

Hornsea 4

Ørsted



Hornsea Project Four: Preliminary Environmental Information Report (PEIR)

Volume 5, Annex 11.1: Seascape, Landscape and Visual Resources Technical Report

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Glossary

Term	Definition
Cumulative effects	The combined effect of Hornsea Four in combination with the effects from a number of different projects, on the same single receptor/resource.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with Hornsea Four.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for one or more Nationally Significant Infrastructure Projects (NSIP).
Effect	Term used to express the consequence of an impact. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity, of the receptor or resource in accordance with defined significance criteria.
Export cable corridor (ECC)	The specific corridor of seabed (seaward of Mean High Water Springs (MHWS)) and land (landward of MHWS) from the Hornsea Four array area to the Creyke Beck National Grid substation, within which the export cables will be located.
High Voltage Alternating Current (HVAC)	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
High Voltage Direct Current (HVDC)	High voltage direct current is the bulk transmission of electricity by direct current (DC), whereby the flow of electric charge is in one direction.
Hornsea Four	The proposed Hornsea Project Four offshore wind farm project; the term covers all elements within the DCO (i.e. both the offshore and onshore components).
Landscape character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Landscape effects	Effects on the landscape as a resource in its own right.
Seascape	Landscapes with views of the coast or seas, and coasts and adjacent marine environments with cultural, historical and archaeological links with each other.
Visual amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating or travelling through an area.
Visual effects	Effects on specific views and on the general visual amenity experienced by people.

Acronyms

Acronym	Definition
AC	Alternating current
AfL	Agreement for Lease
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
DCO	Development Consent Order

Acronym	Definition
EIA	Environmental Impact Assessment
ECC	Export cable corridor
ES	Environmental Statement
FHHC	Flamborough Headland Heritage Coast
FOV	Field of View
GLVIA3	Guidelines for Landscape and Visual Impact Assessment Version 3
HSC	Historic Seascape Character
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IEMA	Institute of Environmental Management and Assessment
LAT	Lowest Astronomical Tide
LCA	Landscape Character Area
LCT	Landscape Character Type
LI	Landscape Institute
LVIA	Landscape and Visual Impact Assessment
MCA	Marine Character Area
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MPA	Marine Plan Areas
NPPF	National Planning Policy Framework
NSIP	Nationally Significant Infrastructure Project
OPEN	Optimised Environments Limited
OS	Ordnance Survey
PEIR	Preliminary Environmental Information Report
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SCA	Seascape Character Area
SLVR	Seascape, Landscape and Visual Resources
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
WTG	Wind Turbine Generator
ZTV	Zone of Theoretical Visibility

Units

Unit	Definition
ha	hectare
km	kilometre
m	metre
mm	millimetre

1 Introduction

1.1 Project background

- 1.1.1.1 Ørsted Hornsea Project Four Limited (the Applicant) is proposing to develop the Hornsea Project Four offshore wind farm (hereafter Hornsea Four). Hornsea Four will be located approximately 65 km offshore of the East Riding of Yorkshire in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone (see [Volume 1, Chapter 1: Introduction](#) for further details on the Hornsea Zone).
- 1.1.1.2 Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall and on to an onshore substation with electrical balancing infrastructure, and connection to the electricity transmission network. The location of Hornsea Four is illustrated in [Figure 1](#). The Preliminary Environmental Information Report (PEIR) boundary combines the search areas for the onshore and offshore infrastructure.
- 1.1.1.3 The Hornsea Four Agreement for Lease (AfL) area was 848 km² at the Scoping phase of project development. In the spirit of keeping with Hornsea Four's approach to Proportionate Environmental Impact Assessment (EIA), the project is currently giving due consideration to the size and location (within the existing AfL area) of the final project that will be taken forward to Development Consent Order (DCO) application. This consideration is captured internally as the "Developable Area Process", which includes Physical, Biological and Human constraints in refining the developable area, balancing consenting and commercial considerations with technical feasibility for construction.
- 1.1.1.4 The combination of Hornsea Four's Proportionality in EIA and Developable Area process has resulted in a marked reduction in the AfL (600km²) taken forward at the point of PEIR. (see [Figure 1](#)). The evolution of the AfL is detailed in [Volume 1, Chapter 3: Site Selection and Consideration of Alternatives](#) and [Volume 4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure](#). The final developable area taken forward to consent may differ from that presented in [Figure 1](#) due to the results of the EIA, technical considerations and stakeholder feedback.
- 1.1.1.5 Optimised Environments Limited (OPEN) was commissioned by the Applicant to undertake a Seascape, Landscape and Visual Resources (SLVR) assessment of the effects of the offshore components of Hornsea Four. All references to Hornsea Four in this technical report shall, for the purposes of the report, refer to the offshore infrastructure and activities only (i.e. those impacts occurring seaward of the Mean High Water Springs (MHWS)). This includes consideration of the effects on the landscape of the Flamborough Headland Heritage Coast (FHHC) as well as the offshore seascape and visual receptors.

1.2 Aims and objectives

- 1.2.1.1 The SLVR assessment identifies and assesses the significance of changes, resulting from the construction and operation of the offshore components, to both the seascape/landscape as an environmental resource, and on people's views and visual amenity. It also assesses the cumulative effects of Hornsea Four in conjunction with other offshore wind farm developments. The assessment is contained in [Volume 2, Chapter 11: Seascape, Landscape and Visual Resources](#). This Technical Report and [Volume 2, Chapter 11: Seascape, Landscape and Visual Resources](#) are supported by visualisations contained in [Volume 5, Annex 11.2: Seascape, Landscape and Visual Resources Visualisations](#).

