

Norfolk Boreas Offshore Wind Farm

Non-Technical Summary

Environmental Statement

Applicant: Norfolk Boreas Limited
Document Reference: 6.4
RHDHV Reference: PB5640-006-000
Pursuant to APFP Regulation: 5(2)(a)

Date: October 2018
Revision: Version 1
Author: Royal HaskoningDHV

Photo: Ormonde Offshore Wind Farm

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Glossary of Acronyms

DCO	Development Consent Order
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
ES	Environmental Statement
GW	Gigawatt
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
MW	Megawatt
PEIR	Preliminary Environmental Information Report
VWPL	Vattenfall Wind Power Limited

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1 INTRODUCTION

1.1 About this Document

1. This document is the Non-Technical Summary of the Environmental Statement (ES) for the proposed Norfolk Boreas offshore wind farm (henceforth referred to as ‘the project’ or Norfolk Boreas). It provides a summary of the project, the site selection process and the key findings of the Environmental Impact Assessment (EIA).
2. Norfolk Boreas is a Nationally Significant Infrastructure Project under the Planning Act 2008. Consequently, an EIA is required to support a Development Consent Order (DCO) application. The purpose of the EIA is to assess and examine the potential impacts of the project on the environment, from construction, operation and decommissioning. In accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, the findings of the EIA process have been presented in an ES and submitted as part of the DCO application.
3. The project is located in the southern North Sea, with a total export capacity of up to 1,800 megawatts (MW); which is enough to power nearly 2 million UK households. The offshore wind farm comprises the Norfolk Boreas site located approximately 73km from the shore (at the nearest points) and an offshore cable corridor which would connect the project to the shore.
4. Norfolk Boreas has a “sister project”, called Norfolk Vanguard, which is approximately one year ahead of Norfolk Boreas in its development. Norfolk Vanguard submitted its DCO application in June 2018, at the time of writing this application is subject to examination. In order to minimise local impacts overall, as desired by stakeholders, a strategic decision was made early on to co-locate, or ‘share’ as much of the infrastructure as possible (including cable routes, onshore project substations and grid connection points) with Norfolk Vanguard. This would allow Norfolk Vanguard to undertake some work which would be common to both projects thereby reducing environmental impacts.
5. If both projects secure consent and progress to construction, these advantages will be realised. However, Norfolk Boreas needs to consider the possibility that the Norfolk Vanguard project may not be built. In order for Norfolk Boreas to be considered as an independent project by the Planning Inspectorate, this scenario must be provided for within the Norfolk Boreas DCO application. Therefore, there are two scenarios which have been considered within the ES:
 - **Scenario 1** – Norfolk Vanguard proceeds to construction and installs ducts and other shared enabling works for Norfolk Boreas. This scenario is optimal and the most probable outcome.

- **Scenario 2** – Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. The Norfolk Boreas EIA will also consider associated constraints and opportunities, under Scenario 2.
6. Norfolk Boreas would comprise offshore wind turbines, offshore electrical platforms (to convert electricity into a form that can be transmitted to shore), an offshore service platform (to provide accommodation for construction workers and/or helicopter refuelling facilities), offshore power cables, landfall (where power cables would come ashore), onshore cables, an onshore project substation and an extension to an existing National Grid substation, including associated overhead line modification works. The location of the offshore and onshore project areas are shown in Figure 1 and Figure 2 respectively, and the onshore project substation and extension to the existing National Grid Substation at Necton is shown in Figure 3 for Scenario 1 and Figure 4 for Scenario 2.
7. Table 1 below outlines which elements would be included under Scenario 1 and which would be included under Scenario 2.

Table 1 Onshore elements of Scenario 1 and Scenario 2 to be undertaken by Norfolk Boreas

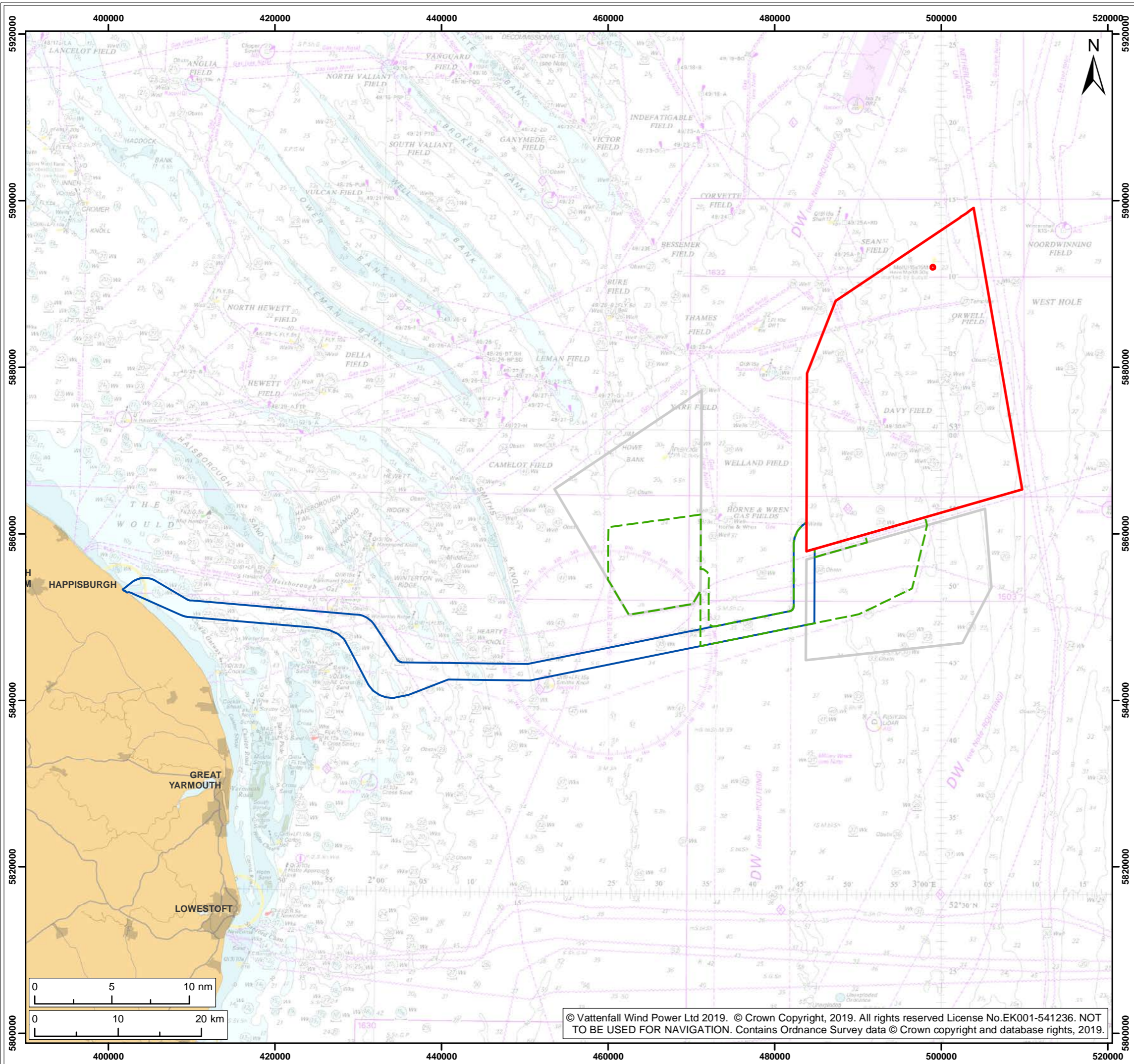
Onshore elements	Scenario 1	Scenario 2
Landfall		
Landfall compounds	✓	✓
Cable duct installation via underground drilling	✓	✓
Transition pits	✓	✓
Cable pulling	✓	✓
Onshore Cable Route		
Pre-construction works	✓	✓
Cable duct installation via open cut trenching	✗ (installed by Norfolk Vanguard)	✓
Cable duct crossings (e.g. hedgerows, underground services, roads or tracks, watercourses)	✗ (installed by Norfolk Vanguard)	✓
Trenchless crossings (e.g. by underground drilling) and associated areas to drill from	✗ (installed by Norfolk Vanguard)	✓
Mobilisation areas	✗ (not required)	✓
Running track for construction vehicles to move along the route	✓ (approx. 12km)	✓ (approx. 60km)
Construction of accesses to the cable route	✓	✓
Cable pulling	✓	✓
Cable logistics area for storage of cables and machinery	✓	✓
Construction of underground cable jointing pits	✓	✓

Onshore elements	Scenario 1	Scenario 2
Onshore Project Substation		
Pre-construction works	✓	✓
A47 junction improvement	✗ (installed by Norfolk Vanguard)	✓
Access road to onshore project substation	✓ (extension of road installed by Norfolk Vanguard by approx. 125m)	✓ (approx. 1.8km)
Construction of onshore project substation	✓	✓
Screening	✓	✓
National Grid Substation Extension and Overhead Modifications		
Pre-construction works	✓	✓
Extension to existing Necton National Grid Substation	✓ (easterly direction)	✓ (westerly direction)
National Grid Overhead line modifications	✗ (installed by Norfolk Vanguard)	✓
Screening	✓	✓

8. This Non-Technical Summary is a high level stand-alone document that provides an overview of the environmental impacts of the proposed project in non-technical terms. For further detailed information, the full ES should be referred to. This can be found at:

<https://www.vattenfall.co.uk/norfolkboreas>

<https://infrastructure.planninginspectorate.gov.uk>



Legend:

- Norfolk Boreas site
- Offshore cable corridor
- Project interconnector search area
- Norfolk Vanguard

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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Title:
Offshore project areas

