

# Norfolk Boreas Offshore Wind Farm

# Appendix 4.7

## Identification of Onshore Cable Corridor

## Environmental Statement

## Volume 3

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*Photo: Ormonde Offshore Wind Farm*

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# REPORT

## **Cable Corridor Site Selection**

Client: Norfolk Vanguard Limited & Norfolk Boreas Limited

Reference: PB5640

Revision: 0.1/Final

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## **1 Identification of Onshore Cable Corridor**

### **1.1 Purpose of the onshore cable corridor technical note**

The purpose of this Technical Note is to present the findings of the various stages of site selection work which have fed into the identification of the preferred option for the Norfolk Vanguard and Norfolk Boreas onshore cable corridor. These stages are:

- Identification and characterisation of the onshore project area (giving a high level assessment of indicative cable corridors);
- Refinement of the cable corridors into a study area (shown at Scoping stage) and identification and assessment of more detailed cable 'branches';
- Production of chosen cable corridor option;
- Review of the preferred cable corridor option; and
- Production of the cable corridor option for Norfolk Vanguard Preliminary Environmental Information Report (PEIR) stage.

## **2 Identification and characterisation of the cable corridor search area**

The purpose of the first stage of this note is to present the findings of a high level assessment of the environmental risks associated with the onshore study area and indicative cable corridors from landfall at Happisburgh South to the substation search area at Necton.

This stage contains the following:

- Identification of the onshore study area;
- Description of the key environmental considerations;
- Outline of the environmental risk assessment methodology used;
- Identification of indicative cable corridors; and
- Presentation of risk assessment findings.

### **2.1 Identification of the study area**

As a first step in the assessment process, an onshore study area was developed.

Plate 1 shows the onshore study area, and was created by firstly identifying the preferred landfall location (between Bacton and Sea Palling) and applying a 10km buffer around the Necton National Grid connection location. A broad area of land was then identified to join these two geographical areas, which was then further refined to avoid the settlements of Fakenham and Briston to the north and Norwich and surrounding settlements to the south. An area south-west of Sea Palling was also removed as this encompassed a large area of The Broads National Park, along with the ecological designations that have been afforded to this area.

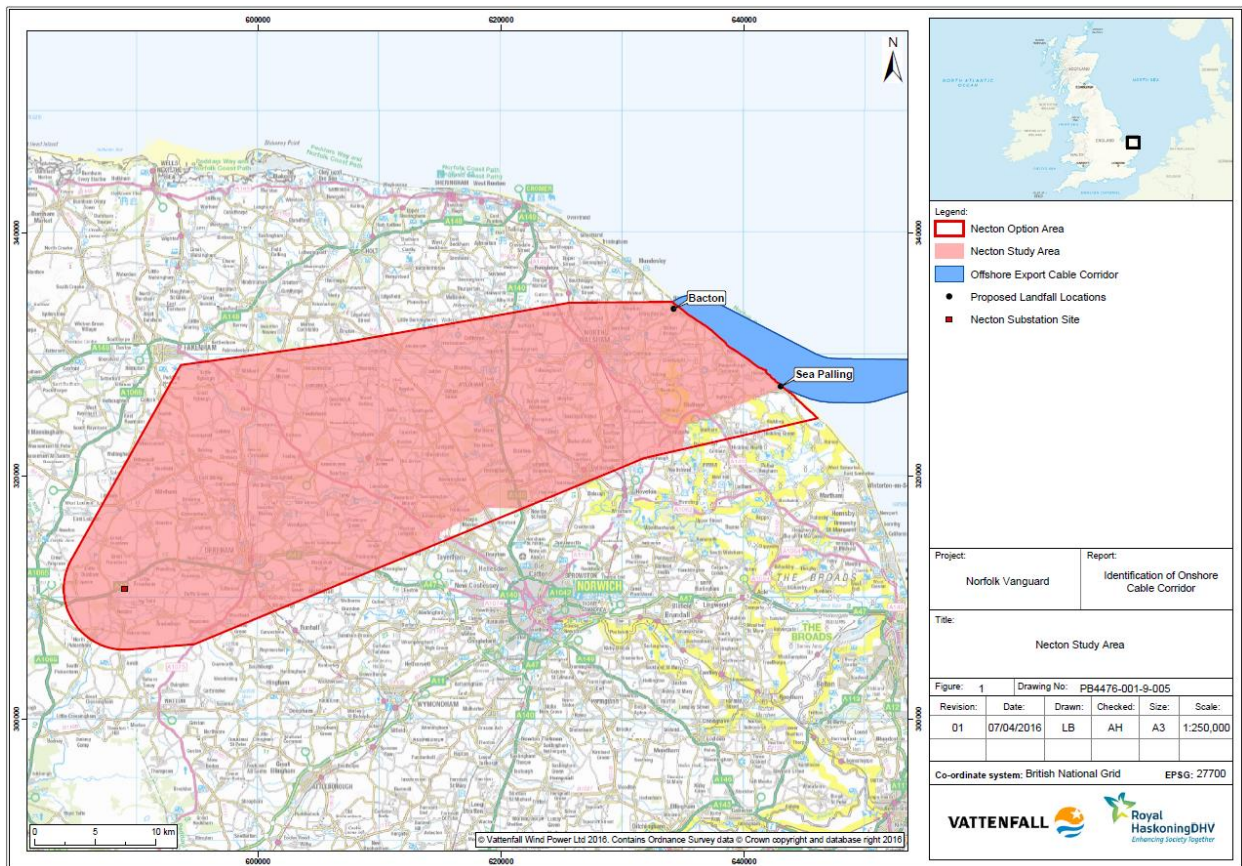


Plate 1 Necton Study Area

## 2.2 Key considerations within each study area

Using the study area identified above, an exercise of mapping was employed using high level, freely available data sets and including the following environmental considerations:

- Populated areas;
- Local Authority boundaries;
- Existing infrastructure and utilities;
- Archaeology and cultural heritage; (Scheduled Ancient Monuments (SAMs), World Heritage Sites (WHS));
- Designated sites (RAMSAR, Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Country Wildlife Sites (CWS), Local Nature Reserves (LNR), National Nature Reserves (NNR), Sites of Special Scientific Interest (SSSI), Areas of Outstanding Natural Beauty (AONB) and National Parks);
- Land Use/type (Ancient woodland); and
- Hydrological features (Main Rivers and waterbodies associated with the Norfolk Broads).

### Key environmental considerations

Plate 2 shows the findings from this constraints mapping. The main populated areas within this study area are North Walsham, Aylsham, Dereham and Reepham, and associated infrastructure of A Roads (A149, A140, A1067, A1075 and the A47), along with the Norwich to Cromer Railway Line. There are a number of ecological designations within the study area including the northern tip of The Broads National

Park, Broadland Special Protection Area (SPA) and Broadland RAMSAR, as well as the Norfolk Valley Fens and River Wensum Special Areas of Conservation (SAC), Foxley Wood National Nature Reserve (NNR) and a range of County Wildlife Sites (CWS). The study area also contains a number of hydrological features, including the River Wensum (designated as an SAC), the River Bure, River Tud, North Walsham and Dilham Canal, Wendling Beck and the River Wissey.

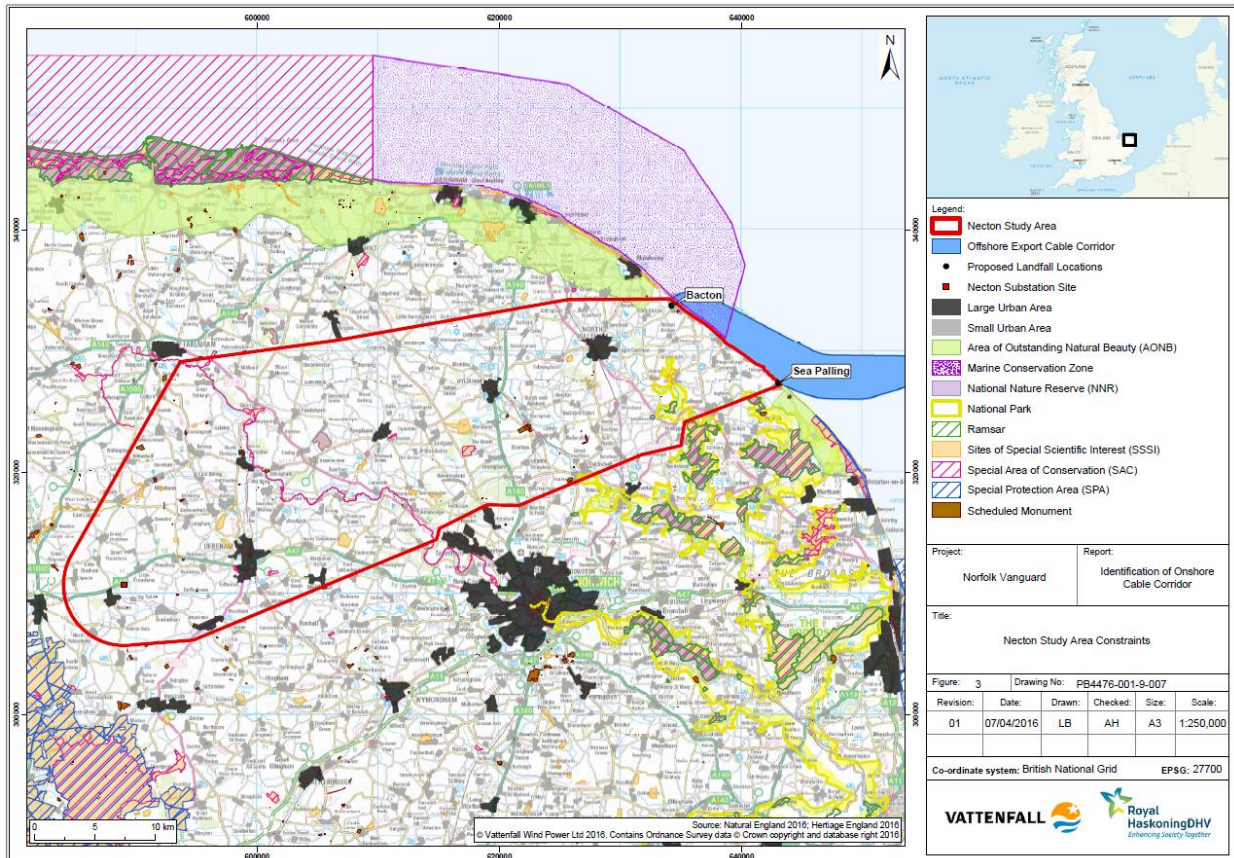


Plate 2 Necton Study Area Constraints

## 2.3 Indicative electrical infrastructure cable route

To aid the decision making process, following the identification and characterisation of the study area, a number of broad cable corridors (3km in width) were identified to take into the risk assessment stage. A buffer of 5km was also placed around the National Grid connection location at Necton, to create a substation search area. These areas were both developed using high level design principles, which can be applied during different stages of the site selection process. These design principles are listed as follows:

- Avoid proximity to residential dwellings;
- Avoid areas of important habitat, trees, ponds and agricultural ditches;
- Minimise requirement for complex crossing arrangements, e.g. road, river and rail crossings;
- Install cables within agricultural land, and to run along field boundaries, wherever possible;
- As far as possible install cables into flat terrain maintaining a straight route for ease of pulling cables through ducts;
- Avoid other services where possible, or aim to cross at right angles where not possible;
- Minimise the number of hedgerow crossings, utilising 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;
- Avoid proximity to historic buildings; and
- Minimise impacts to local residents in relation to access to services and road usage, including footpath closures where possible.