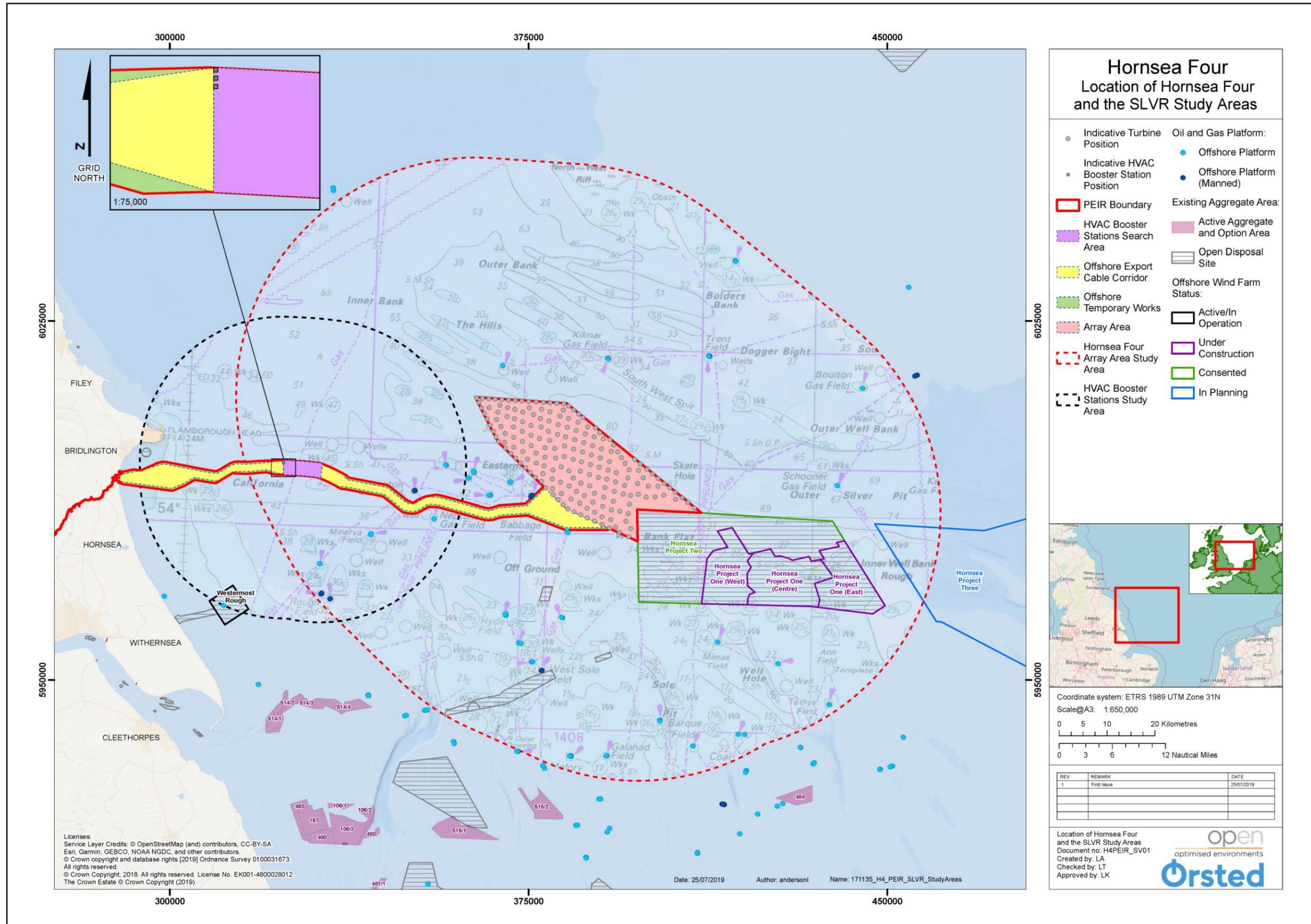


Figure 1: Hornsea Four location and SLVR study area (not to scale).

- 1.2.1.2 The effects on Historic Seascape Character (HSC) are assessed in [Volume 2, Chapter 10: Marine Archaeology](#). However, the SLVR includes consideration of the Sea Surface elements of the HSC as part of the baseline characterisation and assessment of the effects on Marine Character Areas (MCAs).
- 1.2.1.3 The landscape and visual effects arising from the onshore components of Hornsea Four infrastructure are assessed in [Volume 3, Chapter 4: Landscape and Visual](#). This includes the onshore export cables and the onshore High Voltage Direct Current (HVDC) converter substation/ High Voltage Alternating Current (HVAC) substation at the Creyke Beck National Grid substation.
- 1.2.1.4 This Technical Report sets out the methodology for the SLVR. It also presents descriptions and analysis of the baseline seascape, landscape and visual receptors that may be significantly affected by Hornsea Four. This information has been derived from desk study, field work on the coast at Flamborough Head, consultation through the scoping process (PINS, 2018) and computer modelling/analysis as illustrated in [Figure 2, Figure 4 and Figure 5](#) and the SLVR visualisations contained in [Volume 5, Annex 11.2: Seascape, Landscape and Visual Resources Visualisations](#).
- 1.2.1.5 A summary of the responses received in relation to SLVR during the Scoping Process (PINS, 2018), and where these are addressed within the Hornsea Four PEIR are set out in [Table 11.3](#) of [Volume 2, Chapter 11: Seascape, Landscape and Visual Resources](#). The cumulative offshore wind farms and other developments that are considered in the SLVR assessment are listed in [Table 3](#) of this document.
- 1.2.1.6 Visibility information from the Met Office is provided in Appendix A of this document to support the assessments made in [Volume 2, Chapter 11: Seascape, Landscape and Visual Resources](#).

2 Study Areas

2.1 Study Areas for PEIR

- 2.1.1.1 For PEIR, the Hornsea Four HVAC booster station study area has been increased (from the study area presented at Scoping) to 30 km to include the majority of the FHHC. This is due to the potential sensitivity of the setting of the FHHC and the fact that, during the refinement process between Scoping and PEIR, the HVAC booster station search area has moved further offshore, thereby excluding the coast from a study area of 25 km.
- 2.1.1.2 The SLVR assessment presented in [Volume 2, Chapter 11: Seascape, Landscape and Visual Resources](#) that covers the offshore Hornsea Four components described in [Volume 1, Chapter 4: Project Description](#) will assess the effects within the following study areas, which are illustrated in [Figure 1](#) and summarised below:
 - The Hornsea Four array area - 50 km radius study area from array area boundary and including the array area itself;
 - Offshore Export Cable Corridor (ECC) – the area within which the cables may be located; and

- Offshore HVAC booster station(s) – to include the area lying within a 30 km buffer from the offshore HVAC booster substation search area.