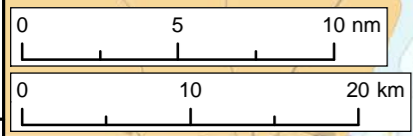
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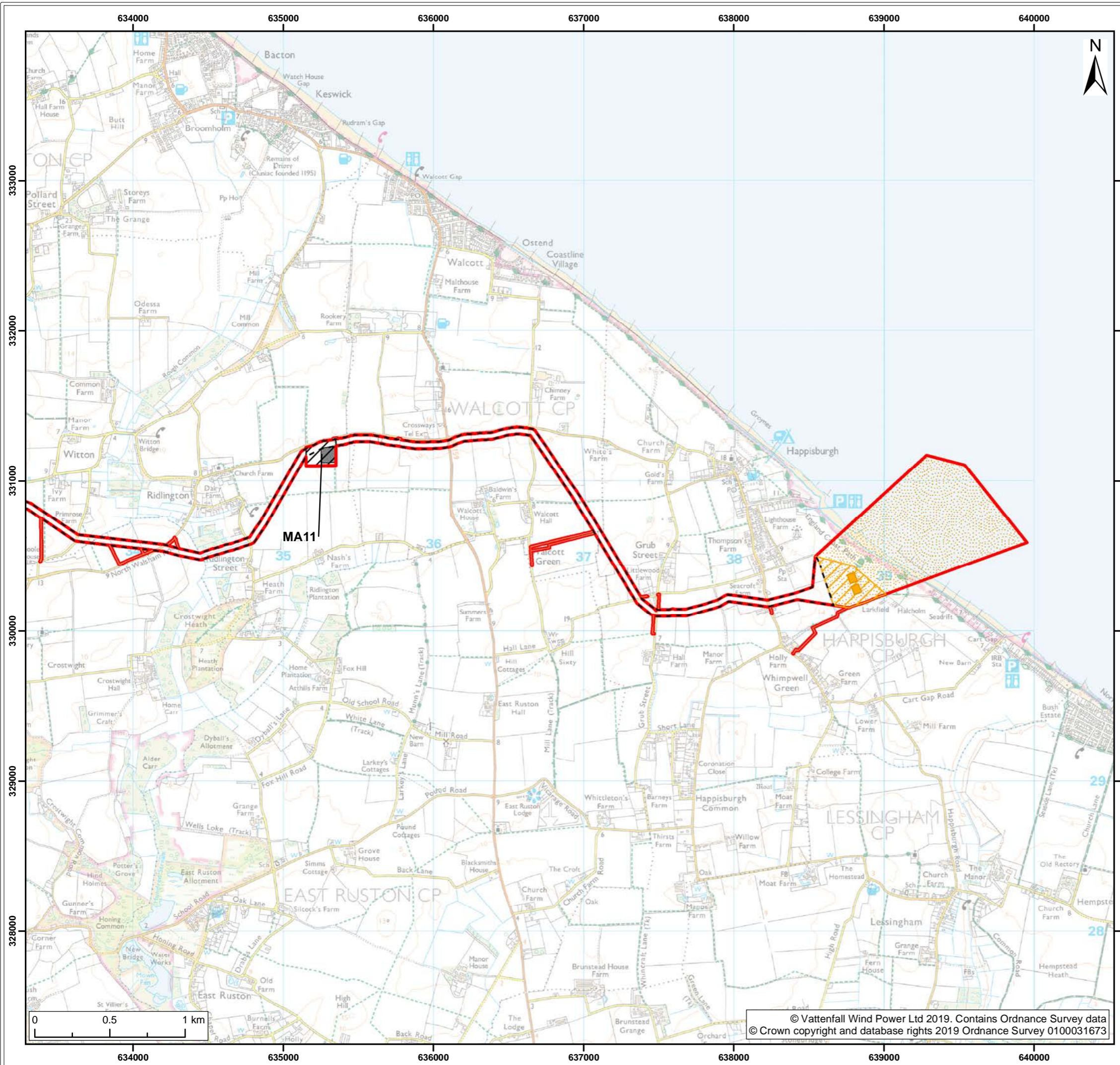
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Landfall zone
- Landfall compound zone
- Indicative landfall compound
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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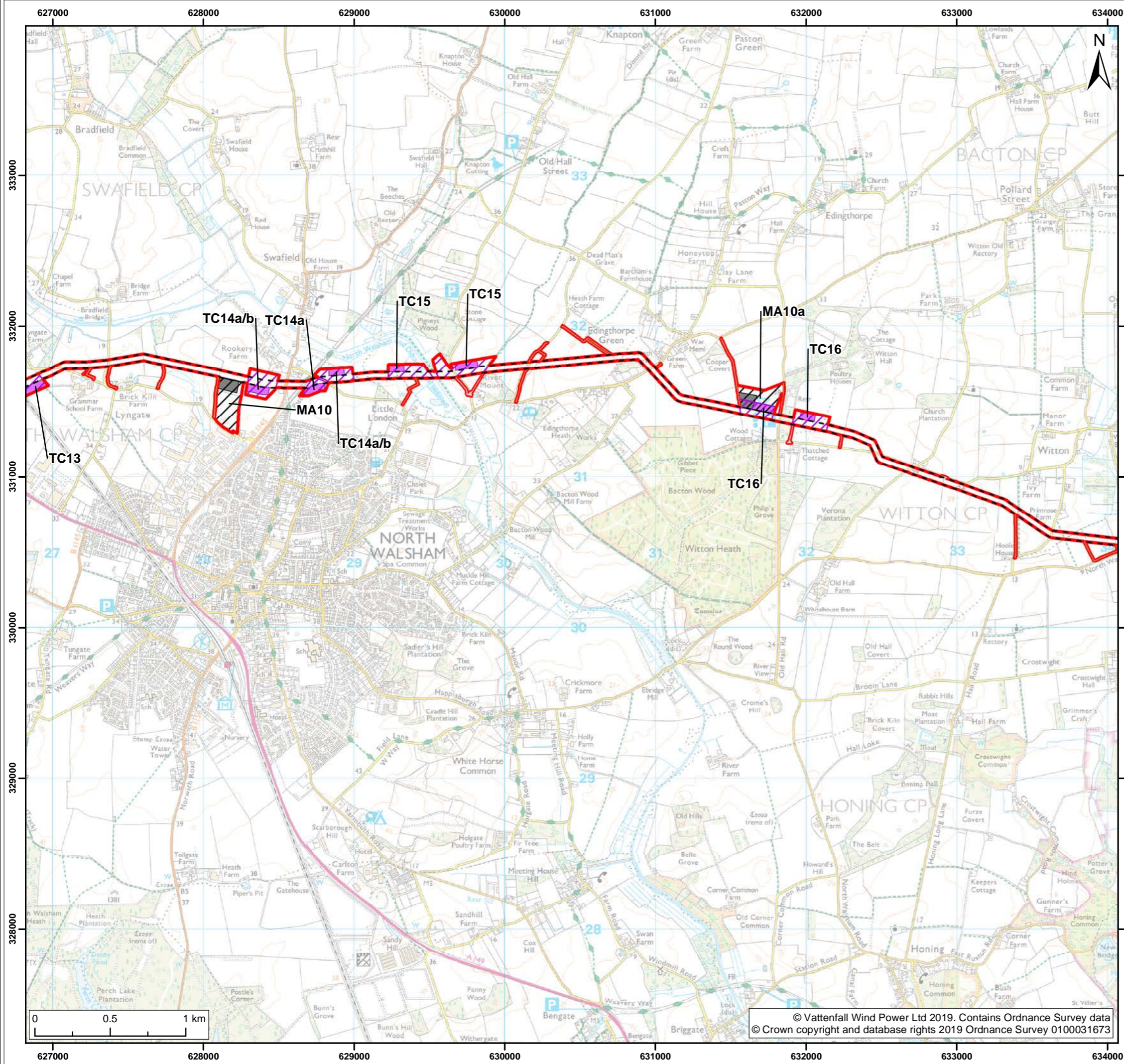
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Onshore project area
(Map 1 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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Title: Onshore project area (Map 2 of 9)
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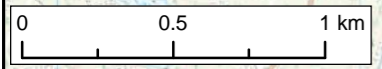
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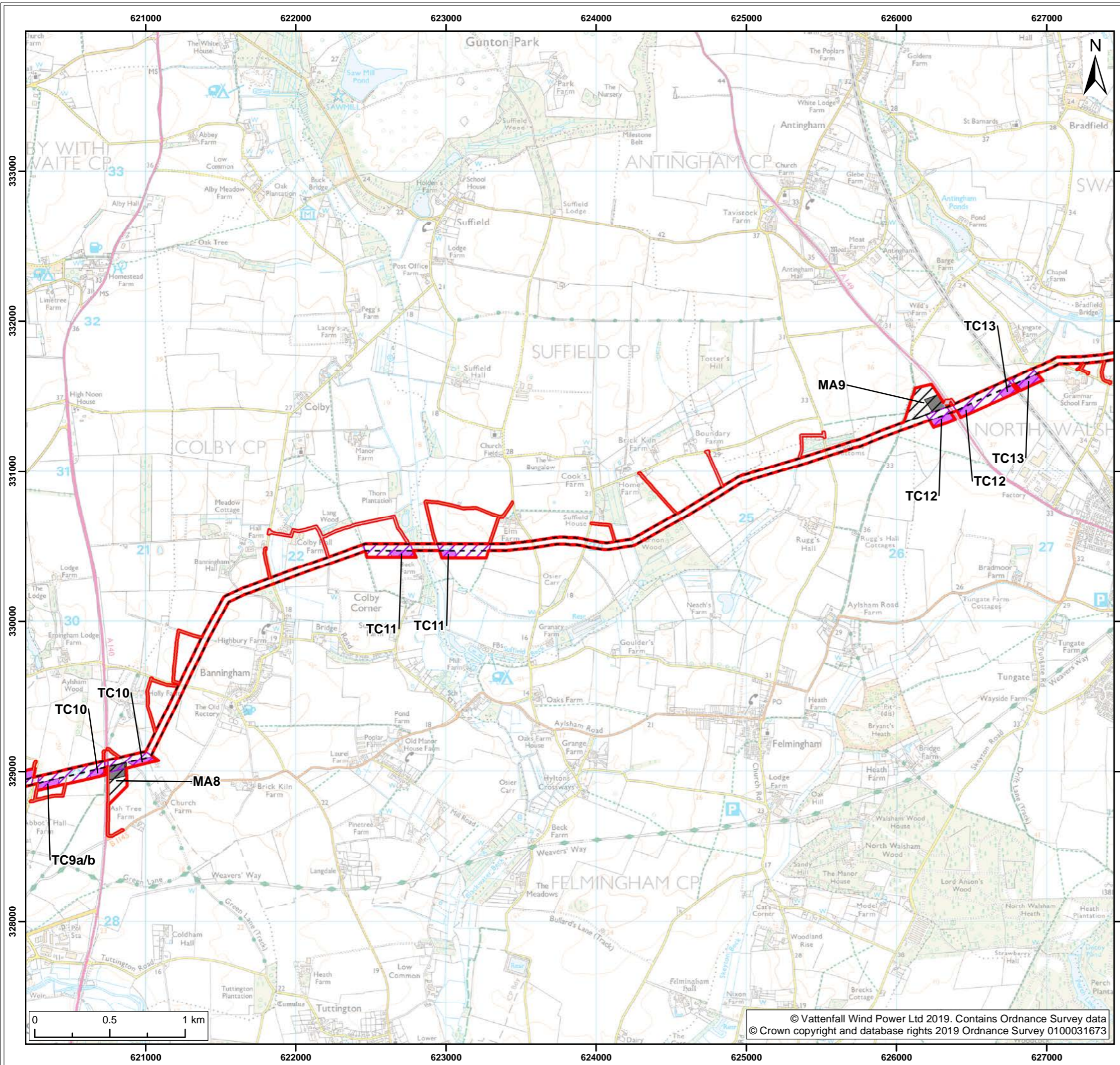
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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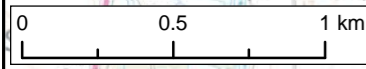
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(Map 3 of 9)

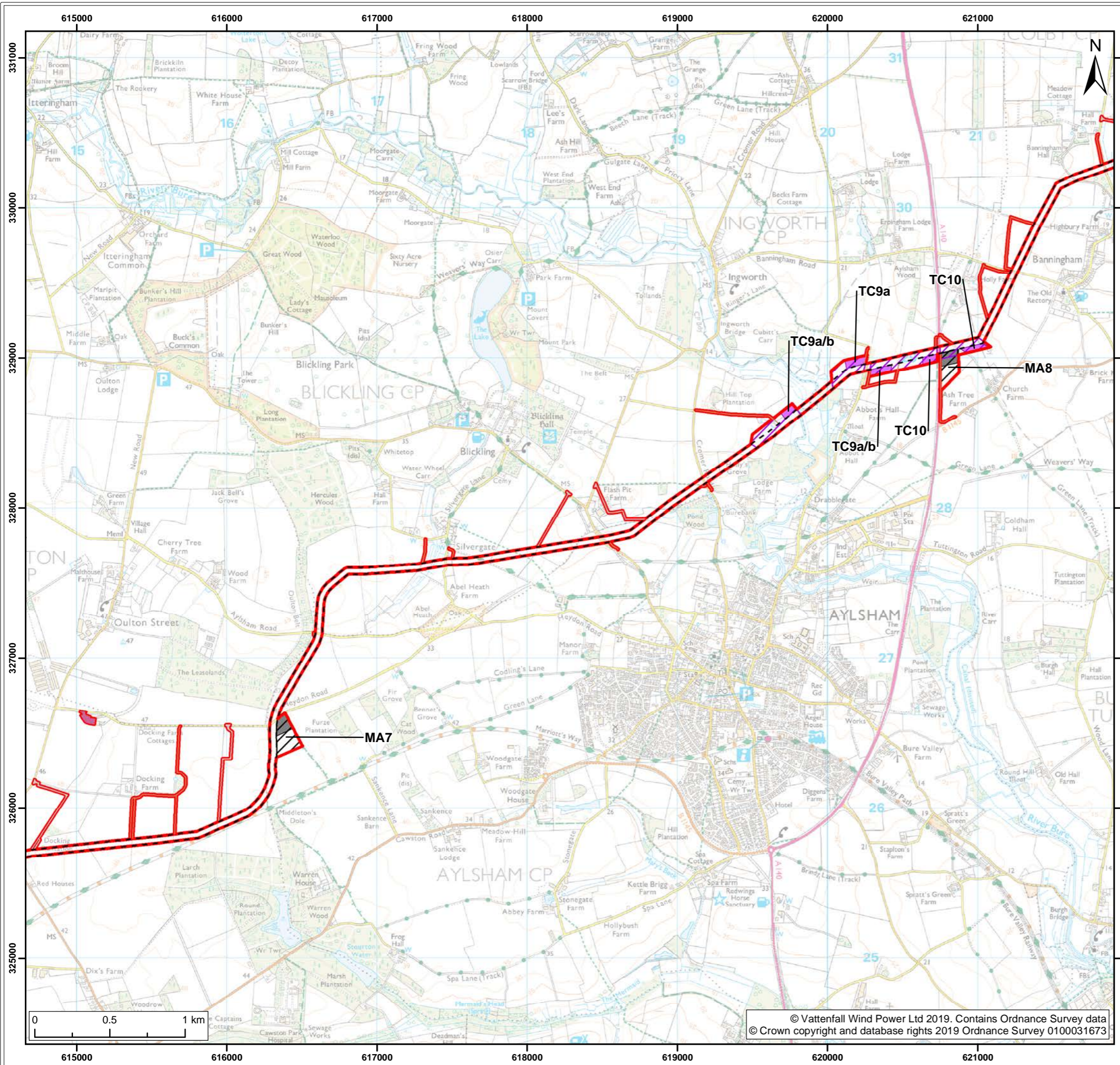
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Co-ordinate system: British National Grid **EPSG:** 27700