Plate 3 shows the three potential high-level indicative cable corridors developed (Options A, B and C). Three corridors were identified based upon the design principles listed above and with the aim of keeping the cable length as short as possible to avoid associated potential environmental impacts. Option A was located within the northern part of the study area with landfall at Bacton, Option B with landfall at Happisburgh crosses the central part of the study area, and Option C is located within the southern portion of the study area, with landfall at Eccles On Sea. Option C crosses the northern edge of the Broads National Park and to the north of Norwich and outlying settlements.

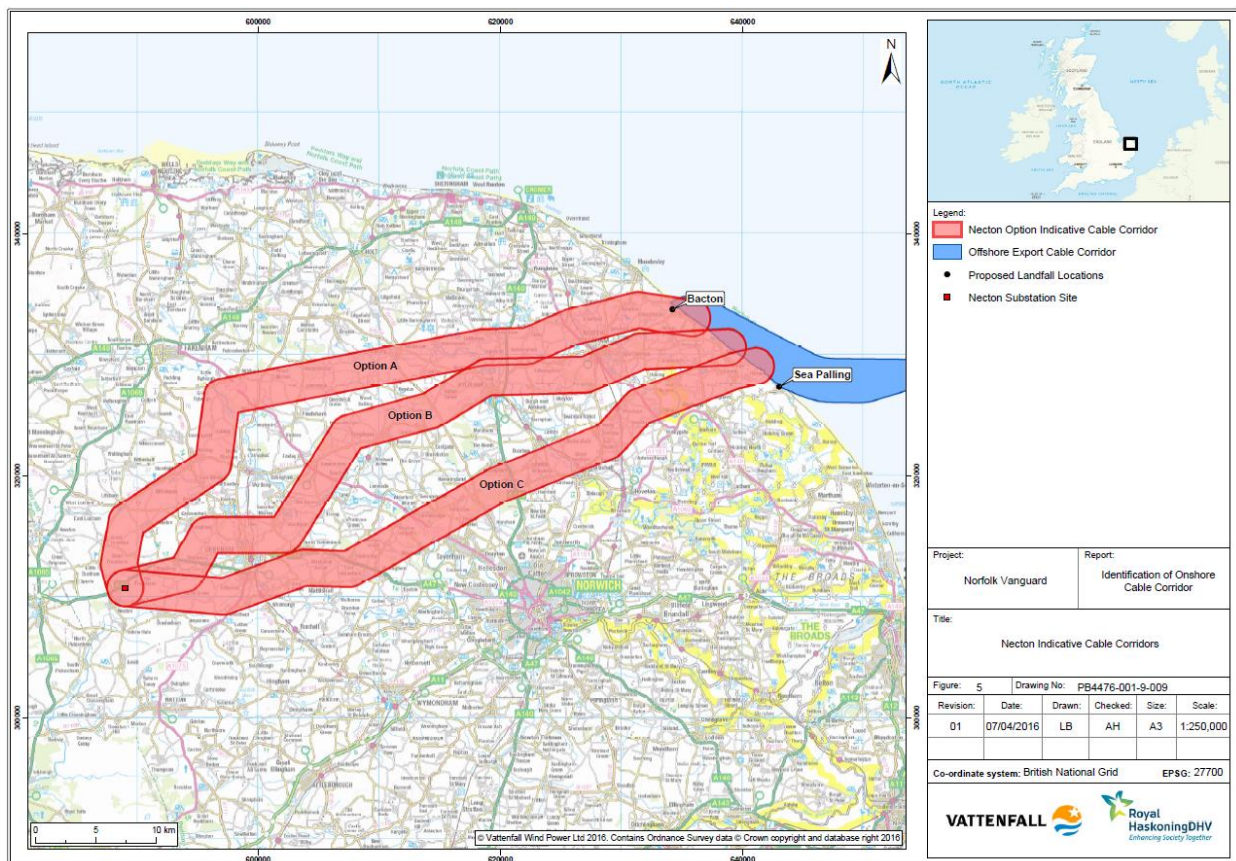


Plate 3 Necton Indicative Cable Corridors

## 2.4 Risk Assessment Methodology

The development considerations listed and found within the 3km cable corridors were then identified. Following this, a risk classification was attributed to each consideration based on a qualitative assessment and expert judgement. The classification system used is shown in Table 1.



Table 1 Classification for development considerations

Grey	Hard constraint / unacceptable risk to the environment
Red	Major risk to the environment
Amber	Minor risk to the environment
Green	Unlikely to pose risk to the environment

Table 2 presents the findings of this stage of the assessment, followed by a short description of the findings. Risks have been summarised using the following standard procedure, and results can be found in Table 3.

- High Risk (Red): e.g. Three or more major risk items identified within the element of the connection;
- Medium Risk (Orange): e.g. Six or more medium risk items identified; and
- Low Risk (Green): e.g. Five or more minor risk items identified.

