Norfolk Vanguard ETG meetings with stakeholders. The majority of these will also apply to Norfolk Boreas and therefore the proposed list of projects is included within **Table 4.6**.

207. Other projects which may require consideration as part of the CIA, may come to light as the project progresses and the full list of projects for will be updated through the PEIR consultation and agreed in consultation with local authorities.

208. **Table 4.6** summarises those projects which have been scoped into the CIA due to their temporal or spatial overlap with the potential effects arising from the project.

209. As identified in **Table 4.6**, in addition to Norfolk Boreas, Vattenfall is also developing Norfolk Vanguard Offshore Wind Farm, with the DCO submission preceding approximately a year ahead of Norfolk Boreas DCO submission. The development of Norfolk Boreas will use the same onshore cable corridor as Norfolk Vanguard.

Table 4.6 Summary of projects considered for the CIA in relation to land use and agriculture ([2] Shortest distance between the considered project and Norfolk Boreas – unless specified otherwise.

Project	Status	Development period	[2]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Rationale
Norfolk Vanguard Offshore Wind Farm.	Pre-Application.	Expected construction date 2026.	0	Pre-application outline only.	High.	Yes.	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature during construction and operation.
Hornsea Project Three Offshore Wind Farm.	Pre-Application.	Expected construction date 2021.	0 – cable intersects project.	Full PEIR available: http://www.dongenergy.co.uk/en/Pages/PEIR-Documents.aspx	High.	Yes.	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature during construction and operation.
Dudgeon Offshore Wind Farm.	Operational.	Construction completed 2017.	0	Approved PDS available.	Complete/ high.	Yes.	Overlapping proposed project boundaries at Necton may result in impacts of a direct and / or indirect nature during operation.
Bacton Gas Terminal Extension	Approved	Approved 20/09/2016. Expires 20/09/2019.	3.1	Approved PDS available	Complete/ high	No.	Terminal extension is located 3km from the project boundary and is located within an existing industrial site. No cumulative impacts are anticipated.
Bacton Gas Terminal coastal protection.	Approved.	Approved 18/11/2016. Expires 18/11/2019.	1.0	Approved PDS available.	Complete/ high.	No.	Terminal extension is located 3km from the project boundary. No cumulative impacts are anticipated.
Bacton Coastal Protection Scheme.	Approved.	Expected construction date 2018.	1.0	Approved PDS available.	Complete/ high.	Yes.	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature.

5 POTENTIAL IMPACTS

210. The following section describes the potential impacts anticipated to arise during the construction, operation and maintenance and decommissioning phases of Norfolk Boreas. The impacts described below have been determined based on our knowledge of the project and the nature of the current baseline land use present.

211. The EIA will be consider Scenario 1 and Scenario 2 separately in order to be able to clearly identify the potential impacts which each scenario will likely give rise to. The 'approach to assessment' detailed in the remainder of this section sets out how the approach to EIA will differ under the two scenarios being considered for the Norfolk Boreas project. The differences between the two scenarios are set out in full in **Appendix 2**.

212. With regards to impacts on land use, the worst case scenario would occur as a result of Scenario 2 (section 2.1) where Norfolk Vanguard is not constructed and therefore no transmission infrastructure is installed by Norfolk Vanguard for use by Norfolk Boreas. Under this scenario, the potential impacts described below would be applicable throughout the entire onshore footprint of works. Under Scenario 1 where Norfolk Vanguard is constructed the impacts of both projects will be considered within the CIA (section 5.1.4)

213. Under Scenario 1, only those impacts associated with construction of the following activities will be considered:

- Landfall duct installation and cable pulling;
- Cable pulling along the cable corridor and construction of jointing pits and link boxes;
- Construction and operation of CRS and project substation;
- Construction and operation of the extension to the existing 400KV National Grid substation and associated overhead line modifications at Necton; and
- Associated access and enabling works.

214. Impacts during operation and maintenance and decommissioning are considered to be the same for both Scenario 1 and Scenario 2. The approach to assessment will be the same for both scenarios with separate assessments being made for each.