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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Cable logistics area
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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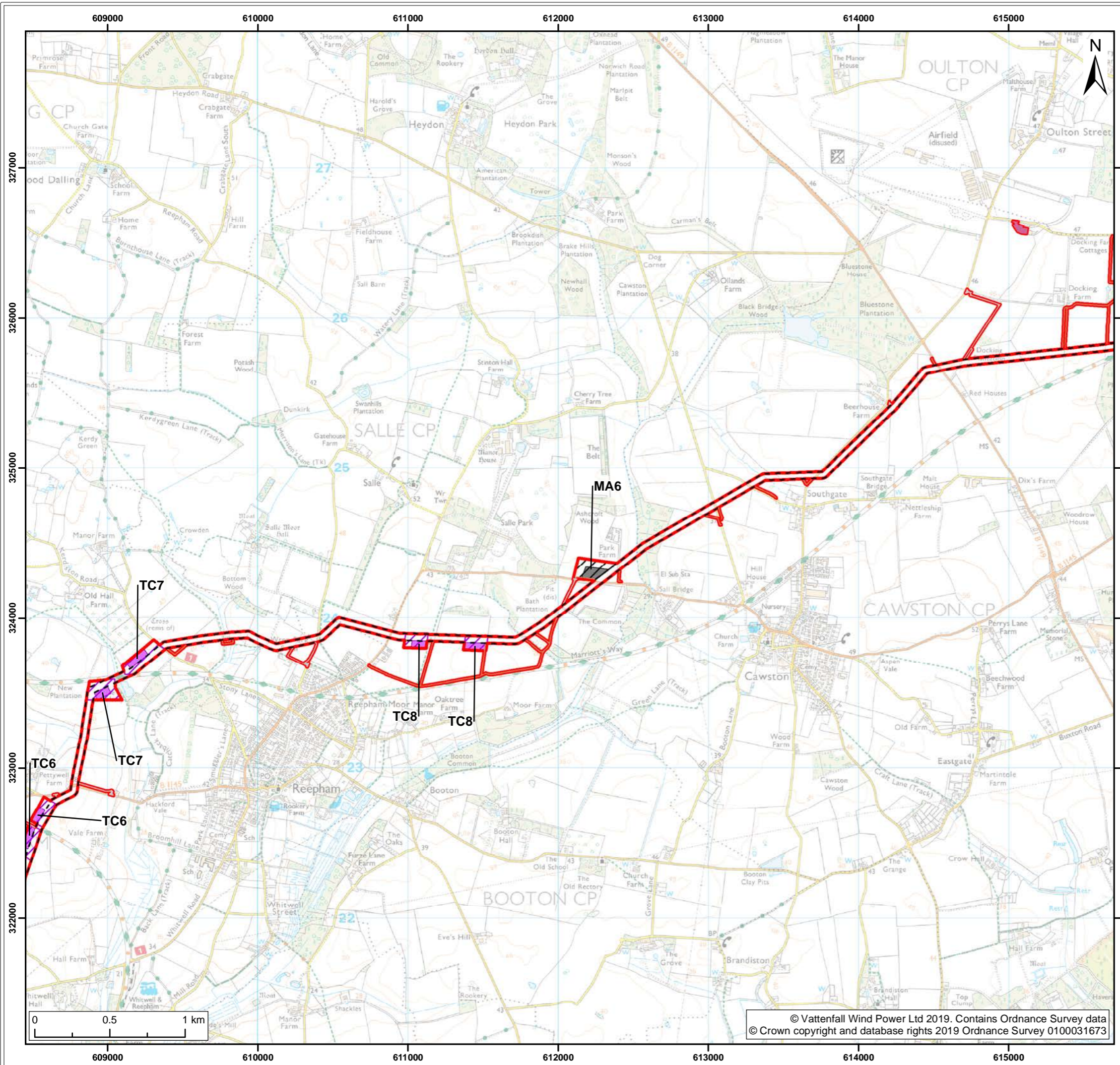
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Cable logistics area
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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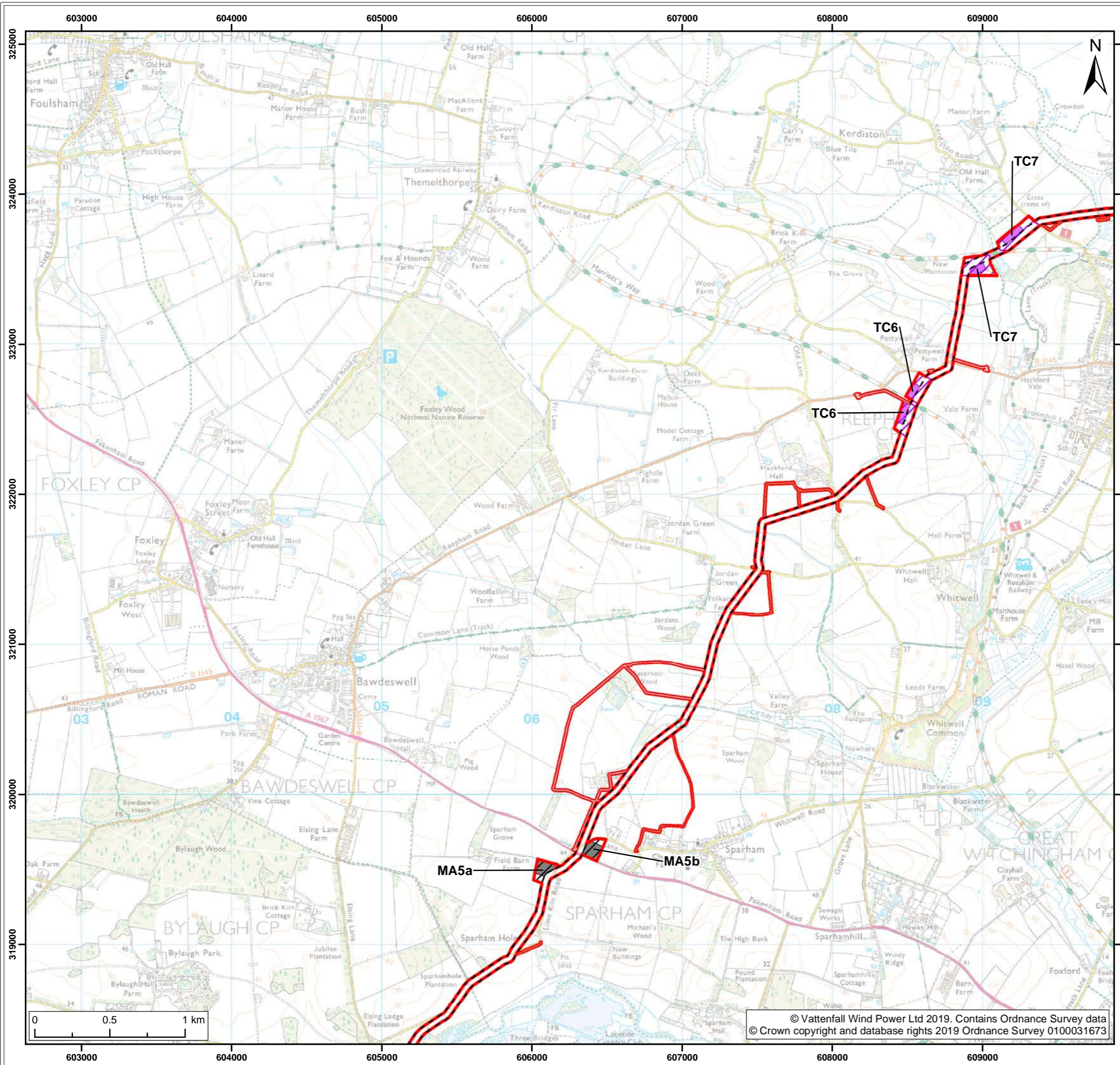
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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Title: Onshore project area (Map 6 of 9)
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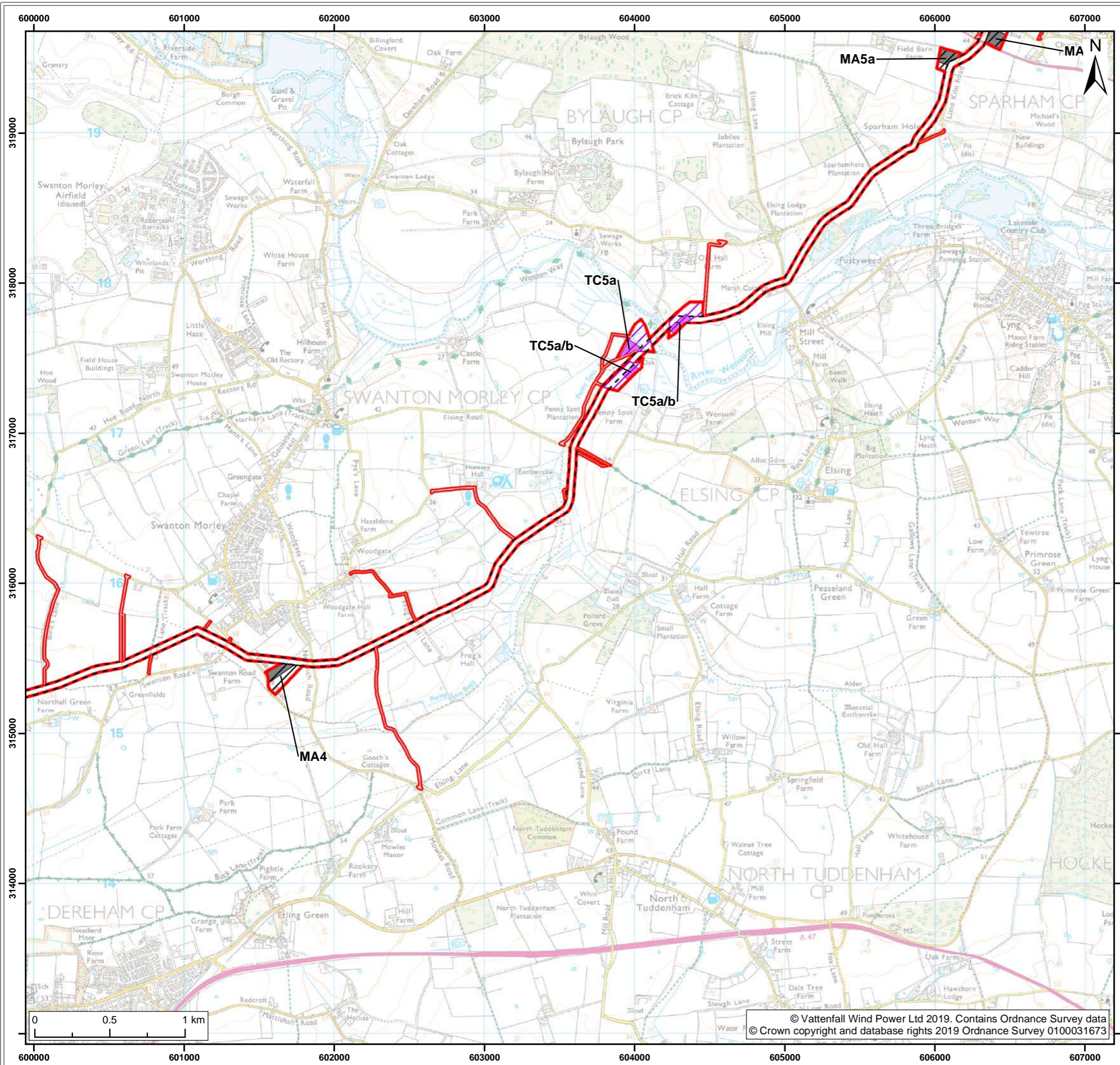
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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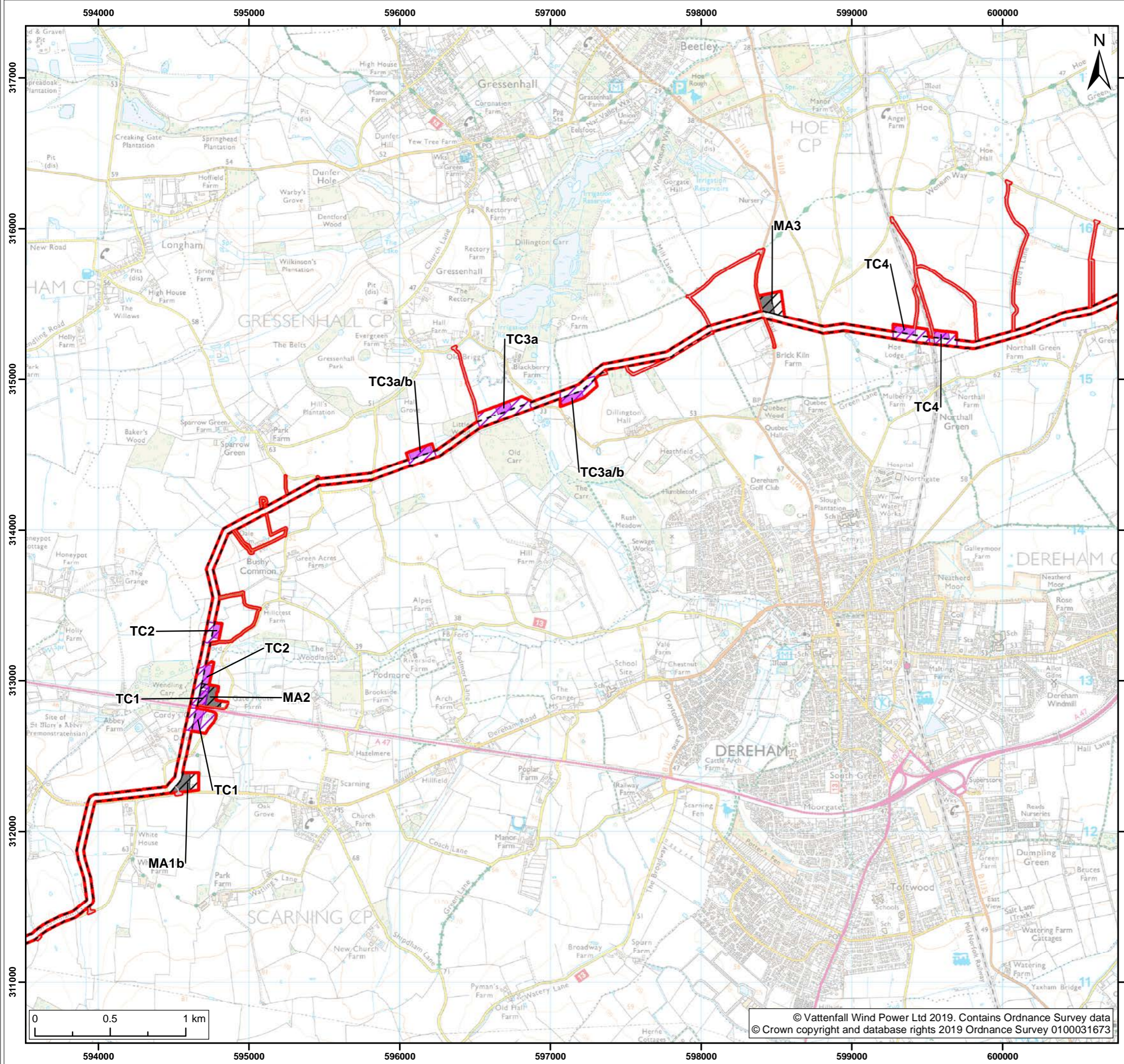
Title:
Onshore project area
(Map 7 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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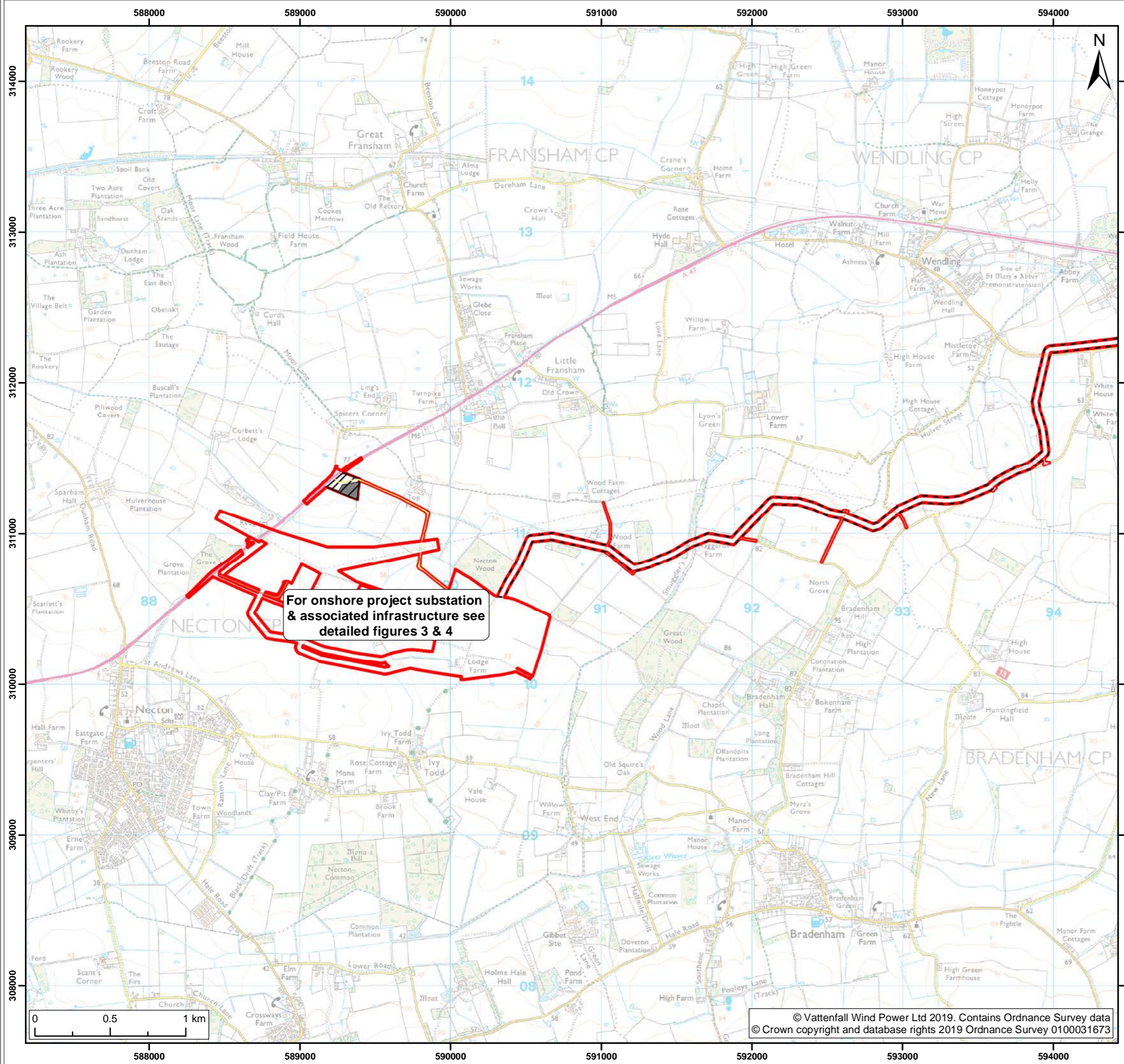
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Onshore project area
(Map 8 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Mobilisation zone
- Indicative mobilisation area compound
- Construction access
- Operational access
- Permanent access