2.1.1.3 The rationale for the SLVR study areas is set out in the following paragraphs.

2.1.1.4 The offshore ECC is largely encompassed within the array area study area and the HVAC booster station study area. The effects of the cable construction and decommissioning that would occur within the ECC are assessed in relation to the SLVR HVAC booster station and array area study areas due to their location largely within these areas. The definition of a study area is an important and established part of SLVR assessment, which is recommended in guidance (Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA), 2013). OPEN has defined these according to legislation, guidance and the Zone of Theoretical Visibility (ZTV) as well as other analysis, with an approach based on the following steps:

- Firstly, relevant legislation was considered. The EIA Regulations 2017 require a description of the 'likely significant effects of the proposed development'. The 50km radius and 30 km radius SLVR study areas were therefore defined to extend far enough to include all areas within which significant effects could occur, using professional judgement. Although the proposed heights of the Wind Turbine Generators (WTGs) and HVAC booster stations could theoretically be visible at distances beyond 50 km and 30 km, respectively, their effect at such ranges is considered to be beyond the thresholds at which they are likely to be significant.
- Secondly, relevant guidance was consulted. IEMA Guidance (IEMA, 2015 and 2017) recommends a proportionate ES focused on the significant effects and a proportionate ES topic chapter. An overly large SLVR study area may be considered disproportionate if it makes the understanding of the key impacts of the proposed development more difficult. This is supported by landscape and visual impact assessment LVIA Guidance produced by the Landscape Institute (GLVIA3) (LI and IEMA, 2013) (para 3.16). This guidance recommends that *'The level of detail provided should be that which is reasonably required to assess the likely significant effects'*. Paragraph 5.2, page 70 also states that *'The study area should include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner'*.

2.1.1.5 Other wind farm-specific guidance, such as Scottish Natural Heritage's (SNH) Visual Representation of Wind Farms Guidance (SNH, 2017) recommends that ZTV distances are used for defining study area based on wind turbine height. Of relevance to the SLVR assessment for the HVAC Booster Station search area is the study area suggested in the SNH guidance for turbines of 86-100 m.

2.1.1.6 The offshore HVAC booster stations that may be included within the area of search located approximately half way along the offshore ECC would be up to 70 m (to topside of main structure) above LAT (excluding helideck or lightning protection) or up to 90 m including these structures, which are of lesser stature than the main deck. This suggests that a 30 km radius study area would be appropriate for these structures. The study area for the HVAC booster stations is shown in [Figure 1](#). This shows that their minimum distance to the coast at Flamborough Head would be approximately 25 km.

- 2.1.1.7 The SNH guidance recommends a 45km radius for WTGs greater than 150 m to blade tip (para 48, p12), however, the guidance does not address WTGs larger than 150 m in height. The heights of current offshore wind turbine models have now exceeded the heights covered in this guidance. The SNH guidance recognises that greater distances may need to be considered for larger wind turbines used offshore. Other guidance such as that prepared by the DTI (DTI 2005) is also of little relevance to this assessment due to turbine height increases since the time of its writing.
- 2.1.1.8 The maximum design scenario for the Hornsea Four offshore array includes turbines of up to 370 m to tip above LAT. The offshore transformer substations, offshore HVDC converter substations and the offshore accommodation platform that may be located within the offshore array area are considerably smaller in height than the tallest turbines that are being considered.
- 2.1.1.9 OPEN has undertaken the assessments for a number of offshore wind farms and this has provided the assessors with experience of the likely effects these may have. To date, the most distant locations where significant effects have been identified are at a range of approximately 37.5 km from the offshore turbine array where the turbines are of up to 300 m to tip. The horizontal field of view (FOV) affected would be 27 degrees. The coastal areas are designated as an Area of Outstanding Natural Beauty (AONB) and defined as Heritage Coast. In that instance, this provides the coastal receptors with higher levels of value and sensitivity than would occur for Hornsea Four as the receptor is protected by a nationally important statutory designation.
- 2.1.1.10 It is notable that any operational or consented offshore wind farms are substantially smaller than those of the maximum design scenario of Hornsea Four and therefore it is difficult to understand the range of visibility that may occur with turbines of a substantially greater scale, however this should not be confused with the potential for the effects of taller turbines to be significant.
- 2.1.1.11 The potential for significant effects will not increase pro-rata with increased turbine or development scale as other factors have a greater bearing on actual visibility and significance of turbines located at a greater distance out to sea, thus reducing their actual effect on viewers located at long distances away. These are:
- Curvature of the earth, which may screen all or lower parts of turbines at long distances, thus influencing the ZTV;
 - The horizontal and vertical field of view of the views that is affected by the development is diminished with distance so that the proportion of the view affected is also reduced;
 - Weather and atmospheric conditions out at sea, which substantially limits actual visibility at long distances; and
 - Visual acuity, whereby the ability of the human eye to pick out objects at long distances is reduced due to their relative scale.
- 2.1.1.12 All of the above factors are likely to reduce the magnitude of change at greater distances and are considered separately below.

2.2 Earth's Curvature and Theoretical ZTV

- 2.2.1.1 Consideration of the blade tip ZTV (**Figure 2**) indicates that the theoretical visibility of the numbers of WTGs of the proposed Hornsea Four will reduce at distances of 40-80 km at sea level due to the curvature of the earth. This also ensures that at sea level only the blades of turbines are theoretically visible at distances of greater than 62 km. The hub height ZTV () illustrates locations where it would be possible to see turbine hubs and below, rather than just blades. By considering the differences between these two ZTVs, the areas where only turbine blades would be visible can be identified. It should be noted that the array area ZTVs have been run based on 190 positions, 180 x WTGs and 10 x other electrical infrastructure (e.g. substations and platforms) proposed as this represents the maximum potential visibility of the array area.
- 2.2.1.2 Due to the elevation of the land coastline and in-land at greater distances, it is theoretically possible to see parts of a greater number of WTGs than it is from sea level as shown on **Figure 2** and **Figure 3**.
- 2.2.1.3 The closest point of the land to the Hornsea Four array area is at a distance of approximately 65 km at Flamborough Head. This is a cliff top headland (with cliffs of up to approximately 50 m Above Ordnance Datum (AOD), which has been identified as a Heritage Coast. The designation of the headland, which includes some of the coastal waters, along with the number of visual receptors (people) using these areas for recreational activities, visiting an attraction or as a place of residence, provides this area with a higher level of sensitivity to changes, which may affect the setting or views. The majority of the coast lies at greater distances of over 77 km from the Hornsea Four array area.
- 2.2.1.4 **Figure 2** illustrates the ZTV for the WTGs within the eastern-most extent of the FHHC. This indicates the limited areas where there would be theoretical visibility of the WTGs at distances of greater than 65 km.