215. Two electrical solutions are being considered for the connection of the Norfolk Boreas offshore wind farm, a HVAC or a HVDC (section 2.3.1). The final decision for the preferred electrical solution would not be made until post consent and the Project Design Envelope (also known as Rochdale Envelope) approach will be considered for the purposes of the EIA. The HVAC option will require a larger land

take of six trenches (see **Plate 2.1**) and construction of a CRS for Norfolk Boreas and is therefore considered the worst case scenario for land use. The HVDC option would require a smaller land take of two trenches (see **Plate 2.2**) and no CRS would be required.

216. Both electrical solutions will be assessed in order to maintain flexibility in the project and DCO application as the design of the project progresses.

5.1.1 Potential Impacts during Construction

5.1.1.1 Impact: Agricultural productivity

217. There is potential for adverse impacts to soil structure and future agricultural productivity of soils impacted during construction through the use of heavy machinery and disturbance.

218. Due to the greater construction area the magnitude of this impact will be far greater under Scenario 2 than it will under Scenario 1.

5.1.1.1.1 Approach to Assessment

219. Under Scenario 2 the potential impacts from the excavation of the cable trench and other earthworks associated with the jointing pits, cable relay stations, onshore project substation and Necton National Grid substation extension will be assessed using agricultural specialists should the requirement be identified following desk based study outlined in section 3.1. Under Scenario 1 all of the above will be assessed apart from cable trench excavation as that would have been undertaken by Norfolk Vanguard.

220. The potential impacts to agricultural productivity associated with the onshore infrastructure will be assessed qualitatively. This assessment will be informed by the results of the desk based assessment outlined in section 3.2. The assessment will assume that any primary and tertiary mitigation measures incorporated into the scheme design will be in place, for example a Code of Construction Practice (CoCP) will be employed during site works to ensure that all appropriate good practice guidelines are followed.

221. Ground conditions and potential contamination is discussed further in the 'Ground Conditions and Contamination Method Statement (document reference PB5640.004.001)'.

5.1.1.2 Impact: Drainage

222. The excavation of the cable trench (under Scenario 2), earthworks associated with the onshore project substation, cable relay station and Necton National Grid substation extension (under Scenario 1 and 2) and stockpiling of soils (under both Scenarios) has the potential to cause an adverse impact to the natural and artificial field drainage systems during construction works.

5.1.1.2.1 Approach to assessment

223. The potential impacts of the excavation of the cable trench (Under Scenario 2 only), earthworks associated with substation (both onshore project and Necton National Grid) and cable relay station construction and the excavation and stockpiling of soils (both Scenarios) will be assessed qualitatively. This assessment will be informed by the results of the desk based assessment outlined in section 3.2. The approach to the assessment of impacts on drainage is discussed in more detail in the Onshore Water Resources and Flood Risk Method Statement.

5.1.1.3 Impact: Disruption to farming practices

224. All aspects of the onshore construction works have the potential to cause adverse impacts on farming and other land use practices through the temporary loss of land availability, restricted access and disruption caused by working areas and construction traffic.

225. The excavation of soils and earthworks associated with the onshore infrastructure has the potential to result in temporary loss of ALC land due to the removal of soil during excavation for onshore cable installation. The scheme will seek to use areas of poorer quality land in preference to that of a higher quality. Impacts to soil will take account of the Government's policy for the protection of the best and most versatile (BMV) agricultural land as set out in paragraph 112 of the National Policy Planning Framework (NPPF).

226. There is potential for adverse impacts to soil structure and future agricultural productivity of soils impacted during construction through the use of heavy machinery and disturbance. Ground conditions and potential contamination is discussed further in the 'Ground Conditions and Contamination Method Statement' (document reference number PB5640.004.001).

227. There is potential for land sterilisation (restricting activities on a plot or area of land by isolating it) to occur along the cable route. The socio-economics impacts of this are discussed in the Socio-Economics, Tourism and Recreation Method Statement (document reference number PB5640.004.010).

228. There is also potential for a beneficial impact to local farmers if access tracks are upgraded. The temporary haul road would be removed and reinstated upon completion of the construction phase.

229. Due to the greater construction area, the magnitude of this impact will be far greater under Scenario 2 than it will under Scenario 1.