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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Title: Onshore project area (Map 9 of 9)
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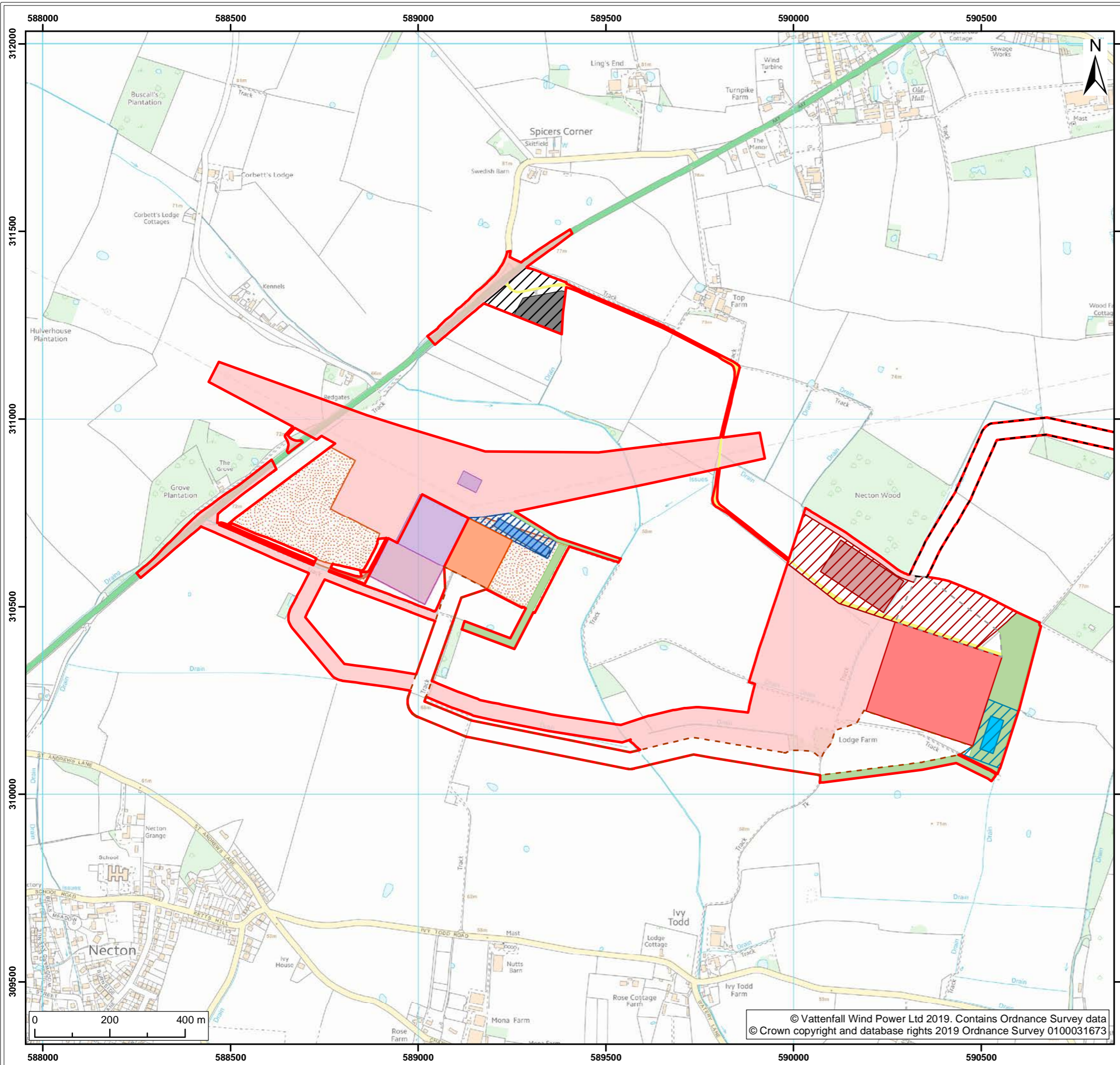
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Legend:

Norfolk Boreas red line boundary	Indicative onshore project substation temporary construction compound
Norfolk Boreas Onshore Project Infrastructure (Scenario 1)	Attenuation pond zone
Onshore cable route	Indicative attenuation pond
Cable route entry to substation	Indicative mitigation planting
Onshore 400kV cable route	National Grid substation extension
Mobilisation zone	National Grid temporary works
Indicative mobilisation area compound	National Grid attenuation pond location search area
Construction access	Indicative National Grid attenuation pond
Operational access	Alternate areas required under scenario 2
Permanent access	Existing substation locations
Onshore project substation	Dudgeon substation
Onshore project substation temporary construction compound zone	Necton National Grid substation

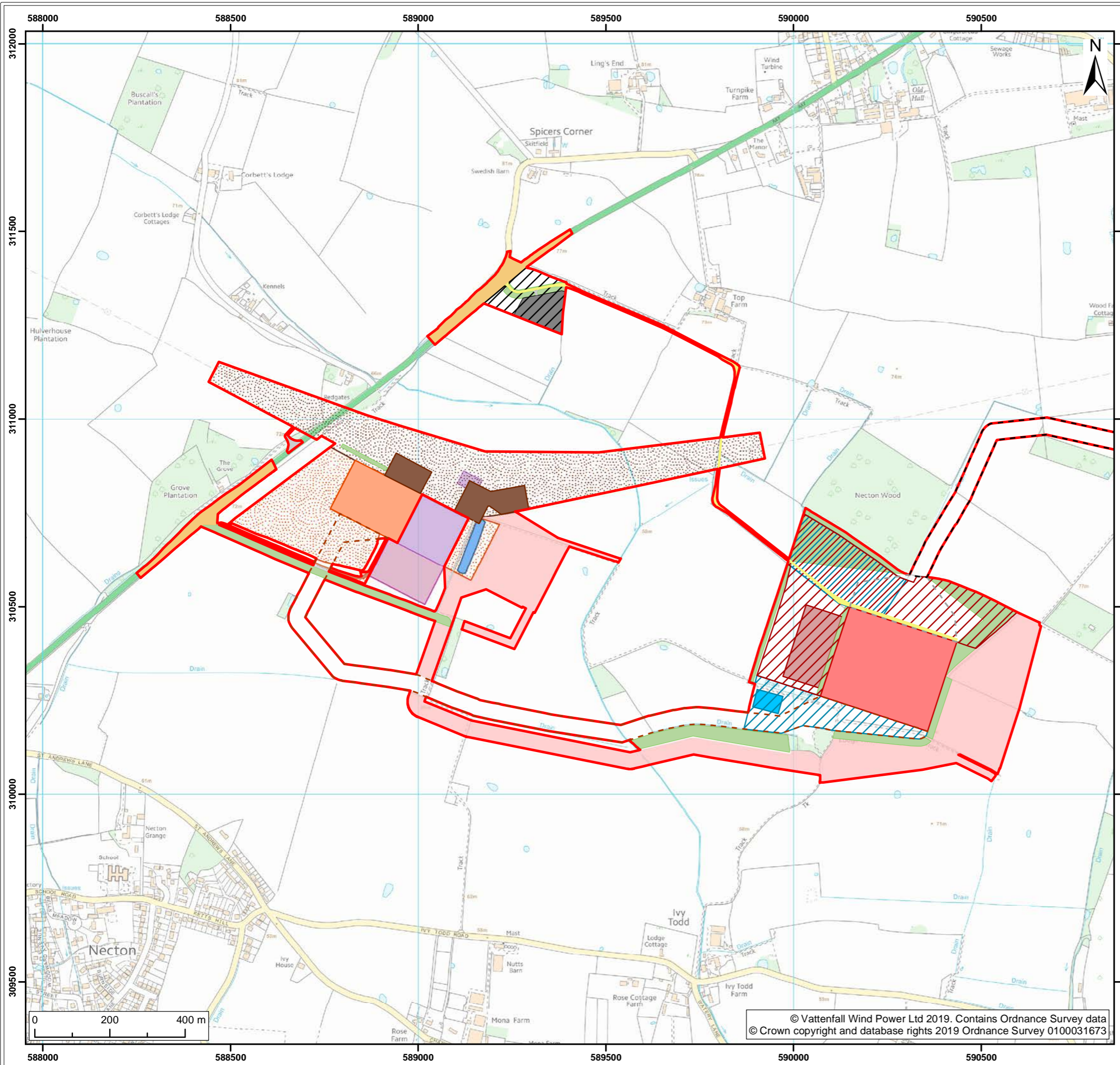
Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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Title:
Onshore project substation and extension to National Grid substation Scenario 1