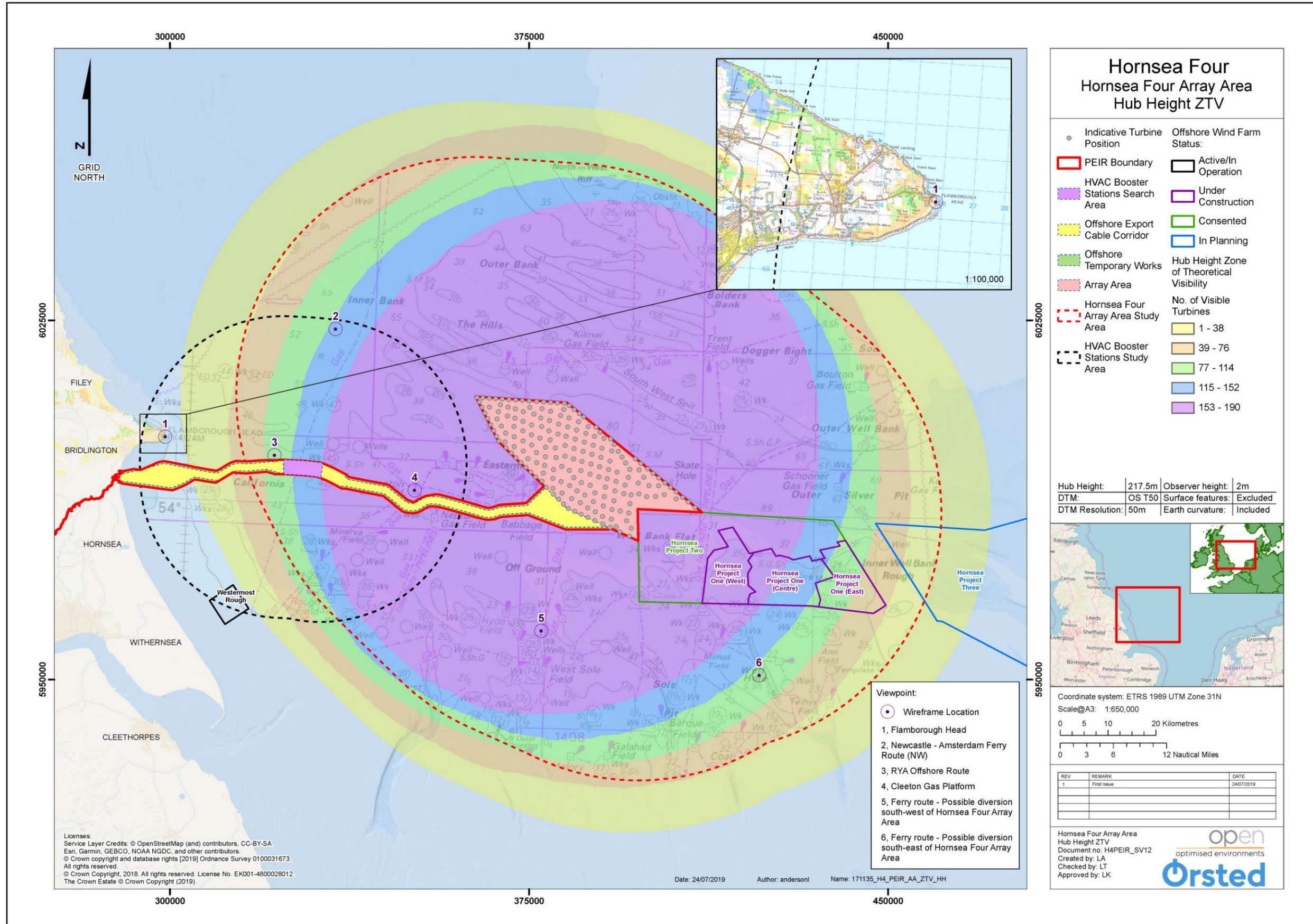


Figure 3: Hub height ZTV (not to scale).

2.3 Horizontal and Vertical Field of View

- 2.3.1.1 **Figure 1** of **Volume 5, Annex 11.2: Seascape, Landscape and Visual Resources Visualisations** presents a viewpoint located close to the most easterly point of Flamborough Head. This shows that only the upper parts of the WTCs would be theoretically visible and that the lower parts of all the turbines would be hidden behind the sea horizon with some of the more distant turbines almost completely hidden.
- 2.3.1.2 At distances over 65 km from the Hornsea Four array area, the lateral spread of the Hornsea Four array area (and HVAC booster stations) will occupy a very small portion of available views. The Horizontal Angle ZTVs (**Figure 4** and **Figure 5**) illustrate that the Hornsea Four array area would be seen across less than 20 degrees of the horizontal FOV and the HVAC booster stations would be seen across one degree of the horizontal FOV. As shown on **Figure 1** of **Volume 5, Annex 11.2: Seascape, Landscape and Visual Resources Visualisations**, the horizontal field of view that would be theoretically affected by views of the WTCs in the Hornsea Four array area would be 19 degrees of the panoramic views across the sea from this location. The vertical height of the WTCs would appear relatively small, therefore significant visual effects are unlikely to arise (even if the wind turbines are visible - in only the most excellent visibility conditions) as is identified below.

2.4 Met Office Visibility Information

- 2.4.1.1 The Met Office sets out definitions for the different ranges of visibility on its website¹ at visibility ranging from 'very poor' to 'excellent' as follows:
- Very poor visibility - range is less than 1 km;
 - Poor visibility - range is 1 to 4 km;
 - Moderate visibility - range is 4 to 10 km;
 - Good visibility - range is 10 to 20 km;
 - Very good visibility - range is 20 to 40 km; and
 - Excellent visibility - range is over 40 km.
- 2.4.1.2 This suggests that the HVAC booster stations would require 'very good' visibility to be visible from the coast at a range of 25 km. WTCs located within the Hornsea Four array area would require better than just 'excellent' visibility conditions for them to be visible from the coast at a range of 65 km.
- 2.4.1.3 Both GLVIA3 (LI & IEMA, 2013) and SNH guidance (SNH, 2017, para 39) refer to the use of Met Office visibility data to assess typical visibility conditions within an area. Most synoptic observing stations have sensors which provide a measurement of visibility. Visibility sensors measure the meteorological optical range which is defined as the length of atmosphere over which a beam of light travels before its luminous flux is reduced to 5% of its original value. The use of light within the visible spectrum allows the sensor to most accurately simulate

¹ <https://www.metoffice.gov.uk/guide/weather/symbols#>

human perception of visibility. Reasonably accurate measurements are possible over a range of visibility extending from a few tens of metres to a few tens of kilometres.