Table 2 Onshore Study Area Risk Assessment

Topic	Considerations	Cable Route Option A	Cable Route Option B	Cable Route Option C
Approximate Length		<ul style="list-style-type: none"> <li>60km</li> </ul>	<ul style="list-style-type: none"> <li>58km</li> </ul>	<ul style="list-style-type: none"> <li>57km</li> </ul>
Local Planning Authority	Number of LPAs crossed by cable corridor	<ul style="list-style-type: none"> <li>North Norfolk District Council</li> <li>Broadland District Council (<i>potential to avoid when micro-siting</i>)</li> <li>Breckland District Council</li> </ul>	<ul style="list-style-type: none"> <li>North Norfolk District Council</li> <li>Broadland District Council</li> <li>Breckland District Council</li> </ul>	<ul style="list-style-type: none"> <li>North Norfolk District Council</li> <li>Broadland District Council</li> <li>Breckland District Council</li> <li>South Norfolk District Council (<i>potential to avoid when micro-siting</i>)</li> </ul>
International Nature Conservation Designated Sites	SACs, SPAs, Ramsars	<ul style="list-style-type: none"> <li>River Wensum SAC</li> <li>Paston Great Barn SAC</li> </ul>	<ul style="list-style-type: none"> <li>River Wensum SAC</li> <li>Norfolk Valley Fens SAC</li> </ul>	<ul style="list-style-type: none"> <li>River Wensum SAC</li> <li>Norfolk Valley Fens SAC</li> <li>The Broads SAC</li> <li>Broadland SPA</li> <li>Broadland Ramsar</li> </ul>
National Nature Conservation Designated Sites	SSSIs, Ancient Woodlands, National Nature Reserves, RSPB Reserves	<ul style="list-style-type: none"> <li>4 x SSSIs: <ul style="list-style-type: none"> <li>Horse Wood, Mileham SSSI</li> <li>Paston Great Barn SSSI</li> <li>River Nar SSSI</li> <li>River Wensum SSSI</li> </ul> </li> <li>Paston Great Barn NNR</li> <li>17 x Ancient Woodlands</li> </ul>	<ul style="list-style-type: none"> <li>9 x SSSIs: <ul style="list-style-type: none"> <li>Booton Common SSSI</li> <li>Dereham Rush Meadow SSSI</li> <li>Foxley Wood SSSI</li> <li>Dillington Carr, Gressenhall SSSI</li> <li>Holly Farm Meadow, Wendling SSSI</li> <li>Happisburgh Cliffs SSSI</li> <li>River Wensum SSSI</li> <li>Westwick Lakes SSSI</li> <li>Bryant's Heath, Felmingham SSSI</li> </ul> </li> <li>Foxley Wood NNR</li> </ul>	<ul style="list-style-type: none"> <li>10 x SSSIs: <ul style="list-style-type: none"> <li>Badley Moor SSSI</li> <li>Broad Fen, Dilham SSSI</li> <li>East Ruston Common SSSI</li> <li>Hockering Wood SSSI</li> <li>Mattishall Moor SSSI</li> <li>Potter &amp; Scarning Fens, East Dereham SSSI</li> <li>River Wensum SSSI</li> <li>Rosie Curston's Meadow, Mattishall SSSI</li> <li>Smallburgh Fen SSSI</li> <li>Swannington Upgate Common SSSI</li> </ul> </li> <li>11 x Ancient Woodlands</li> </ul>

Topic	Considerations	Cable Route Option A	Cable Route Option B	Cable Route Option C
			<ul style="list-style-type: none"> <li>17 x Ancient Woodlands</li> </ul>	
National Landscape Designations	AONB, National Parks	<ul style="list-style-type: none"> <li>Norfolk Coast AONB</li> </ul>	<ul style="list-style-type: none"> <li>The Broads National Park</li> </ul>	<ul style="list-style-type: none"> <li>The Broads National Park</li> </ul>
Archaeology and Heritage of national importance	Registered Battlefields, Registered Parks and Gardens, SAMs, World Heritage Sites (WHS)	<ul style="list-style-type: none"> <li>10 x SAMs</li> <li>6 x Registered Parks and Gardens</li> </ul>	<ul style="list-style-type: none"> <li>5 x SAMs</li> <li>5 x Registered Parks and Gardens</li> </ul>	<ul style="list-style-type: none"> <li>9 x SAMs</li> </ul>
Archaeology and Heritage of local importance	Listed Buildings, Heritage Coast	<ul style="list-style-type: none"> <li>20 Grade I</li> <li>193 Grade II or II*</li> </ul>	<ul style="list-style-type: none"> <li>22 Grade I</li> <li>468 Grade II or II*</li> </ul>	<ul style="list-style-type: none"> <li>11 Grade I</li> <li>159 Grade II or II*</li> </ul>
Local Nature Conservation Designated Sites	Local Nature Reserves, County Wildlife Sites, Forestry Commission Woodland	<ul style="list-style-type: none"> <li>Litcham Common LNR</li> <li>Knapton Cutting LNR</li> <li>Pigneys Wood LNR</li> <li>63 x County Wildlife Sites</li> </ul>	<ul style="list-style-type: none"> <li>Felmingham Cutting LNR</li> <li>79 x County Wildlife Sites</li> <li>2 x Forestry Commission Woodland</li> </ul>	<ul style="list-style-type: none"> <li>50 x County Wildlife Sites</li> <li>2 x Forestry Commission Woodland</li> </ul>
Road Crossings	A Road crossings	<ul style="list-style-type: none"> <li>A47</li> <li>A149</li> <li>A140</li> <li>A1067</li> </ul>	<ul style="list-style-type: none"> <li>A47</li> <li>A149</li> <li>A1067</li> </ul>	<ul style="list-style-type: none"> <li>A47</li> <li>A149</li> <li>A140</li> <li>A1067</li> <li>A1075</li> </ul>
Rail Crossings		<ul style="list-style-type: none"> <li>1 x rail crossing</li> </ul>	<ul style="list-style-type: none"> <li>1 x rail crossing</li> </ul>	<ul style="list-style-type: none"> <li>1 x rail crossing</li> </ul>
Main River Crossings	EA designated main rivers	<ul style="list-style-type: none"> <li>North Walsham and Dilham Canal (disused)</li> <li>River Bure</li> <li>River Wensum</li> </ul>	<ul style="list-style-type: none"> <li>North Walsham and Dilham Canal (disused)</li> <li>River Bure</li> <li>River Wensum</li> <li>Wendling Beck</li> </ul>	<ul style="list-style-type: none"> <li>North Walsham and Dilham Canal (disused)</li> <li>River Bure</li> <li>River Wensum</li> <li>River Tud</li> </ul>