Figure: 3	Drawing No: PB5640-006-000-003				
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Legend:

- Norfolk Boreas red line boundary
- Onshore cable route
- Cable route entry to substation
- Onshore 400kV cable route
- Mobilisation zone
- Indicative mobilisation area compound
- Highways temporary works area
- Construction access
- Operational access
- Permanent access
- Onshore project substation
- Onshore project substation temporary construction compound zone
- Indicative onshore project substation temporary construction compound
- Attenuation pond zone
- Indicative attenuation pond
- Indicative mitigation planting
- National Grid substation extension
- National Grid new / replacement OHL tower search area
- National Grid temporary works
- Overhead line temporary works
- National Grid attenuation pond location search area
- National Grid attenuation pond
- Alternate areas required under scenario 1
- Existing substation locations**
- Dudgeon substation
- Necton National Grid substation

Project: Norfolk Boreas	Report: Environmental Statement: Non-Technical Summary
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Title:
Onshore project substation and extension to National Grid substation Scenario 2

Figure: 4	Drawing No: PB5640-006-000-004				
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1.2 The Developer

9. The project is being developed by Norfolk Boreas Limited (an affiliate company of Vattenfall Wind Power Limited (VWPL, henceforth Vattenfall)). Vattenfall is the second largest developer in the global offshore wind sector and is strongly committed to significant growth in wind energy, both onshore and offshore. Vattenfall is also developing the aforementioned Norfolk Vanguard project.
10. Vattenfall has invested over £3.5bn in the UK since 2008, mainly in onshore and offshore wind and now has 1 gigawatt (GW) in operation. Vattenfall plans to invest €5bn in renewables, mainly offshore wind, in Northern Europe by 2020 with an overall ambition to have 4GW of operational capacity by 2020 and 7GW by 2025. The company has the ambition that the UK will continue to be a growth market for Vattenfall, with Norfolk Boreas and Norfolk Vanguard providing a significant next step towards this ambition, potentially adding up to 3.6GW to Vattenfall's capacity when fully operational.

1.3 The Need for the Project

11. The UK Committee on Climate Change (CCC)¹ (2018) reported that 2017 was in the top three warmest years on record. This followed 2016 which was the hottest year on record and was the fifth time in the 21st century a new record high annual temperature has been set (along with 2005, 2010, 2014, 2015) (NOAA, 2016). The project would make a large contribution both to achieving UK decarbonisation targets and to global commitments to mitigating climate change. By generating low carbon, renewable electricity in the UK, the project will also help to reduce the UK's reliance on imported energy. Further detail is provided within the ES in Chapter 2 Need for the Project and Chapter 3 Policy and Legislative Context.
12. Moreover, the project would have a direct positive impact by providing up to 1,800MW; which is enough to power nearly 2 million UK households². The project will also contribute to the economy by providing jobs during all phases of the proposed project.
13. In addition, Vattenfall is leading the way in bringing down the cost of offshore wind throughout Europe and according to the 2018 Offshore Wind Industry Prospectus (compiled by the Offshore Renewable Energy Catapult and the Offshore wind

¹ The Committee on Climate Change is an independent, statutory body established to advise the UK Government on emissions targets and report on progress made in reducing greenhouse gas emissions and preparing for climate change.

² Based on a load factor of 47.3% which is advocated by BEIS for new offshore wind farm projects (BEIS, 2018) and RenewableUK www.renewableuk.com/page/UKWEDEexplained

Industry Council) offshore wind has the potential to be one of the lowest cost sources of new power generation when operational.

1.4 Site Selection and Assessment of Alternatives

14. The site selection and assessment of alternatives is a progressive process to identify and assess potential sites and options for the proposed development. In common with most offshore wind farm projects in the UK, the site selection process starts with the identification of wide search areas within which the key project elements may be located.
15. For the offshore wind farm itself, a zone suitable for the development of large scale offshore wind farms was identified off the East Anglian coast by the UK Government and The Crown Estate following a Strategic Environmental Assessment.
16. In 2015, the location of the Norfolk Boreas wind farm site within this zone was identified by Vattenfall following a review of available environmental and technical information. Important environmental considerations included:
 - Shipping and navigation;
 - Existing infrastructure, including cables and pipelines and oil and gas platforms;
 - Aggregate dredging grounds;
 - Nature conservation designations;
 - Commercial fisheries activity; and
 - Civil and military radar coverage and helicopter main routes.
17. Other technical considerations included anticipated wind resource and the suitability of seabed conditions to accommodate wind turbines.
18. Following the identification of the wind farm site, Norfolk Boreas Limited and National Grid worked together to identify the location where the project would connect to the National Grid. Initially a list of fourteen potential onshore connection locations were identified. These were assessed against the distance from the Project, the extent of additional infrastructure required, compliance with the Security and Quality of Supply Standards (criteria and methodology for planning and operating National Grid), technical limitations and high-level environmental issues. Following this assessment three options, Necton, Norwich Main and Eye Airfield emerged as possible grid connection locations.
19. In parallel to this process possible landfall locations and offshore cable corridors were assessed within an area from The Wash to Harwich and extending out to the wind farm site. The majority of the coastline between the Wash and Harwich is protected by European level nature conservation designations; however, three potential landfall areas were identified that avoided these designated areas. A

comprehensive assessment was then undertaken to better understand the impacts associated with each landfall / offshore cable corridor option based on an understanding of the environmental constraints. This process led to the identification of the preferred landfall area between Bacton Green to Cart Gap.

20. Following the identification of the preferred landfall and in consultation with National Grid the two connection points at Necton and Norwich Main were still considered feasible. Based on these two potential connection points, two study areas were developed: one covering the onshore cable corridor for an onshore connection point at Necton; the second covering the onshore cable corridor associated with the alternative location at Norwich Main.
21. A comparison of the two study areas found that, in general, there is an increase in all constraints such as designated sites, roads, rivers and populated areas, from west to east across Norfolk due to the location of Norwich (and the associated infrastructure and utilities) and The Broads National Park. As far more of the Norwich main study area was located in the east and in close proximity to Norwich, the Necton study area was identified as the preferred option.
22. In November 2016, an offer was made by National Grid to connect to the existing Necton National Grid substation.
23. To minimise impacts during construction and reduce the visual impact over the lifetime of the project, an early project decision was taken to install the onshore cables within buried plastic tubes, known as ducts, rather than install overhead lines. Furthermore, a strategic approach has been adopted across both the Norfolk Boreas and its sister project Norfolk Vanguard, where ducts for Norfolk Boreas cables would be installed by the Norfolk Vanguard project meaning many areas would only be disturbed once thus significantly reducing the overall construction relation disturbance. This decision has been taken based on consultation with local authorities and other consultees.
24. After the grid connection point was confirmed, a detailed site selection exercise was undertaken by Vattenfall to identify where the onshore project substation would be located. In order to minimise the distance to the existing Necton National Grid substation from the onshore project substation (and hence to reduce transmission losses), the onshore project substation search area was defined as a 3km radius from the existing Necton National Grid substation. Potential sites within this 3km radius were then identified and assessed.
25. In order to connect the electricity exported from Norfolk Boreas the National Grid substation will have to be extended. The location of this extension is largely dictated by the location and configuration of the existing National Grid substation and has

been determined in consultation with the National Grid and in accordance with the Horlock Rules³.

26. In parallel with the onshore substation site selection exercise, potential onshore cable route options were also developed.
27. The main considerations when identifying the onshore cable route and onshore project substation were:
 - The National Grid offer to connect to the National Grid 400kv substation close to Necton;
 - Avoid proximity to residential dwellings;
 - Avoid proximity to historic buildings;
 - Avoid designated sites;
 - Minimise impacts to local residents in relation to access to services and road usage, including footpath closures;
 - Avoid noise sensitive receptors such as houses;
 - Wherever possible, seek to use open agricultural land;
 - Use of existing woodland, and landform to help screen the substation, minimising visual impact wherever possible;
 - Minimise requirement for road, river and rail crossings;
 - Ease of road access for large loads (substation only);
 - Avoid areas of important habitat, trees, ponds and agricultural ditches;
 - Install cables in flat terrain maintaining a straight route where possible for ease of pulling cables through ducts;
 - Avoid other services (e.g. gas pipelines);
 - Minimise the number of hedgerow crossings, using existing gaps in field boundaries where possible;
 - Minimise impacts on agricultural practices and access, and avoid rendering parcels of agricultural land inaccessible during construction where possible; and
 - Taking all of the above into consideration take the most direct route possible to minimise the area impacted.
28. In October 2017, an important project decision was taken to use High Voltage Direct Current (HVDC) technology. This decision removed the requirement for a cable relay station and decreased the working width of the onshore cable route for Norfolk Boreas from 50m to 35m, thereby reducing potential impacts along the cable route.

³ National Grid's guidelines for the consideration of siting of electricity network infrastructure.

1.5 The EIA Process

29. The topics included in the EIA were agreed with the Planning Inspectorate and other relevant stakeholders through the scoping process; the Planning Inspectorate provided a Scoping Opinion in June 2017 which is available in the documents section of the Norfolk Boreas website:

<https://www.vattenfall.co.uk/norfolkboreas>

30. Open and extensive consultation with communities, stakeholders, landowners and statutory bodies has been undertaken since October 2016, in order to inform and help shape the EIA processes of both Norfolk Boreas and Norfolk Vanguard. The results of consultation to date have informed the approach to each assessment, as well as the alternatives considered and the site selection process.
31. For each topic, a detailed description of the current baseline has been identified through a combination of desk based studies, consultation and a variety of surveys commissioned to inform the EIA process.
32. All potential impacts of the construction, operation or decommissioning of the project have been identified, and an assessment made on the severity of each potential impact.
33. Where significant environmental impacts are identified, mitigation measures are proposed to avoid or reduce impacts to acceptable levels.
34. The process also considers:
- Inter-relationships, where impacts to one receptor can have a subsequent impact on another (for example an impact on a fish population may lead to reduced prey for birds and marine mammals);
 - Cumulative impacts, where the project will be considered alongside the predicted impacts of other sizable construction projects in the nearby area (for example another offshore wind farm or a road development); and
 - Transboundary impacts, where activities in other countries may be impacted (for example shipping routes and fishing activities).
35. The Norfolk Boreas PEIR was published on the 31st October 2018 and was subject to a statutory consultation period which ended on the 11th December 2018. The PEIR, which is also available on the Norfolk Boreas website, was as far as possible a draft ES, which has now been updated to reflect the responses of that consultation.

1.6 Role of National Policy Statements in the Decision Making Process

36. National Policy Statements are produced by government. They give reasons for the policy set out in the statement and include an explanation of how the policy takes

account of government policy relating to the mitigation of, and adaptation to, climate change. They comprise the government's objectives for the development of nationally significant infrastructure in a particular sector.

37. There are three National Policy Statements which are relevant to the Norfolk Boreas project:
 - EN-1 Overarching Energy, which highlights that there should be a presumption in favour of granting consent for projects which fall within relevant NPSs, and recognises that offshore wind is a key factor in meeting UK policy objectives;
 - EN-3 Renewable Energy Infrastructure, which identifies the construction of offshore generating stations in excess of 100MW as Nationally Significant Infrastructure Project; and
 - EN-5 Electricity Networks, which covers the electrical infrastructure in conjunction with EN-1.
38. Each technical topic within the ES outlines how the development of the project will comply with the requirements of these National Policy Statements.

2 PROJECT DESCRIPTION

39. The wind farm itself comprises the Norfolk Boreas site, within which wind turbines will be located (Figure 1). The offshore wind farm would comprise of the following:
- Wind turbines;
 - Offshore platforms (including electrical and service platform); and
 - Subsea cables (including array cables connecting the wind turbines, interconnector cables connecting platforms within the site or potentially within the Norfolk Vanguard site and export cables taking energy to shore).
40. The project will also require onshore infrastructure in order to transmit and connect the offshore wind farm to the National Grid (Figure 2), which in summary would comprise:
- Landfall at Happisburgh South, where the offshore cables are brought ashore and jointed to the onshore cables;
 - Underground cables;
 - An onshore project substation near the existing Necton National Grid substation; and
 - Works at the National Grid Substation (including extension of the existing substation and potentially modification of the overhead powerlines).
41. A diagram illustrating the main project elements that would be installed for the project is shown on Plate 1.
42. Construction of the project is anticipated to commence between 2021 and 2022 for the onshore works, and around 2025 or 2026 for the offshore works. An indicative timeline is shown on Plate 2.

2.1 Offshore Works

43. Between 90 and 180 wind turbines would be installed within the wind farm site (Figure 1). A range of different turbines sizes and foundations are currently being considered. Turbines could be as tall as 350m (above sea level) and produce up to 20MW of power each, whilst the smallest turbines under consideration would produce 10MW of power per turbine, and therefore a maximum of 180 turbines would be required to deliver 1,800MW of installed capacity.