- 2.4.1.4 Although there are limitations to how this data can be applied to judgements about wind farm visibility, the 'visibility' data provides some understanding and evidence basis for evaluating the actual visibility of the wind turbines against their background.
- 2.4.1.5 The closest coastal Met Office location with a synoptic observing station is 74 km to the south of the Humber estuary at Donna Nook. The observing station is located within the same climatic zone (cold winters, cool summers) and has the same polar continental prevailing wind (cold and dry) (<https://www.bbc.com/bitesize/guides/zjk7hyc/revision/1>) as Flamborough Head and the coastal area to the south of there. This is considered sufficiently close and representative for it to provide an indication of the likely visibility frequency offshore within this area.
- 2.4.1.6 Tables setting out the maximum optical range measured every hour over the ten years between January 2009 and December 2018 are included in **Appendix A** of this Technical Report.
- 2.4.1.7 This information indicates that from locations on the coast visibility of the array area and HVAC booster stations is likely to occur broadly in line with the visibility monitored over the past 10 years and as set out in **Table 1**.

Table 1: Summary of visibility from the coast at distances from the array area and HVAC booster stations.

Distance	Visibility measured over 10 year period (%)	Total time per annum (approximately)
Array Area		
65 km (to closest point on Flamborough Head)	0.27%	< 1 day
70 km (to coast around Bridlington)	0.05%	< 5 hours
HVAC booster stations		
25 km (to closest point on Flamborough Head)	33%	122 days
30 km (to coast around Bridlington)	12%	43 days

- 2.4.1.8 To inform the Hornsea Four SLVR assessment, reference has also been made to the Met Office visibility data used in the Hornsea Project Two Offshore Wind Farm (hereafter Hornsea Project Two) Seascape and Visual Resource assessment. The data collected offshore is known to be less accurate than visibility data collected onshore, however it does show that there were no recordings of visibility at distances of over 25 km from vessels.

- 2.4.1.9 The prevailing weather and visibility conditions have a material influence on the actual visual impacts of offshore infrastructure, and therefore the likelihood of significant effects, particularly at long viewing distances.

2.5 Visual acuity

- 2.5.1.1 Relatively early in the evolution of the onshore wind farm industry, work carried out on behalf of SNH by the University of Newcastle (2002) (Visual Assessment of Windfarms Best Practice. Scottish Natural Heritage Commissioned Report F01AA303A) includes helpful information on the visibility and perception of WTCs which considers the theoretical and actual visibility of objects located at a distance from observers.

- 2.5.1.2 Whilst it is noted that a 100 m structure could theoretically be seen from near to sea level at a distance of 46 km (i.e. it would not be fully screened beyond the horizon formed due to the earth's curvature) it is also advised in University of Newcastle (2002) that:

'actual human perception is affected by the acuity of the human eye. In good visibility (visibility is meteorologically defined as the greatest distance at which an object in daylight can be seen and recognised), a pole of 100 mm diameter will become difficult to see at 1 km and a pole of 200 mm diameter will be difficult to see at 2 km. In addition, mist, haze or other atmospheric conditions may significantly affect visibility (Hill et al, 2001). Assuming this relationship is linear, and assuming absolute clarity of view, this suggests that the outer limit of human visibility in clear conditions of a pole (e.g. a notionally cylindrical wind turbine tower) 5000 mm (5 m) in diameter (a representative figure for a 60+ m high tower) will be of the order of 50 km; and the absolute limit of visibility imposed by the limit of the horizon viewed across a flat plane is similar at approximately 46 km.'

- 2.5.1.3 The cylindrical towers of the maximum adverse scenario for the Hornsea Four WTCs would have a maximum diameter of 12 m. Assuming the same linear relationship of visual acuity suggested above, this would suggest that where there is no influence by atmospheric conditions it would possible to see a 12 m wide structure at a range of up to 120 km. However, whilst this may theoretically possible such long-range visibility would require both highly unlikely atmospheric conditions (when compared with Met Office Visibility Data) and elevated vantage points due to the screening effect of the earth's curvature from low lying locations.

2.6 Visibility of lighting

- 2.6.1.1 There has been some informative research undertaken relatively recently by a group based in the USA. This is entitled Offshore Wind Turbine Visibility and Visual Impact Threshold Distances (2012) and is based on fieldwork and reporting of observations carried out in the UK in relation to a number of offshore wind farms located in the Irish Sea and the English Channel.

- 2.6.1.2 The study observed that *'Past assessments of offshore wind turbine visibility were based on smaller turbines and facilities in use at the time and underestimate the visibility for current*

*projects, which use more and larger turbines.*¹ Therefore, its relevance to effects of the larger WTCs proposed for Hornsea Four is limited. However, there is some useful information relating to the visibility of the lighting that is relevant as the requirements for this remain similar.

- 2.6.1.3 In relation to the visibility of offshore turbines at night, the researchers observed red, flashing, medium intensity lights mounted on the nacelles of moderately sized offshore wind facilities at night. It found the aviation obstruction lighting to be visible at just under 40 km. This would imply that visibility of the lights at just over 40 km would be limited. At a distance of 21 km both red aviation obstruction lighting and amber marine navigation lighting were visible at one facility, as seen from an elevated viewpoint.