5.1.1.3.1 Approach to assessment

230. The potential impacts of the onshore construction works on farming practices will be assessed qualitatively, informed by the results of the desk based assessment outlined in section 3.2.

231. The potential impacts of the excavation of soils and earthworks associated with the onshore infrastructure will be assessed qualitatively. This assessment will be informed by the results of the desk based assessment outlined in Section 3.2. The assessment will assume that any primary and tertiary mitigation measures incorporated into the scheme design will be in place, for example a Code of Construction Practice (CoCP) will be employed during site works to ensure that all appropriate good practice guidelines are followed.

232. The approach for the ground conditions assessment is discussed in more detail in the Onshore Ground Conditions and Contamination Method Statement (document reference number PB5640.004.001).

5.1.1.4 Impact: Existing utilities

233. Cable installation activity has the potential to impact on water, power and gas infrastructure. Due to the greater construction area, the likelihood of this impact occurring and magnitude of the impact will be far greater under scenario 2 than it will under scenario 1.

234. Changes to ground levels beneath or close to existing overhead lines have the potential to reduce safety clearances for the overhead lines. The only existing overhead line which would be crossed is the main National Grid line from the Necton National Grid substation. As part of the overhead line modifications under Scenario 2 (section 2.3.1.5) ground levels may be altered around the existing lines, however these would be designed to maintain safety clearances. Under Scenario 1 the modifications would already be complete and therefore would not be included in the assessment.

235. In addition, there is the potential for ground levels above existing electricity cables to be altered.

236. Drilling or excavation work could have the potential to disturb or adversely affect the foundations of existing electricity towers. Again this is more likely to occur under Scenario 2 than Scenario 1.

237. There is the potential for adverse impacts relating to a high pressure gas pipeline that runs south west from the Bacton gas terminal and crosses the onshore cable route near Witton. Other domestic service gas pipelines would need to be crossed.

238. The assessment will draw on information which has been gathered for the Norfolk Vanguard EIA on water and sewage pipes that might need to be crossed. In particular Figure 21.5 of the Norfolk Vanguard PEIR (Royal HaskoningDHV, 2017b)

5.1.1.4.1 Approach to assessment

239. The impacts on existing utilities will be informed by the desk based assessment outlined in Section 3.2 and in consultation with the National Grid.

240. The assessment will assume that any primary and tertiary mitigation measures incorporated into the scheme design will be in place. For example, a Code of Construction Practice (CoCP) will be employed during site works to ensure that all appropriate good practice guidelines are followed. It will also be assumed that all relevant guidance in relation to working safely near to existing overhead lines is adhered to (as described in **Table 1.1**).

5.1.1.5 Impact: Public health and safety

241. The EIA will focus on elements which could be of concern to members of the public, for example issues relating to invasive plant species, notifiable scheduled diseases and procedures required to prevent any health or safety issues arising in relation to existing buried gas, electric and water services. Issues relating to public health are considered in the Health Method Statement (document reference number PB5640.004.009).

5.1.1.5.1 Approach to assessment

242. The approach to the assessment of issues relating to public health is considered in the Health Method Statement (document reference number PB5640.004.009).

5.1.2 Potential Impacts during O&M

243. Operation and maintenance activities will follow standard procedures to minimise potential impacts. In addition, non-routine maintenance will be subject to robust and effective planning and risk assessment procedures. The operational project will be

the same under both scenarios and therefore will not require separate assessment for the operation and maintenance phase.

5.1.2.1 Impact: Loss of land

244. The presence of permanent infrastructure of the cable ducts, the onshore project substation, cable relay station and Necton National Grid Substation extension (including modification of the overhead lines) would result in the permanent loss of land including farmland, and therefore also a loss in agricultural productivity of these areas.

5.1.2.1.1 Approach to assessment

245. The potential impacts to loss of land will be assessed qualitatively. This assessment will be informed by the results of the desk based assessment outlined in Section 3.2 as well as consultations with farmers. The assessment will assume that any primary and tertiary mitigation measures incorporated into the scheme design will be in place. For example, the design of a cable route which, as far as possible, is kept close to field boundaries. The assessment will cover all land within the footprint of the construction works, including access routes for construction machinery.