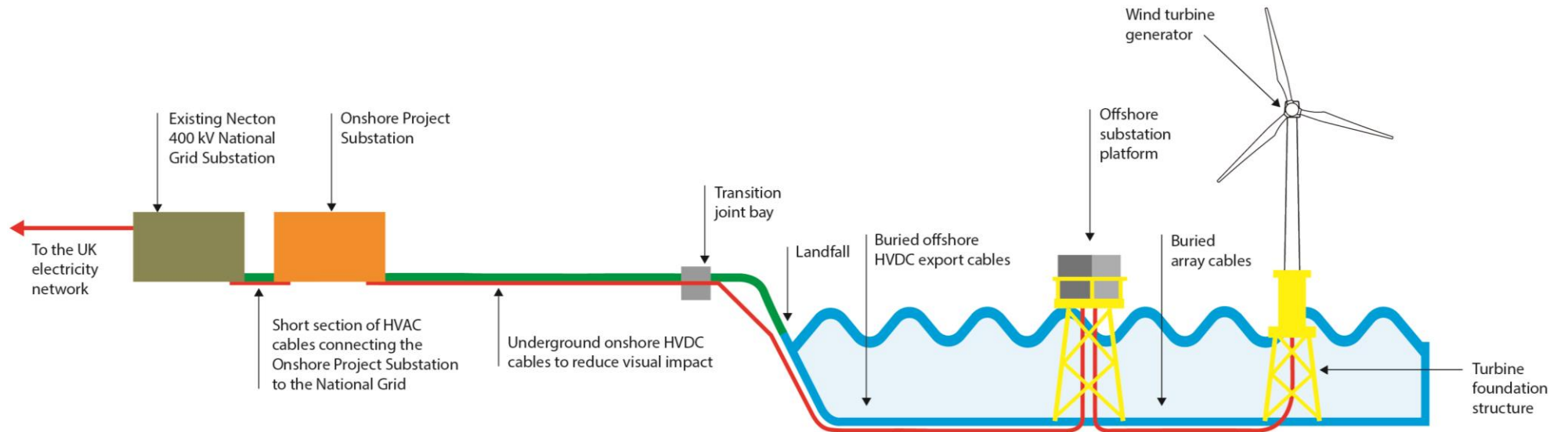


Plate 1 Diagram illustrating the key components of the Norfolk Boreas project

Norfolk Boreas Indicative Timeline and Next Steps

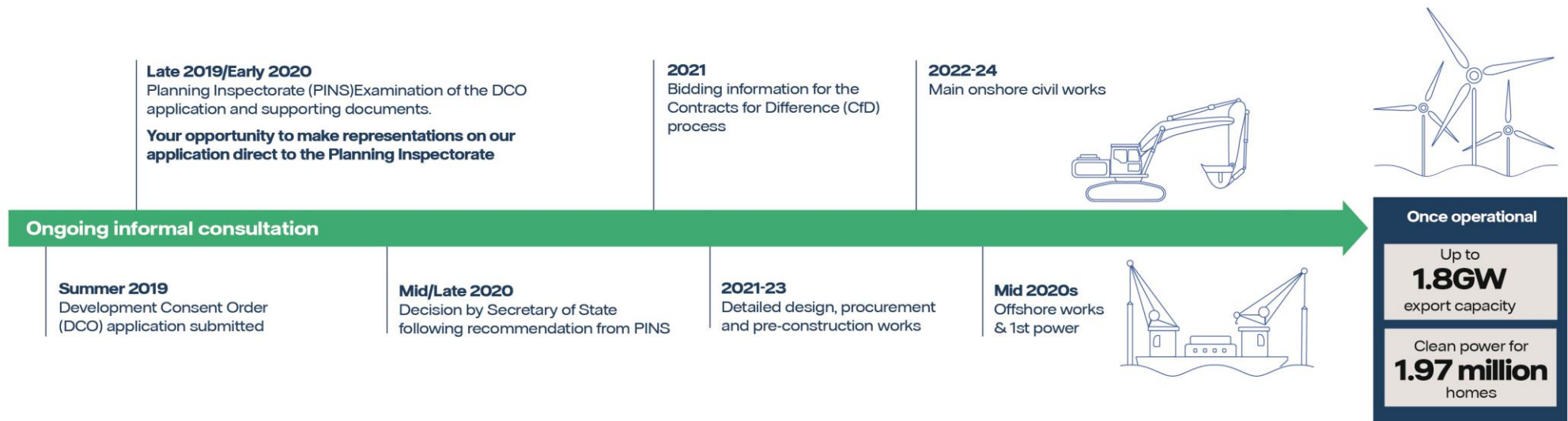


Plate 2 Indicative timeline for Norfolk Boreas

2.2 Onshore works

44. Offshore export cables would make landfall south of Happisburgh. At the landfall, ducts would be installed under the cliffs and beach using a drilling method, which would avoid the need for any construction works on the beach, see Plate 3. Once the ducts are in place, the offshore export cables would be pulled through the ducts and connected to the onshore cables.

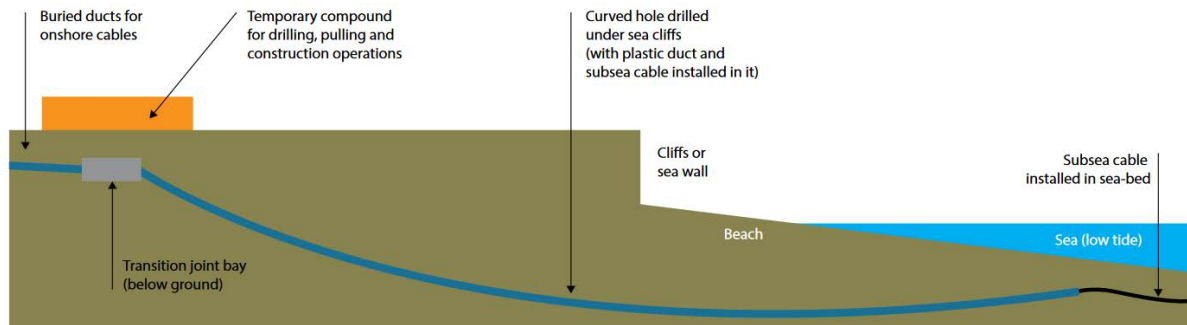


Plate 3 Diagram illustrating ducts installed at the landfall

45. Along the onshore cable route, cables would be installed in ducts installed by Norfolk Vanguard (Scenario 1). After the cables have been installed in the ducts there would be no obvious above ground infrastructure following construction⁴. If ducts have not already been installed by Norfolk Vanguard, trenches would be dug by Norfolk Boreas, in which the ducts would be placed. Once each section of duct had been installed the trench would be filled and the land returned to its preconstruction condition.
46. At certain locations where specific features need to be crossed or avoided, such as railways and rivers, trenchless techniques such as drilling under the feature would be used to install the ducts to minimise environmental impacts and disruption. However, under Scenario 1 this work would have already been undertaken by Norfolk Vanguard.
47. A number of temporary construction compounds would be required along the onshore cable route to facilitate duct installation under Scenario 2 and a running track would be created along the route to allow safe access of construction vehicles and to minimise construction vehicles on the public highway.
48. Norfolk Boreas would need to construct an onshore project substation to convert the electricity produced by the wind farm into a format that can be accepted by the

⁴ Link boxes will be required at approximately 5km intervals along the onshore cable route. Link boxes would either be buried under ground, or alternatively, above ground link box cabinets may be installed with maximum dimension of 1.2m x 0.8m x 1.8m. Where possible, link boxes would be located close to field boundaries.

National Grid. The largest buildings within the onshore project substation would be the converter halls (up to two in total) with an approximate height of 19m. The total land requirement for the onshore project substation would be 250m x 300m.

49. In order to accommodate the electricity produced by the project, the existing Necton National Grid substation would need to be extended. The extension would be in an easterly direction under Scenario 1 (Figure 3) and in a westerly direction under Scenario 2 (Figure 4).
50. Due to the extension of the Necton National Grid substation, the overhead powerline configuration around Necton would also require some modifications close to the existing substation. This would include the removal of one existing pylon and the installation of two new pylons. These works are likely to be undertaken by Norfolk Vanguard under Scenario 1, however under Scenario 2 this work would be undertaken by Norfolk Boreas.
51. Landscape and tree planting schemes will be carefully designed to reduce visual impacts of the onshore infrastructure at the onshore project substation and the extension to the existing Necton National Grid substation. Disturbed ground associated with the onshore construction will be reinstated following construction as far as possible.
52. Further details of the project elements are provided in the ES in Chapter 5 Project Description.

3 TOPICS CONSIDERED IN THE ENVIRONMENTAL IMPACT ASSESSMENT

53. The Norfolk Boreas EIA assesses the topics which were included within the Planning Inspectorate's Scoping Opinion. Each of those topics have been summarised as part of this Non-Technical Summary in the following sections.

3.1 Offshore

3.1.1 Marine Geology, Oceanography and Physical Processes

54. The assessment considered the construction, operation, and decommissioning phases of the project and its potential effects on relevant features, including three marine conservation sites. These have been designated for sandbanks or chalk reef which are important habitats for seabed species.
55. The assessment considers the impacts of the project on waves, currents and movement of sediment, both in the water column and along the seabed. Overall, the effects of the proposed project on these processes are predicted to be small scale, localised and temporary. Hence, they are categorised as low, negligible or no impact.
56. Importantly, a commitment has been made to bury, as far as possible, all offshore cables below the seabed, to minimise the need for additional cable protection which could affect movement of sediment within offshore sandbanks and at the coast.
57. No cumulative impacts with other projects, such as Norfolk Vanguard, East Anglia THREE, or aggregate extraction activities were identified in the assessment. This is due to the fact that the effects would be small scale, observed only within a few kilometres of the project and temporary in nature, generally restricted to a few days.
58. The Marine Geology, Oceanography and Physical Processes chapter was also used as a basis for the assessments of many of the following marine topics.

3.1.2 Marine Water and Sediment Quality

59. The assessment work undertaken showed that the water quality within the offshore study area is good, and seabed sediments do not contain levels of pollution that would be of concern. Additionally, natural levels of sediment in the water vary depending on season and during stormy weather. The assessment considers the impacts of the release of sediment, as well as the potential for the release of pollutants which may already be present within the seabed that may be disturbed when constructing the project. Overall, no significant impacts on marine water and sediment quality were identified in the assessment, and through the application of standard measures (such as developing an appropriate spill plan and using biodegradable oils and lubricants in the wind turbines) to reduce the risk of potential

pollution, all potential impacts to water and sediment quality are considered to be small scale, localised and temporary.

60. No cumulative impacts with other projects, including Norfolk Vanguard, East Anglia THREE, and aggregate extraction activities were identified in the assessment. This is due to the small scale of the effects and their temporary nature.

3.1.3 Seabed (Benthic) and Beach (Intertidal) Ecology

61. A broad scale survey of the seabed ecology of the former East Anglia Zone (within which the wind farm site is located) was conducted in 2010 and 2011. In addition, site specific surveys were undertaken in the offshore cable corridor in 2016 and in the Norfolk Boreas site in 2017 (Figure 1). These studies included a combination of samples taken from the seabed using a grabbing device, trawling gear and underwater video imagery.
62. Across the site, the main species were found to be marine worms, brittle stars, sea urchins and starfish, typical of the southern North Sea. Two protected habitats; sandbanks and reefs formed by marine worms are present in the area. Detailed pre-construction surveys will allow offshore infrastructure to be located away from sensitive habitats to reduce any impacts. The offshore cable corridor runs through the Haisborough, Hammond and Winterton Special Area of Conservation, and to the south of the Cromer Shoal Chalk Beds Marine Conservation Zone.
63. Potential impacts considered include temporary disturbance of habitats, loss of habitat, changes in water quality, increases in suspended sediments and potential impacts on designated sites of marine conservation interest.
64. Impacts were assessed to be negligible or minor due to the relatively small scale of the seabed footprint of Norfolk Boreas, and in the context of the available habitat in the wider area.
65. Cumulative impacts during the construction and operational phase may occur with Norfolk Vanguard and East Anglia THREE offshore wind farms and are assessed to be negligible or minor. These impacts would be small scale, highly localised and temporary.

3.1.4 Fish and Shellfish Ecology

66. Information from existing research of fish and shellfish in the Southern North Sea was reviewed and combined with relevant data obtained from surveys undertaken in areas relevant to the project in order to develop a comprehensive understanding of the fish and shellfish communities in the area.

67. Fish and shellfish species were taken forward for assessment based on their ecological value and value to commercial fishermen. Species of conservation importance such as salmon and lamprey were also included in the assessment. The impact assessment also took into consideration the information and results presented within the commercial fisheries, marine physical processes, seabed ecology and underwater noise assessments carried out for the project.
68. Overall, the assessment concluded that the project could result in a range of small scale effects on fish and shellfish ecology (such as temporary habitat loss and disturbance). The potential effects identified are anticipated to result in minor impacts to fish and shellfish populations.
69. Cumulative impacts may occur during the construction and operational phase with adjacent offshore wind farm projects however, cumulative impacts are assessed as minor or negligible due to the temporary nature and geographically small-scale of impacts.

3.1.5 Marine Mammals

70. The numbers of marine mammals that use the Norfolk Boreas site were estimated based on high resolution aerial photographs taken over a 24 month period using low flying aeroplanes. Information from other, similar surveys in the Southern North Sea area was used to improve understanding of which species would use the site. The site surveys and other data indicated low numbers of marine mammals, with only three species, harbour porpoise, grey seal and harbour seal, using the wind farm site in sufficient numbers to enable them to be analysed. The project is not predicted to have a significant impact on any other species which may visit the area infrequently.
71. The impact assessment concluded that only minor impacts to marine mammals would occur as a result of construction, operation and decommissioning of the project, following implementation of the recommended mitigation measures.
72. There are potential cumulative impacts with other offshore wind projects as a result of underwater noise from pile driving, which have the potential to disturb harbour porpoise and grey seal over a wider area. The cumulative impact of the operational phase of the project was assessed as minor following mitigation. Norfolk Boreas Limited has committed to working with the regulators, their advisors and other offshore wind developers to understand and manage cumulative impacts at a strategic level where possible.