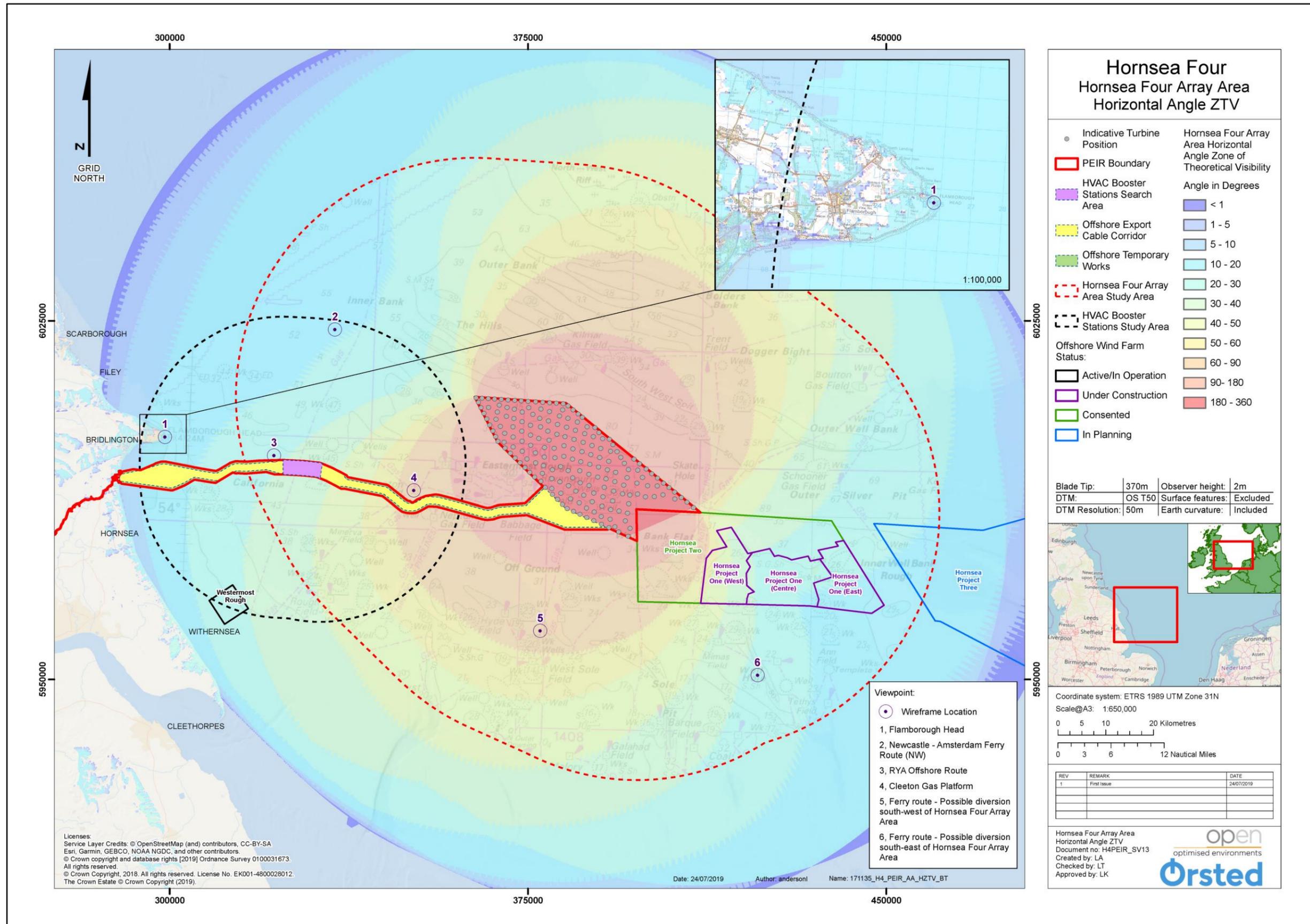


Figure 4: Array area horizontal field of view ZTV (not to scale).

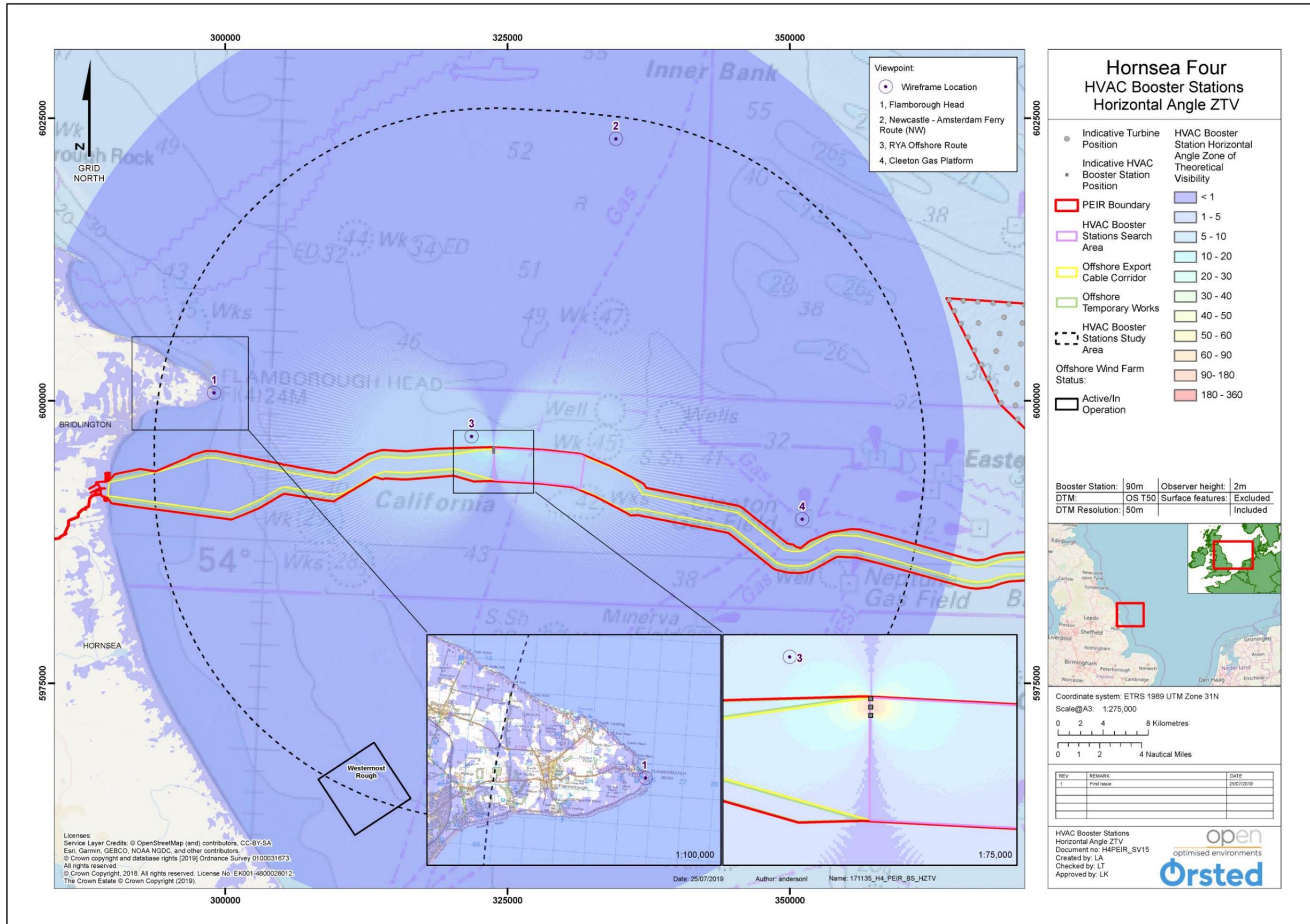


Figure 5: HVAC booster stations horizontal field of view (not to scale).