5.1.2.2 Impact: Drainage

246. Permanent infrastructure and hardstanding at the substation and cable relay station, plus the presence of buried cables has the potential to permanently impact upon land drainage. Impacts on drainage will be considered further in the Onshore Water Resources and Flood Risk Method Statement (document reference number PB5640.004.008).

5.1.2.2.1 Approach to assessment

247. The potential impacts of permanent infrastructure on drainage will be assessed qualitatively. This assessment will be informed by the results of the desk based assessment outlined in section 3.2. Further approach to the assessment of impacts on drainage is discussed in more detail in the Onshore Water Resources and Flood Risk Method Statement (document reference number PB5640.004.008).

5.1.2.3 Impact: Disruption to farming practices / land use

248. There is the potential for farming practices to be restricted due to the presence of cables and access restrictions, and also where maintenance and repair works are being carried out along the cable route and on other onshore infrastructure. It is anticipated all running track would be removed and land reinstated upon completion of the works. Ducts and jointing pits (apart from the requirement for above ground

structures associated with link boxes described in section 2.3.1.3.6) would be buried at sufficient depths not to cause prohibition of normal farming activities. However it is likely that there will be restricted covenants over the cable easement which would restrict a number of activities such as planting trees, erecting buildings of any form and any form of deep ploughing.

249. There is also the potential for a permanent/long-term reduction in quality of ALC land along the cable route.

5.1.2.3.1 Approach to assessment

250. The potential impacts of the permanent onshore infrastructure will be assessed qualitatively. This assessment will be informed by the results of the desk based assessment outlined in section 3.2. The assessment will assume that any primary and tertiary mitigation measures incorporated into the scheme design will be in place, for example the design of a cable route which, as far as possible, is kept close to field boundaries. The assessment will cover all land within the footprint of the construction works, including access routes for construction machinery.

251. The approach for the ground conditions assessment is discussed in more detail in the Onshore Ground Conditions and Contamination Method Statement (document reference number PB5640.004.001).

5.1.2.4 Impact: Public health and safety

252. Issues of public concern and health such as EMF arising in relation to buried cables will be considered further in the Health Method Statement (document reference number PB5640.004.009).

5.1.2.4.1 Approach to assessment

253. The approach to the assessment of this impact is considered further in the Health Method Statement (document reference number PB5640.004.009).

5.1.2.5 Impact: Soil heating

254. Buried cable systems emit some heat, potentially causing impacts on soil characteristics and productivity. The electrical system is designed to minimise heat loss to a level which is not likely to affect crop growth. Any potential heating effect from the cables is likely to only affect the region immediately adjacent to and directly above the cable system.

5.1.2.5.1 Approach to assessment

255. The potential impacts of the buried cable on soil heating will be assessed qualitatively, informed by the results of the desk based assessment outlined in Section 3.2.

256. As this impact is only likely to affect a small area, the scope of the assessment will be restricted to the area directly above and immediately adjacent to the cable system.

5.1.3 Potential Impacts during Decommissioning

257. No decision has been made regarding the final decommissioning policy for the substation and cable relay station, as it is recognised that industry best practice, rules and legislation change over time. However, the substation and cable relay station equipment will likely be removed and reused or recycled. It is expected the onshore cables will be removed from ducts and recycled, with the transition pits and ducts left in situ.

258. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan would be provided.

259. It is anticipated that the decommissioning impacts will be similar in nature to those of construction.

5.1.4 Potential Cumulative Impacts

260. Onshore cumulative impacts will be considered as part of the EIA process (See section 2.3.5 for further details). Any other project with the potential to result in impacts that may act cumulatively with Norfolk Boreas will be identified during consultation as part of the EPP and following a review of available information. These projects will then be included in the CIA and therefore are scoped into the assessment.

261. The assessment will consider the potential for significant cumulative impacts to arise as a result of the construction, operation and decommissioning of Norfolk Boreas in the context of other developments that are existing, consented or at application stage.

262. Under Scenario 1, the CIA will take into account the combined footprints and durations of disruptions of both Norfolk Boreas and Norfolk Vanguard as part of the CIA.

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