3.1.6 Offshore Ornithology

73. The importance of the wind farm site for seabirds, and the potential effects of Norfolk Boreas have been assessed using observations obtained from monthly digital

aerial surveys undertaken over a 24 month period. A standard survey area, covering Norfolk Boreas and a 4km buffer was used. The results of these surveys have allowed the identification of bird species and estimate population sizes of birds using or passing across the area.

74. All species of seabird recorded were assessed with regard to their nature conservation value and sensitivity to effects from wind farms. Species of particular interest included red-throated diver, kittiwake, gannet, guillemot and razorbill. Effects assessed were disturbance and displacement, collision risk, barriers to movement and indirect effects (e.g. those on prey species etc.). The analysis followed industry best practice methods, including the use of collision risk modelling to fully assess the potential impacts of the proposed development.
75. The conclusion of the assessment was that the project is predicted to have minor impacts on birds when considered in isolation. There is the potential for effects of the project to act cumulatively with adjacent projects, including other offshore wind projects and aggregate extraction activities. It is concluded that there is no pathway for interaction between impacts other than in respect to collision risk impact.
76. An assessment was undertaken considering the collision risk for Norfolk Boreas and adjacent offshore wind farm projects. This assessment concluded that the collision risk during operational phase of the project as no greater than a minor cumulative impact.

3.1.7 Commercial Fisheries

77. Although many different nationalities including Dutch, Belgium, French, UK, Danish and German have been recorded fishing in the Norfolk Boreas project area using a variety of different fishing gear, the majority broadly fall into two categories:
 - Dutch vessels undertaking trawling (including UK flagged but Dutch owned beam trawlers) and seine netting; and
 - Local UK vessels using static gear (mainly pots).
78. The key species for the trawlers include plaice and Dover sole, whilst the local fishermen target lobster, edible crab and whelks.
79. All potential impacts from the project alone were considered to be minor, following the implementation of mitigation measures.
80. There is potential for cumulative impacts to occur on commercial fisheries receptors if proposed offshore wind farms, oil and gas decommissioning activities, aggregate dredging and conservation areas are implemented within the assessed area. Cumulatively these projects and plans could result in significant loss or restricted access to traditional fishing grounds.

3.1.8 Shipping and Navigation

81. The shipping and navigation assessment considers the transport of goods or persons by vessel, for either commercial or recreational purposes, in addition to any navigational aspects of marine activities, for example fishing, marine aggregates, or oil/gas.
82. The key shipping and navigation features within the vicinity of the Norfolk Boreas site are the International Maritime Organisation Routeing Measures; namely the DR1 Lightbuoy Deep Water Route passing to the west of the Norfolk Boreas site, and the West Friesland route passing to the east. These form part of the wider Routeing Measure network within the North Sea, which has been established to promote safe navigation by all vessels. The majority of marine traffic in the vicinity of the wind farm site is therefore comprised of cargo vessels and tankers, largely utilising the routeing measures, however there is some commercial traffic that currently crosses the wind farm site and as mentioned in section 3.1.7 fishing vessels also regularly use the site.
83. Identified impacts include vessel displacement, an increase in vessel to vessel collision risk, the potential for a vessel to interact with the wind farm structures or subsea infrastructure (cables and mooring lines). Also considered is the potential diminishment of Search and Rescue resources. With suitable mitigation measures implemented where necessary (such as construction vessel routeing and entry/exit points into the Norfolk Boreas site), impacts were considered to be within acceptable or tolerable risk levels.
84. Furthermore, with suitable mitigation in place, all cumulative impacts were considered to be at acceptable levels.

3.1.9 Aviation and Radar

85. The potential effects of the offshore wind farm on radar were considered, since wind turbines can generate a 'clutter' effect on the screens of radar equipment which may hamper radar operators' ability to distinguish aircraft images from those created by the wind turbines, and therefore degrade the safety and efficiency of the air traffic services being provided.
86. It is predicted that the wind turbines would be detectable and have the potential to affect the National Air Traffic Services Primary Surveillance Radar located at Cromer, and the Norfolk and the Ministry of Defence Air Defence Radar located at Trimmingham, Norfolk. A radar mitigation scheme has been agreed with National Air Traffic Services, which would successfully mitigate the impact to Cromer. The employment of appropriate mitigation measures for the Air Defence Radar at Trimmingham is currently under discussion with the MoD and will be implemented

prior to construction commencing, which would ensure impacts are fully mitigated. Agreed mitigation will remain in place during the decommissioning process and until the turbines are removed.

87. The potential for cumulative effects on radar have been analysed. The establishment of Norfolk Boreas in the southern North Sea is assessed as providing adequate airspace around the development in which aircraft can be operated to enable the prescribed radar separation standards to be achieved, without incurring adverse impacts from other developments, either onshore or offshore.

3.1.10 Offshore and Intertidal Archaeology and Cultural Heritage

88. The existing offshore and intertidal archaeological baseline has been established through a desk-based assessment and a review of offshore archaeological survey data. The known offshore archaeological baseline comprises charted wrecks and obstructions and previously unidentified anomalies of possible maritime or aviation origin. The approach to mitigation is to avoid these features via Archaeological Exclusion Zones and micro-siting during detailed design to ensure that direct impacts will not occur.
89. In addition to the known archaeological baseline, which has been established through a review of historical data sets and studying the seabed survey data; studies have been conducted on core samples which have been taken to a depth of up to six meters below the seabed. These cores have uncovered peat samples which have provided an insight into the environment that would have existed in the area that is now occupied by the Norfolk Boreas site, before the area was flooded and became what is now the North Sea. These findings may be crucial in adding to our understanding of how early humans populated the British Isles.
90. In order to account for unexpected archaeological finds, a formal protocol for archaeological discoveries will be agreed with regulators and implemented during construction.
91. With the application of recommended measures, significant impacts to offshore and intertidal archaeology (including cumulative and transboundary impacts) would not occur.

3.1.11 Infrastructure and Other Users

92. This assessment looked at potential impacts upon other wind farm developments, cables and pipelines, oil and gas activities, marine aggregate activities and unexploded ordnance.
93. Impacts would largely be avoided, as there is a requirement for industries to co-operate and operate in a safe manner. Norfolk Boreas Limited will be required to

establish crossing agreements with operators of other relevant cables and pipelines to ensure that these crossings are made safely and without damage to other infrastructure.

3.2 Onshore

3.2.1 Ground Conditions and Contamination

94. The majority of the onshore project area is located in agricultural land, where significant contamination is not expected. The ground conditions assessment included a desk-based review of the current conditions found within the onshore project area and identified mitigation measures where appropriate for those significant effects that may potentially arise as part of the project.
95. The impacts assessed include the potential for contamination leaks and spills from construction plant, potential for existing contaminant release during any works and impacts on groundwater quality and mineral resources availability. A Code of Construction Practice will be produced for each stage of construction, which will provide details of the industry best practice measures that would be undertaken to reduce potential construction impacts onshore.
96. Provided mitigation measures are in place, the project is predicted to have no greater than minor impacts in relation to ground conditions and contamination during construction. No potential impacts are anticipated for the operational phase.
97. Cumulative impacts with other relevant projects during construction phase have been assessed as being no greater than minor, and impacts have been scoped out for the operational phase. No cumulative effects are likely as the project will meet all regulatory requirements regarding protection of surface and groundwater

3.2.2 Water Resources and Flood Risk

98. To inform the impact assessment, a desk based review of publicly available data and data obtained from the Environment Agency and Internal Drainage Boards was undertaken. In addition, a geomorphological walkover survey of the locations where the onshore cable route would cross watercourses was also undertaken.
99. The study area for this assessment was categorised by the three main surface water catchments; the River Bure catchment, the River Wensum catchment, and the River Wissey catchment. The River Bure and River Wensum are both designated Special Area of Conservation and Site of Special Scientific Interest, and several of their tributaries, including the King's Beck, North Walsham and Dilham Canal, Wendling Beck and Blackwater Drain will be crossed by the proposed onshore cable route. The proposed grid connection at the existing National Grid substation near Necton will be located within the River Wissey headwaters. Due to the designated status of the

River Bure and River Wensum, these watercourses and their tributaries are considered to be receptors of high value.

100. The impact assessment considered potential impacts upon receptors including direct disturbance of surface water bodies, increased flood risk, soils entering watercourses, and accidental spills of fuels, oils and lubricants during construction.
101. Mitigation measures have been identified including a commitment to trenchless crossing techniques for a number of sensitive watercourses, sediment management, construction drainage, and implementation of best practice measures to be set out in the Code of Construction Practice which will be provided as part of the DCO application in June 2019. Under Scenario 2 potentially significant impacts related to disturbance of some surface water bodies and soils potentially entering watercourses would remain even with mitigation.
102. The assessment is based on worst case assumptions which reflect the number of construction activities (e.g. cable trenching and watercourse crossings) occurring within the wider network of watercourses, rather than the potential impacts on any individual watercourse. Overall these will be short term impacts, with moderate impacts relating to duct installation works for the onshore cable route. These will be undertaken sequentially in 150m sections at a time and would take a maximum of two weeks for each 150m section. Typically, impacts would be reversible once activities have been completed. If Norfolk Vanguard were to install the ducts for Norfolk Boreas (Scenario 1) no significant impacts are predicted following mitigation.
103. The presence of new permanent above ground infrastructure has the potential to increase flood risk where permeable ground is replaced with buildings and other hard surfaces. The onshore project substation and National Grid substation extension are located in Flood Zone 1, which is classified as land with a low risk of flooding (less than 0.1% chance of flooding in any year). The risk of flooding associated with the introduction of this new above ground infrastructure has been assessed, and a suite of mitigation measures have been incorporated into the design to mitigate any potential risk. This includes capturing surface water (from rainfall and water flowing overland) as it reaches the onshore project substation and discharging it in a controlled manner to mimic the run-off rate for greenfield land; creation of new water storage at the onshore project substation (e.g. a large pond); and the creation of increased water storage at the National Grid substation near Necton. With these measures in place, the risk of flooding associated with the introduction of new above ground infrastructure has been assessed as negligible.
104. Cumulative impacts with other relevant projects may be higher than the impacts of Norfolk Boreas alone.

3.2.3 Land Use and Agriculture

105. To inform the land use and agriculture impact assessment, a desk based literature review of existing reports and survey data was undertaken to provide indicative baseline conditions for land use. Additionally, consultation was undertaken with relevant Local Planning Authorities and feedback has been sought from landowners and occupiers within the study area to provide information on agricultural practices.
106. The assessment considered the potential impacts of the project on drainage, agricultural land, soil quality, Environmental Stewardship Schemes and utilities. Provided mitigation measures are in place, the project is predicted to have no greater than minor impacts in relation to land use and agriculture. Mitigation measures include the use of an Agricultural Liaison Officer, ensuring agricultural field drains are maintained, avoiding the best and most versatile land, and employing best practice measures through a Soils Management Plan.
107. Cumulative impacts with other relevant projects are assessed as being no greater than minor.

3.2.4 Onshore Ecology

108. An extensive suite of ecological surveys was undertaken throughout 2017 and 2018 to describe the ecological baseline. The scope of these surveys was agreed in advance with Natural England.
109. All sites designated for their nature conservation value, have been avoided, where possible, during the site selection process. Where avoidance was not possible, for example at the River Wensum Special Area of Conservation, alternative construction techniques have been selected to avoid impacts (e.g. trenchless techniques to pass beneath the feature). Ancient woodland and woodland parcels have been avoided wherever possible and, where hedgerows must be crossed during construction the working width will be reduced from 35m to 13m⁵ under Scenario 2 to minimise potential impacts. Under Scenario 1 hedgerows would not require crossing as the ducts would have already been installed by Norfolk Vanguard.
110. Temporary habitat loss and fragmentation will occur during the project construction phase. Habitats will be reinstated as far as practicable following construction and the effects will be reversible in the long-term.

⁵ This width assumes that the onshore cable route bisects each hedgerow in a perpendicular fashion. In reality, some hedgerows will be crossed at an angle, therefore increasing the maximum width of the gap required up to a possible 16.5m.

111. Potential impacts on badgers, bats, water voles, otters, great crested newts, common reptiles, Desmoulin's whorl snail and protected flora are also anticipated to occur during the construction phase. These impacts include disturbance and risk of injury, permanent and temporary habitat loss and habitat fragmentation. Species-specific mitigation has been identified for these impacts, which includes pre-construction surveys (to confirm if populations have changed), reinstatement of lost habitats and precautionary methods of working.
112. Under Scenario 2 significant residual impacts will remain following mitigation for bats (loss of connective hedgerow habitat) and hedgerows only; however, these impacts will reduce to non-significant over time as replacement hedgerows mature. If Norfolk Vanguard install ducts for Norfolk Boreas (Scenario 1) as Vattenfall intend, then no significant impacts caused by the Norfolk Boreas project are predicted.
113. Potential impacts during operation may arise from maintenance and operational lighting at the onshore project substation. Operational lighting will be designed to conform with best practice guidance such as that set out in the Bat Conservation Trust's *Artificial Lighting And Wildlife Guidance* to minimise disturbance to light-sensitive species.
114. Cumulative impacts with other relevant projects are assessed as being no greater than for Norfolk Boreas alone.