3 Designations and Defined Areas

3.1 Introduction

3.1.1.1 No parts of the offshore components of Hornsea Four are located within a landscape planning designation. The views and setting of the FHHC may be affected by visibility of Hornsea Four and in particular the HVAC booster stations and the export cable construction. The SLVR HVAC booster station study area includes the FHHC so that the effects of these components of Hornsea Four are assessed.

3.2 Flamborough Headland Heritage Coast

3.2.1.1 The SLVR study area for the HVAC booster station covers an area that has been defined (not designated) as the FHHC through agreement between the relevant local authorities and Natural England. This area is shown on [Figure 6](#). The Heritage Coast covers 19 km (12 miles) of coastline between Reighton in the north and Sewerby in the south, with an inland boundary that encloses 3265 ha (approximately 13 square miles).

3.2.1.2 The FHHC is one of 45 stretches of Heritage Coast around England and Wales. Natural England advises that the purpose of heritage coasts is as follows:

- conserve, protect and enhance:
 - the natural beauty of the coastline;
 - their terrestrial, coastal and marine flora and fauna; and
 - their heritage features;
- encourage and help the public to enjoy, understand and appreciate these areas;
- maintain and improve the health of inshore waters affecting heritage coasts and their beaches through appropriate environmental management measures; and
- take account of the needs of agriculture, forestry and fishing and the economic and social needs of the small communities on these coasts.

3.2.1.3 Heritage Coasts are protected through development control within the planning system. Paragraph 173 of the National Planning Policy Framework (NPPF) (2019) states that: *'Within areas defined as Heritage Coast (and that do not already fall within one of the designated areas mentioned in paragraph 172), planning policies and decisions should be consistent with the special character of the area and the importance of its conservation. Major development within a Heritage Coast is unlikely to be appropriate, unless it is compatible with its special character.'*

3.2.1.4 Notably the NPPF does not mention development within the wider setting of the Heritage Coast, which is what may be affected by Hornsea Four through its visibility.

3.2.1.5 Protection of the FFHC is provided by policies within the East Riding Local Plan 2012-2029, Adopted 2016. It defines Heritage Coast as: *'Areas of undeveloped coastline which are managed to conserve their natural beauty, and, where appropriate, to improve accessibility for visitors.'*

3.2.1.6 Within the Local Plan 'Policy ENV2: Promoting a high-quality landscape' advises that proposals should 'protect and enhance existing landscape character as described in the East Riding Landscape Character Assessment'. It notes that in particular this applies to Important Landscape Areas which include the Heritage Coast at Flamborough Head.

3.2.1.7 Policy A2 entitled 'Bridlington Coastal sub area' sets out in a section entitled Environment that Plans, strategies and development decisions in the Bridlington Coastal sub area should:

'Sensitively maintain the character of the undeveloped coast, particularly the Flamborough Heritage Coast, and improve public access to, and enjoyment of, the coast, ensuring that development proposals protect and enhance its distinctive landscape, conservation initiatives and the quality of the natural environment.'

3.2.1.8 The Local Plan notes that the Flamborough Management Plan (2007) has been prepared to ensure integrated management of wildlife, landscape and access in the area, and looks to ensure that human activities are managed in a way that is compatible with the area's natural assets. The 2007 plan is not specific to the FFHC and it was developed to fulfil a number of objectives with an overall view to ensure that human activities at Flamborough Head are managed in a way that is compatible with the natural assets of Flamborough Head and to seek opportunities to improve these assets and the human activities that depend upon them. This includes fulfilling specific requirements of Regulation 34 of The Conservation (Natural Habitats &c.) Regulations 1994 with regards to the Flamborough Head European Marine Site, which is a mandatory requirement.

3.2.1.9 The 2007 plan advises that the most recent management strategy for the Heritage Coast was published in 2002. It outlines the objectives and priorities for sustainable development on the headland, however over the past few years this strategy has become inactive due to having no dedicated project officer to oversee its implementation. Therefore, the rich historic value and varied natural beauty of the Heritage Coast has been recognised by the 2007 Management Plan, with actions and policies from the strategy incorporated within this reviewed Plan.

3.2.1.10 The FFHC (2002) Management Strategy sets out a useful description of the Headland's heritage, features and qualities that make it so distinctive as follows:

- *'Outstanding natural features;*
- *Areas of great architectural and historical value;*
- *Internationally important wildlife sites; and*
- *A special interaction between people and the local environment.*

Its spectacular chalk cliffs topped with boulder clay and its unique wildlife and geological interest attract much interest from large numbers of visitors and locals alike.'

3.2.1.11 It is recognised in the 2002 Management Strategy that *'some elements of the headland's heritage are more visually attractive than others, but all have their interest and represent aspects of what has resulted in the rich mixture of features and activities that are found on and*

around the headland today. There are many other elements that go to make up the whole picture that is Flamborough Headland Heritage Coast today, however, and reflect how people use and enjoy the area.'

3.2.1.12 Under the heading of 'Landscape' the 2002 Management Strategy sets out the following:

'The coastal landscape remains the basis for Heritage Coast designation however the area's landscape and wildlife are inextricably linked. The landscape and wildlife habitats, which it contains, are a product of geology, climate, and human use and management. This is what serves to make Flamborough Headland truly special and unique.'

In landscape terms, the headland is effectively an eastward extension of the Yorkshire Wolds, although the substantial covering of glacial material compared with the Wolds gives it a distinctive character. It shows the continuation of the dip slope of the chalk from north of Bridlington in an ENE direction to Thornwick Bay, becoming more broken hillock eastwards. The scarp slope of the chalk is visible at Speeton, where it leaves the coast to form the steep northern edge of the Wolds.

The combination of hard chalk overlain by glacial material gives rise to a coastal landscape type found nowhere else in Britain. Together with the influence of the North Sea, these factors give rise to the presence of wildlife habitats and communities that have unique characteristics. The coastal landscape and wildlife is affected by influences arising both inland and at sea.'