Topic	Considerations	Cable Route Option A	Cable Route Option B	Cable Route Option C
Buried Infrastructure	Gas pipelines, electricity cables	<ul style="list-style-type: none"> <li>Dudgeon Onshore Cable</li> <li>Sheringham Shoal Onshore Cable</li> <li>6 x National Grid High Pressure Gas Pipe locations (<i>potential to avoid when micrositing</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Sheringham Shoal Onshore Cable</li> <li>2 x National Grid High Pressure Gas Pipe locations</li> </ul>	<ul style="list-style-type: none"> <li>2 x National Grid High Pressure Gas Pipe locations</li> </ul>
Urban Areas		<ul style="list-style-type: none"> <li>Necton (<i>potential to avoid when micrositing</i>)</li> </ul>	<ul style="list-style-type: none"> <li>North Walsham</li> <li>Aylsham</li> <li>Reepham</li> <li>Dereham</li> <li>(<i>N.B. potential to avoid all when micrositing</i>)</li> </ul>	<ul style="list-style-type: none"> <li>Horsford</li> <li>Mattishall</li> <li>Dereham</li> <li>Necton</li> <li>(<i>N.B. potential to avoid all when micrositing</i>)</li> </ul>
<b>Risk Summary</b>				

## 2.5 Overview and summary of initial risk assessment findings

Table 3 Environmental Risk Assessment Summary

Cable Corridor A	Cable Corridor B	Cable Corridor C

The cable corridor options increase in environmental risk moving south across the study area due to The Broads National Park (a designated nature conservation site). An increase in the number of road and river crossings, and more heavily populated urban areas increase the risk for cable corridors B and C. As a result option A is identified as the preferred option, then option B and option C is the least favoured (Table 2).

The number of buried infrastructure present with the cable corridor options was also considered (Table 2). These include the Sheringham Shoal Offshore Wind Farm onshore cables (for options A and B), Dudgeon Offshore Wind Farm onshore cables (for option B) and the National Grid high pressure gas pipes coming from Bacton (for options B and C). Option A has the greatest number, then option B and then option C; however these would be addressed through crossings agreements with the owner/operators.

## 3 Refinement of the cable corridors into a study area and identification and assessment of more detailed cable ‘branches’

### 3.1 Risk Assessment Methodology

Following the identification of the National Grid connection at Necton, the following areas of work were undertaken on the cable corridor elements of work:

- Indicative Cable Corridors A and B (defined as being lower risk in high level study) were taken forward as the Cable Corridor Study Area, as shown in Plate 4;
- The Cable Corridor Study Area was defined as from the western edge of the Cable Relay Station Area, along Corridors A and B and to the eastern edge of the Substation Study Area;
- The Cable Corridor Study Area was then split into Cable Corridor Sections (C1, C2 and C3) based upon the main river crossings of the River Bure and River Wensum;
- The Cable Corridor options were then identified within each section (as shown in Plate 5); and
- Naming convention: [Cable Corridor Section No.].[Route Corridor Option].[Route No.] – e.g C1.A.1 or C1.B.1 Each 200m ‘branch’ of the cable route options was given a unique code to allow for easier identification.