3.2.5 Onshore Ornithology

115. Information was gathered through a combination of desk-based assessment and a programme of field surveys (wintering bird and breeding bird surveys) of the onshore study area conducted between 2016 and 2017. The suitability of the survey data for characterising the baseline environment was agreed with Natural England.
116. The potential for temporary habitat and disturbance of birds during construction was assessed, along with potential noise and light disturbance during operation associated with the onshore project substation.
117. Provided mitigation measures are in place, the project is predicted to have no greater than minor impacts in relation to onshore ornithology. Mitigation measures include removing vegetation prior to bird breeding seasons, reinstatement of removed hedgerows following construction, and an operational lighting scheme at the onshore project substation that conforms to recognised guidance.
118. Cumulative impacts with other relevant projects are assessed as being no greater than minor significance.

3.2.6 Traffic and Transport

119. The traffic and transport assessment for the project is based on forecasts of background levels of traffic for 2023 for Scenario 1 and 2026 for Scenario 2 as these represent the main anticipated construction years under each Scenario. Transport requirements were determined through a series of desk based assessments utilising open source data obtained from the Department for Transport and the relevant Highway Authorities. Further traffic data was obtained via commissioned onsite Automatic Traffic Count surveys undertaken in 2017, and through classified automatic traffic counts in 2018 from Hornsea (Ørsted Hornsea Project Three, 2019).
120. A total of 108 highway links within the traffic and transport study area have been assessed for the effects of severance (the perceived division that can occur within a community when it becomes separated by a major traffic movements), pedestrian amenity (the relative pleasantness of a journey which is affected by traffic flow, traffic composition and pavement width and separation from traffic), road safety and driver delay. With the application of mitigation measures (as appropriate) the residual impact for all highway links (bar one road) was assessed to be not significant.
121. Little London Road (south of Swafield, off the B1145) was identified as potentially experiencing significant residual impacts for pedestrian severance and pedestrian amenity during construction; this road is not wide enough to allow two-way construction traffic and as such is considered to be a receptor of high sensitivity. For mitigation, the use of this road will be limited to, and used only to facilitate the installation of a very short section of the cable route and therefore would only be used for a few weeks. Furthermore, it is considered that community liaison, including providing advance notice of the works will help to minimise disruption.
122. No significant impacts were identified for the operational phase and no significant cumulative impacts with other projects (including Norfolk Vanguard and Hornsea Project Three) were identified.

3.2.7 Noise and Vibration

123. To inform the noise and vibration impact assessment, a baseline noise survey was undertaken to quantify the existing noise environment in the vicinity of proposed onshore assets and construction corridors. Noise modelling was undertaken to inform several subsequent assessments in order to determine any potential impacts relating to the construction and operation of the project at agreed receptors.
124. Potential impacts from noise were identified as arising from construction works in a small number of locations along the onshore cable route. Provided mitigation

measures are in place, the project is predicted to have no significant impacts in relation to noise.

125. The only sources of noise during the operation of the project are those from the onshore project substation. Norfolk Boreas Limited will provide a final design of the project which will not exceed the noise limits (at the nearest noise sensitive receptors) already imposed on the existing Dudgeon substation. Noise reduction technologies and potential design approaches have been considered and there are many proven mitigation options that, through the detailed design process, can be combined to create a design that will adhere to the required noise limits.
126. During operation, there is the potential for impacts from the project to act cumulatively with Norfolk Vanguard, as the two projects' onshore substations will operate simultaneously. The effect this has been modelled and the level of noise reduction required across both projects would be readily achievable. The resultant noise levels, provided mitigation measures are in place, would not exceed the noise limits (at the nearest noise sensitive receptors) imposed on the existing Dudgeon substation.
127. No impacts from vibration effects have been identified in the assessment.

3.2.8 Air Quality

128. A desk-based assessment was carried out using air quality monitoring data collected by Local Authorities within the study area, as well as pollution maps provided by the Department of Environment, Food and Rural Affairs (Defra), to establish existing pollution levels. The air quality assessment considered the potential impacts associated with onshore construction phase dust and road traffic emissions only.
129. In accordance with air quality guidance, a suite of best-practice mitigation measures has been identified (such as dampening down the running track during dry periods to minimise dust generation), which are in proportion with the level of dust risk of the construction activities. With the implementation of the mitigation measures, dust impacts can be considered to be not significant and cumulative impacts with other relevant projects are also assessed as being not significant.

3.2.9 Human Health

130. An assessment of activities which may have an impact on physical or mental health during the construction, operation and decommissioning of the project was undertaken. Impacts associated with offshore elements of the project were not assessed as there are no sensitive receptors close enough to experience health impacts.

131. The human health effects that were considered included: construction and operational noise, air quality, exposure to contaminated land, employment during construction and operation, and exposure to electromagnetic fields (EMF) during operation.
132. The onshore infrastructure is largely routed through agricultural land and away from population centres and sensitive receptors, thus the potential number of receptors has been reduced through site selection and project design.
133. With the implementation of the mitigation measures identified within the separate topics (such as measures to minimise construction noise and to minimise the risk of dust generation), there are not predicted to be any significant effects.
134. As with any electrical current carrying device the buried cable systems will produce EMFs. Public Health England has produced guidelines identifying EMF thresholds above which there is the potential for human health effects. The level of EMFs produced by the Norfolk Boreas buried HVDC cable systems is approximately 1% of the value Public Health England has identified as safe. HVAC cables connecting the onshore project substation with the National grid extension (which would be approximately 1.5km in length) would be approximately 8% at source reducing to 1% at a distance of 25m. As such, the conclusion of the assessment is that there would be no effect either from the project in isolation or cumulatively with other projects to population health due to EMFs during operation. For further information please see an EMF information leaflet which has been produced by Vattenfall and National Grid⁶.

3.2.10 Onshore Archaeology and Cultural Heritage

135. The existing onshore archaeology and cultural heritage baseline has been established by a desk based exercise and supplemented by a programme of aerial photographic assessment and non-intrusive surveys to identify potential archaeological features underground (such as magnetometer surveys).
136. The onshore archaeological and cultural heritage baseline resource comprises both designated and non-designated heritage assets and includes both below ground archaeological remains and above ground built heritage assets. The baseline also considers the historic landscape character of project area.
137. Designated heritage assets (e.g. Scheduled Monuments) have been avoided as part of the site selection process and as such, no direct physical impacts are anticipated

⁶ <https://corporate.vattenfall.co.uk/contentassets/bf0e5e31bbab467eaf02040c7b17513a/vattenfall-emf-information-sheet.pdf>

to occur. Indirect impacts do, however, have the potential to occur, such as impacts to the setting of a heritage asset.

138. Non-designated heritage assets may be subject to direct and / or indirect impacts as a result of the project. Direct impacts may arise as the result of ground excavation during construction.
139. A Written Scheme of Investigation will be submitted with the application, in June 2019, which will outline the stages of mitigation to be undertaken post-consent. This will inform further decisions regarding the subsequent archaeological mitigation strategy so that the historic environment resource can be safe-guarded in a manner that is both appropriate and proportionate to the significance of the archaeological remains identified and present. With this commitment in place any impacts are considered to be non-significant. Furthermore, cumulative impacts with other relevant projects are also assessed as being non- significant.

3.3 Project Wide Impacts

3.3.1 Landscape and Visual Impact Assessment (LVIA)

140. The potential effects of the onshore components of the project were assessed for landscape and visual receptors during the construction, operation and decommissioning phases of the project. The visibility of the offshore works and operation of the wind turbines was scoped out of the assessment as, due to the distance of the project offshore, it will not be visible from the coast.
141. The LVIA demonstrated that despite the scale of the onshore project elements, any significant effects would occur in relatively contained areas only, with the majority of landscape and visual receptors either undergoing non-significant effects or no effect.
142. In respect of the landfall and onshore cable route, significant effects would occur only during the construction phase, with no significant effects during the operational phase as infrastructure will be buried below ground. These effects would be short term in relation to the construction works, and medium term in relation to the re-establishment of hedgerows.
143. There would be no cumulative effects in relation to either the landfall or the onshore cable route, with the exception of a localised and short term significant cumulative effect arising in respect of walkers on a short section of the Marriott's Way walking route to the south-west of Salle Park, where Hornsea Project Three onshore cable route would have a cumulative influence if both projects were under construction at the same time. This would only occur in the unlikely event that Norfolk Boreas was being constructed under Scenario 2.

144. During operation, potentially significant visual effects associated with the onshore project substation and National Grid substation extension would be largely contained within the local landscape, owing to the extent of existing woodland cover to the north and east and rising land to the south and, owing to the enclosure of hedgerows along roads and around settlements. As such, significant visual effects are limited to road-users on a short section of the A47, an opening on Ivy Todd Road and walkers on Lodge Lane.
145. Mitigation planting will be introduced which has been designed with the aim of reducing these identified impacts. The planting includes areas of fast growing woodland species as this will provide the height required, as well as the density, to ensure effective screening.
146. Woodland planting would mitigate these localised effects within 10 years in respect of the views from the A47, 20 years in respect of the views from Lodge Lane and 25 years in respect of the opening on Ivy Todd Road as the woodland becomes established. In respect of local landscape character, effects would be gradually mitigated as planting grows, and within 20 years of operation, significant effects would be mitigated.
147. The onshore project substation and National Grid substation extension for Norfolk Boreas in conjunction with the onshore project substation and National Grid substation extension for Norfolk Vanguard would have a significant cumulative effect. Significant effects would arise from Lodge Lane to the south of the site and a very localised section of Ivy Todd Road to the south-west. Woodland planting would mitigate these cumulative effects within 20 years as the woodland becomes established.

3.3.2 Tourism and Recreation

148. A desk-based assessment combined with consultation enabled an identification of the important recreational and tourism features. Visitors are attracted to the local area to enjoy sandy beaches, historic towns and villages, and open landscapes.
149. There is the potential for tourism and recreation impacts to occur in the short term to local features near the landfall works (i.e. coastal areas and footpaths) during construction due to noise, traffic and general construction presence. With mitigation measures in place the project is predicted to have no greater than minor impacts. In addition, at the landfall, ducts will be installed under the cliffs and beach by drilling, which will avoid the need for any construction works on the beach. No impacts were identified to tourism and recreation receptors during operation.
150. Cumulative impacts with other relevant projects are assessed as being no greater than minor.

3.3.3 Socio-economics

151. A review of policy, strategy, and business analysis was undertaken that showed that the offshore wind industry in East Anglia is growing quickly, with Vattenfall seen as a significant contributor in this growth. The project may create up to up to 481 jobs during construction and up to 175 jobs during operation. With appropriate skills and training programmes in place, the East Anglia job market could supply this demand, and this would represent a potential minor benefit to the area.
152. When considered cumulatively with other projects, there is the potential for moderate long term benefits to the region due to increased employment across the supply chain serving the offshore wind industry.

4 CONCLUSIONS

153. For all offshore topics, the assessments conclude that following suitable mitigation measures Norfolk Boreas will not result in any significant environmental impacts. In many cases, this is the result of the project being designed to avoid and minimise impacts.
154. There are potential cumulative impacts with other projects as a result of underwater noise from pile driving, which have the potential to disturb harbour porpoise and grey seal over a wider area. Norfolk Boreas Limited has committed to working with the regulators and other offshore wind developers to manage these impacts at a strategic level and expect these to reduce impacts to minor.
155. For the majority of onshore topics, the assessments conclude that the project would not result in significant impacts. As above, the onshore site selection has resulted in many potential impacts being avoided.
156. Potentially significant landscape and visual impacts may arise as a result of the onshore project substation; however, these impacts are very localised and would reduce over time following the establishment of woodland planting. Significant residual impacts will remain after mitigation for bats (loss of connective hedgerow habitat), but these impacts would also reduce to non-significant over time as replacement hedgerows mature.
157. There are potential significant impacts associated with the number of highly sensitive watercourse crossings and the potential increases in sediment experienced during construction. With the implementation of appropriate measures, the impacts are reduced as low as possible but remain significant. However, these will be short term impacts and reversible once construction is complete.
158. Potentially significant impacts were also identified on one road. This is related to pedestrian usage during construction. The impact is very localised and is for a relatively short duration. A Traffic Management Plan will be developed and agreed with the relevant Highways Authorities with measures for managing the HGV movements on this sensitive highway link.
159. Throughout the ES, Norfolk Boreas Limited has committed to implement mitigation that will ensure that impacts are below the level that would be considered unacceptable under the relevant technical guidance and standards.

5 CONTACT US

160. This document provides a summary of the issues which are being considered as part of the Environmental Impact Assessment for Norfolk Boreas. For more detailed information, the Norfolk Boreas ES is available online at the following link:

[https://infrastructure.planninginspectorate.gov.uk/
projects/eastern/norfolk-boreas/](https://infrastructure.planninginspectorate.gov.uk/projects/eastern/norfolk-boreas/)

161. If you have any further questions on the Environmental Impact Assessment process and areas we are considering please feel free to get in touch:

Visit our project website: www.vattenfall.co.uk/norfolkboreas and register your interest in the project to receive updates.

Email us at: [**Info@norfolkboreas.co.uk**](mailto:Info@norfolkboreas.co.uk)

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