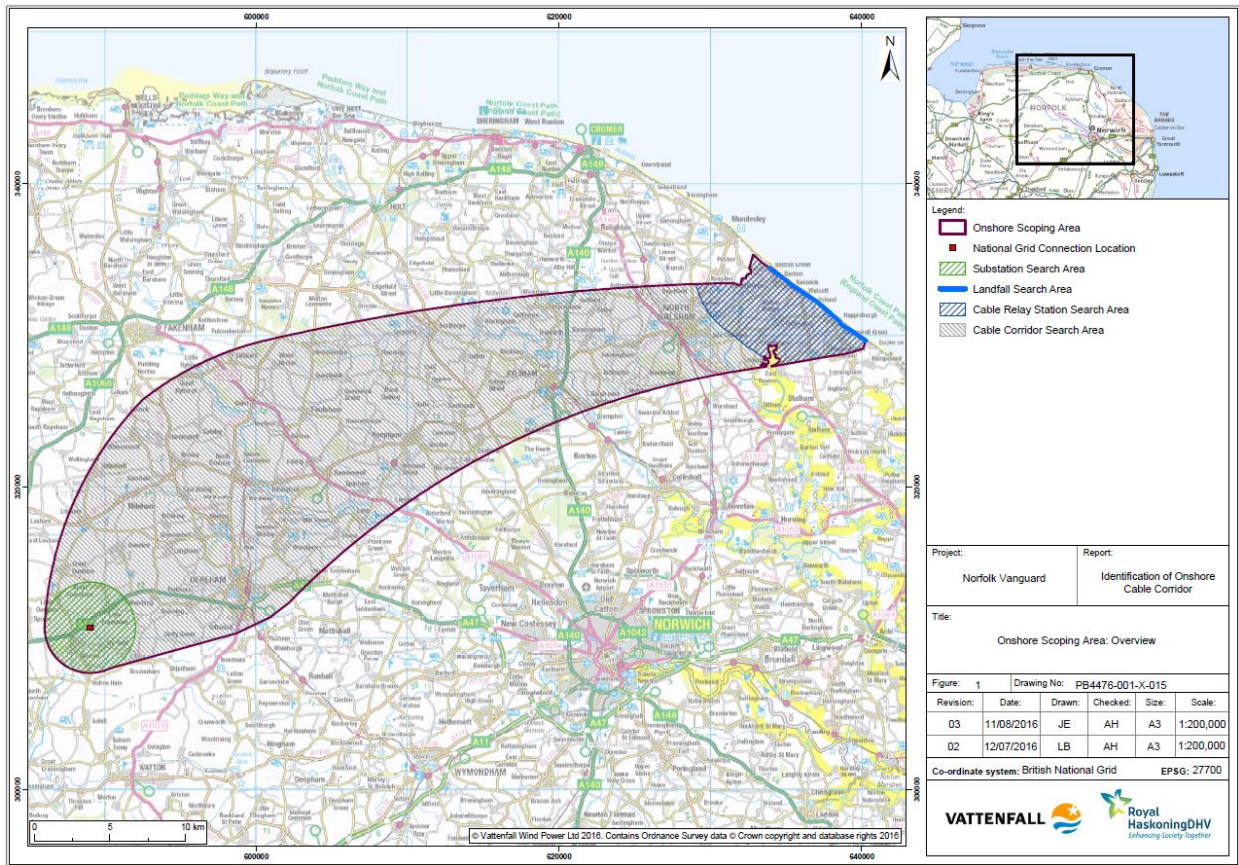


Plate 4 Onshore Cable Corridor Study Area (Shown at Norfolk Vanguard Scoping stage)

The development considerations found within each of the 200m cable ‘branches’ were identified. Following this, a risk classification was attributed to each element based on a qualitative assessment and expert judgement. The classification system used is shown in Table 4.

Table 4 Classification for development considerations

Gray	Hard constraint / unacceptable risk to environment
Red	Major risk to environment
Amber	Minor risk to environment
Green	Consideration unlikely to pose risk to environment

Risk classifications have been summarised using the following standard procedure, and results can be found in Plate 5.

- High Risk (Red): e.g. Four or more major risk (red) items identified within the element of the connection;
- Medium Risk (Amber): e.g. Five or more minor risk (amber) items identified; and
- Low Risk (Green): e.g. If the classification has not been identified as High Risk (red) or Medium Risk (amber) then the risk is identified as low (green).

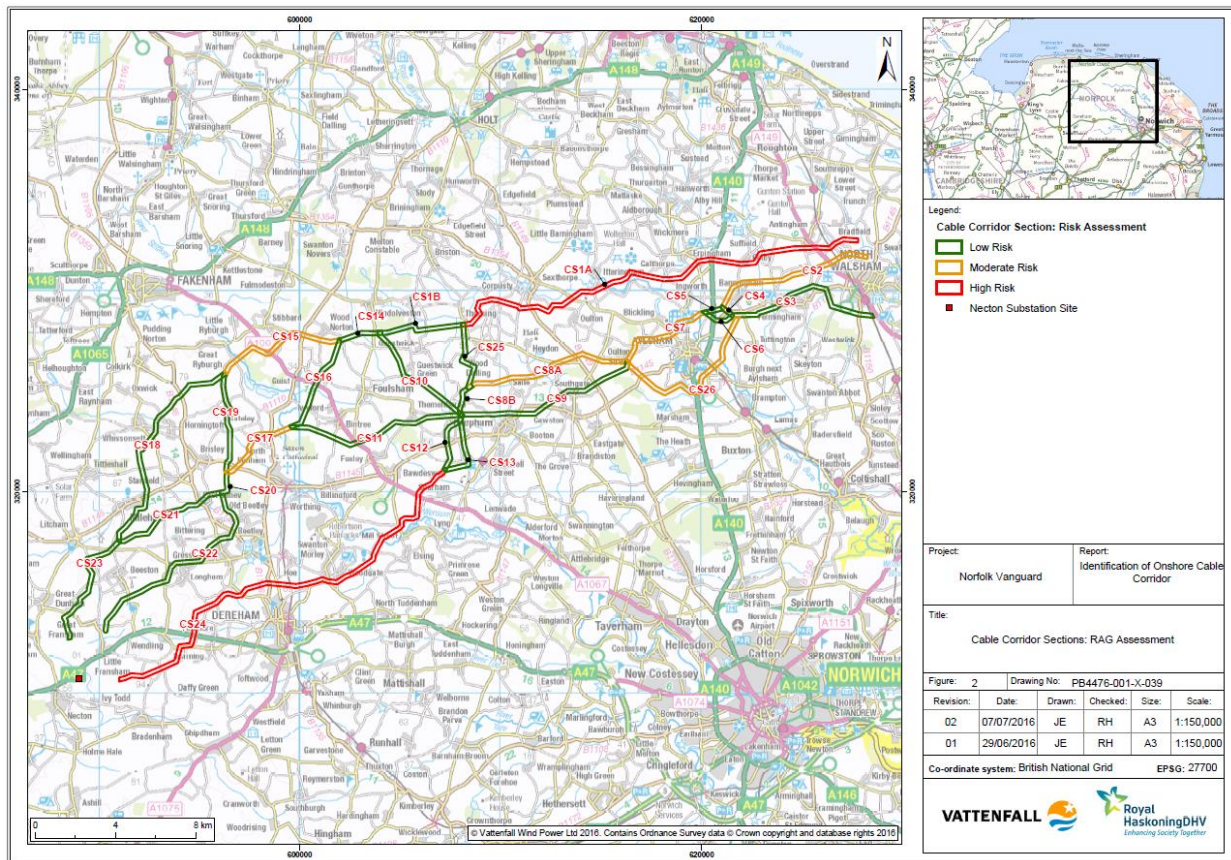


Plate 5 Cable Corridor Selection RAG Assessment

## 3.2 Summary

Through application of the above site selection principles (such as avoiding designated features) where possible, and following an exercise of re-routing around constraints areas where feasible, the environmental risks associated with these cable 'branches' were considered to be predominantly low (45 out of 58 cable 'branches'). 10 of these 58 were considered medium risk.

Only three were found to be high risk, these were CS1a, CS24 and LC30<sup>1</sup>. These were due to LC30 being within the Broads National Park, the associated ecological designations with it and the presence of a number of recreational trails and Norfolk HER areas which could be affected. CS1a was also considered to be high risk due to the presence of the buried infrastructure, the number of road crossings, a high number of Norfolk HER areas and recreational trails. CS24 was considered to be high risk due to the high number of HER areas, main river crossings and the number of buried infrastructure to be crossed.

Based upon environmental risk, engineering requirements and other key considerations (such as stakeholder feedback), Norfolk Vanguard Limited and Norfolk Boreas Limited defined the final preferred cable corridor to take forward into the site selection process.

<sup>1</sup> LC30 has three high major risk items associated with this branch of cable, as opposed to four as outlined in the methodology above in order for this to be classified as High Risk. However, due to the complexities of this area and the high risks anticipated, this has been identified as High Risk.

## 4 Review of the preferred cable corridor option

### 4.1 Cable Corridor review process

The next stage of the cable corridor site selection process was a review of the cable corridor options identified by Norfolk Vanguard and Norfolk Boreas Limited (as shown in Plate 6), primarily to remove features such as clipped land registry boundaries, road margins, tracks and areas of sensitive habitats whilst still maintaining up to 200m cable corridor width (where possible) to allow for engineering flexibility and future micrositing. The review primarily consisted of aligning the cable corridor along land registry boundaries and field margins to avoid isolating parcels of land where possible. The review also considered a minimum cable corridor of 100m in order to allow enough space for the temporary easements required for Norfolk Vanguard and Norfolk Boreas.

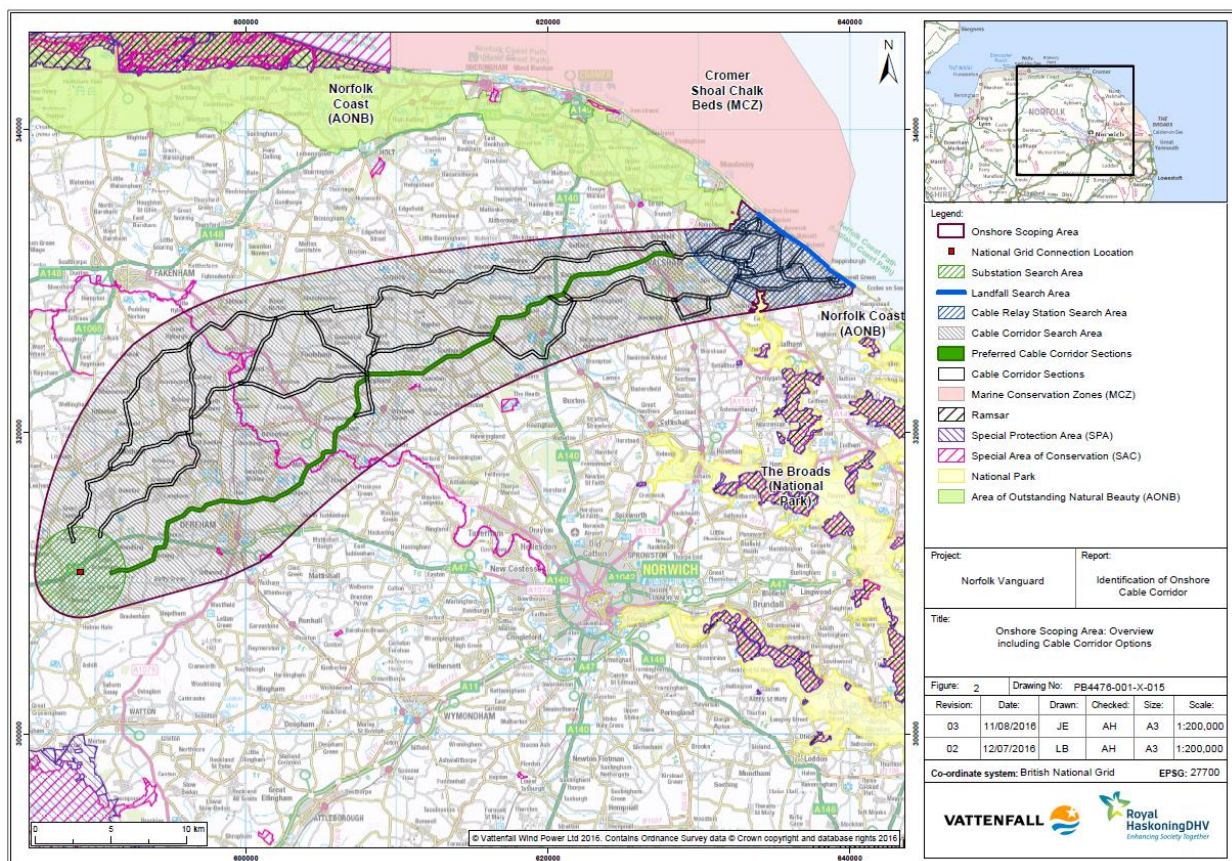


Plate 6 Cable Corridor options within the area used for the Norfolk Vanguard Scoping report

The overall benefits of the cable corridor review process included:

- Reducing the number of potentially affected landowners;
- Avoiding direct impacts to a number of sensitive habitats and features;
- Reviewing the engineering feasibility and constructability; and
- Identifying potential cable pinch points.



## 4.2 Method and Assumptions

The review of the cable corridor was undertaken based on information available at the time, including:

- Mastermap / field boundaries;
- Land registry data;
- APEM aerial imagery;
- Ecology Phase 1 Habitat survey results conducted by Norfolk Vanguard Limited;
- New potential designations;
- Information and photographs gathered from site visits undertaken by Norfolk Vanguard Limited;
- Landowner feedback;
- Information from public information days; and
- Groundsure information.

At this stage this review did not consider:

- Additional trenchless crossing techniques under consideration;
- Finalisation of the location of mobilisation compounds;
- Differentiating between primary mobilisation compounds and secondary mobilisation compounds; and
- Access points.

As part of the cable corridor review, sections of the red line boundary were coded with either:

- Amendment; or
- Review

An “amendment” resulted in an amendment to the red line boundary for the cable corridor, and a “review” resulted in further work required in order to establish the most appropriate alignment.

The resultant cable corridor option was taken forward into the PEIR stages of the project for formal consultation as shown in Plate 7.

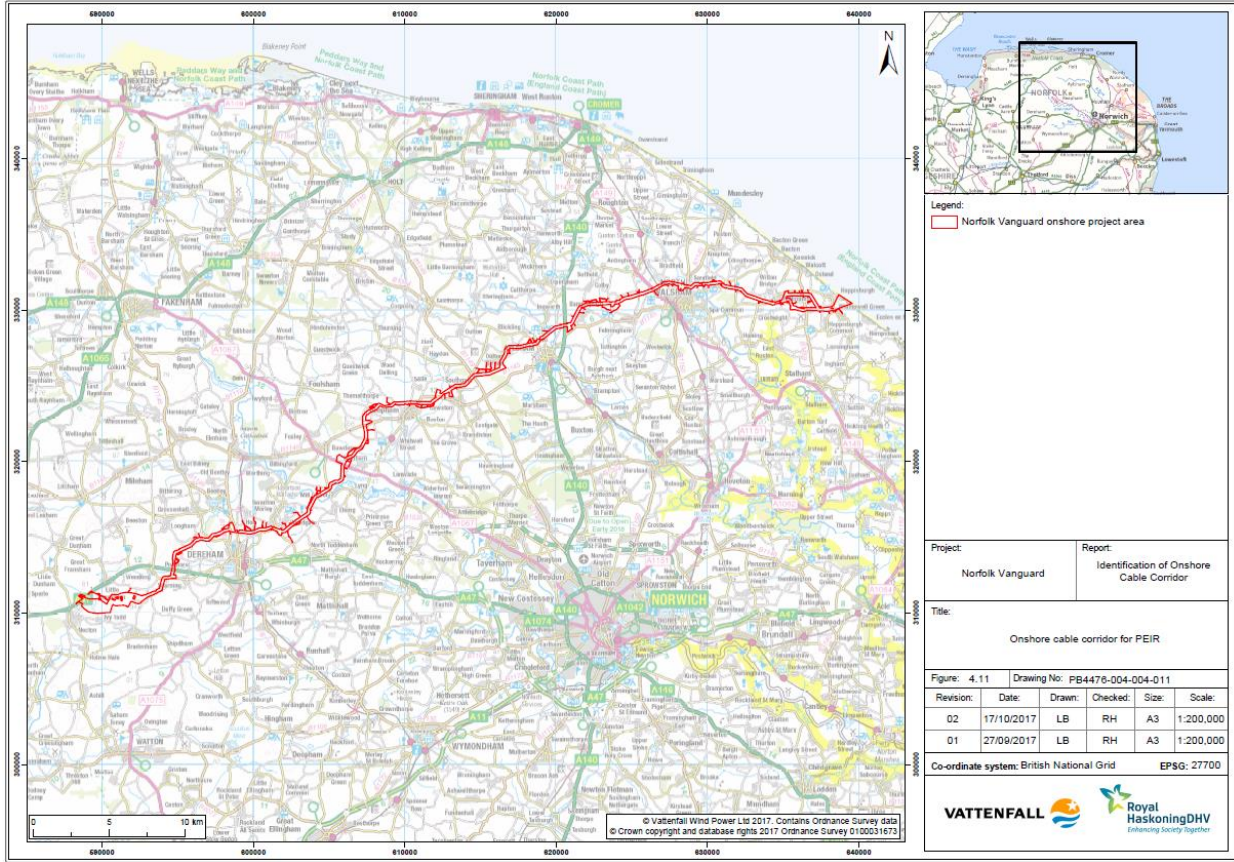


Plate 7 Onshore Cable Corridor for PEIR