3.2.1.13 The Strategy sets out a number of policies that relate to landscape. However, these address development within the Heritage Coast itself with no policies associated with development beyond its boundary or in views to the North Sea. It is noted in the background section that *'The coastal landscape and wildlife is affected by influences arising both inland and at sea'*.

3.2.1.14 The 2007 Flamborough Head Management Strategy does include some information about the future management of energy industries, however this relates only to oil and gas projects as no offshore wind farm development was considered to be an issue at that time.

3.3 Yorkshire Wolds Important Landscape Area

3.3.1.1 Within the SLVR HVAC booster station study area, the FFHC coincides with an area identified in the Local Plan as the Yorkshire Wolds Important Landscape Area, which is also protected by Policy ENV2 and is shown on [Figure 6](#).

4 Seascape Character Receptors

4.1.1.1 Seascape character effects will be assessed within the two defined SLVR Study Areas which together encompass all offshore components of Hornsea Four. Such effects will be considered only during the day as it is only then that the baseline seascape character is apparent.

- 4.1.1.2 The Study Areas are located within four Marine Plan Areas (MPA) - East Inshore (MPA 3), East Offshore (MPA 4), North East Inshore (MPA 1) and North East Offshore (MPA 2) as illustrated on [Figure 7](#).
- 4.1.1.3 A seascape character area assessment covering MPAs 3 and 4 was published by the Marine Management Organisation (MMO) in July 2012 (MMO, 2012) and MPAs 1 and 2 in September 2018 (MMO, 2018). The purpose of the MMO assessments is to provide a strategic scale seascape character assessment to inform the marine planning process. It is these documents that have been used to inform the key characteristics included in [Table 2](#). The MMO seascape assessment for the eastern areas is based upon an earlier pilot study seascape assessment commissioned by Natural England (Natural England, 2012).
- 4.1.1.4 The MMO's seascape character assessments divide the MPAs into smaller Seascape Character Areas (SCAs) and MCAs. As described in the more recent study (P4, MMO, 2018) these are essentially different names for the same thing and are the names given to '*an area of marine space has its own individual character and identity.*' Hereafter within this SLVR assessment they are described as MCAs. These are shown on [Figure 6](#).
- 4.1.1.5 The baseline character of each of the MCAs that may be altered physically or through visibility of Hornsea Four is set out in [Table 2](#): Baseline character of MCAs within the SLVR Study Areas. Further information has also been added to [Table 2](#) with reference to the Historic Seascape Character – Sea Surface components and to describe the predicted change in character associated with offshore wind farm development unaccounted for in the MMO MCA descriptions.

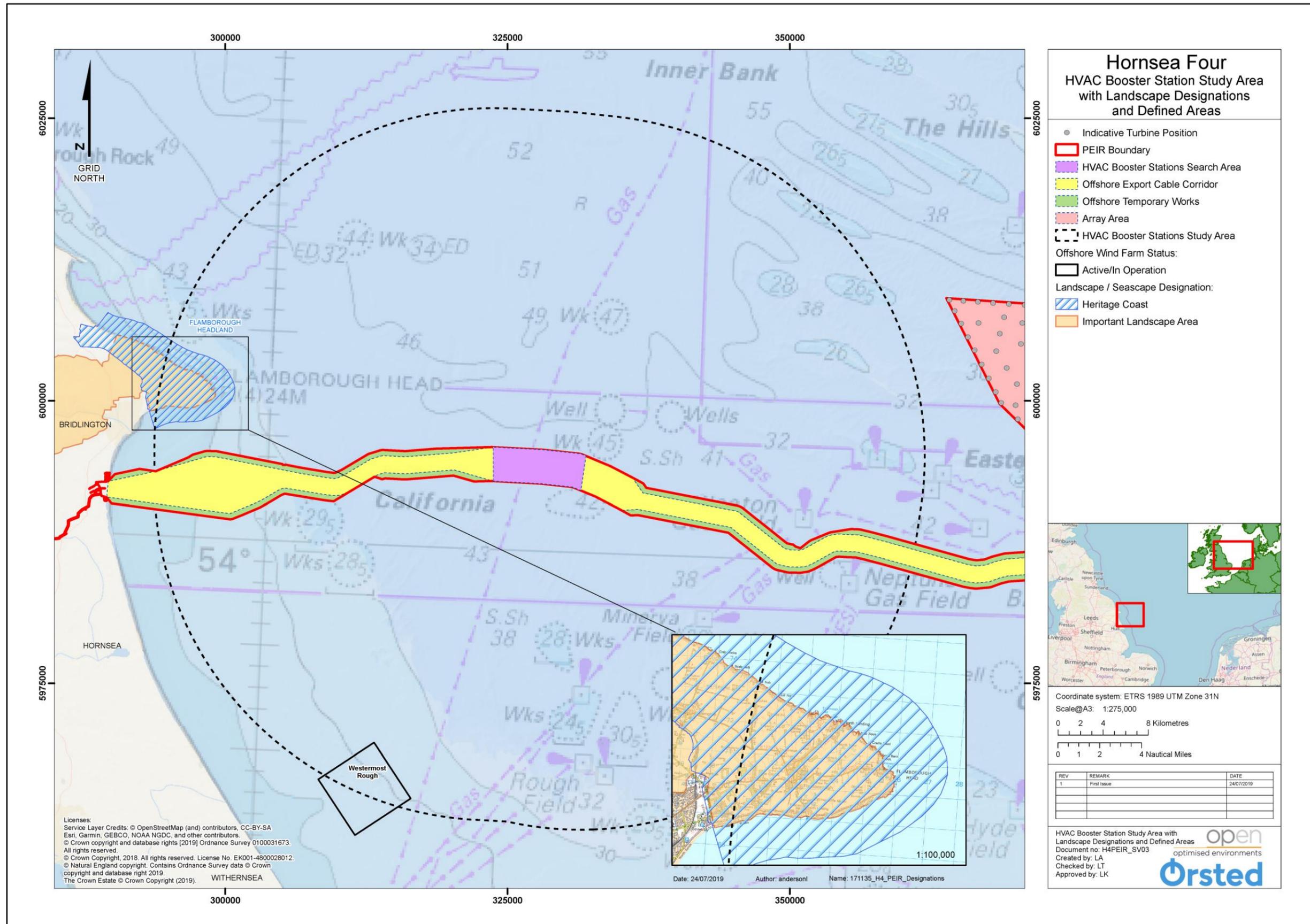


Figure 6: HVAC booster station study area with landscape designations and defined areas (not to scale).

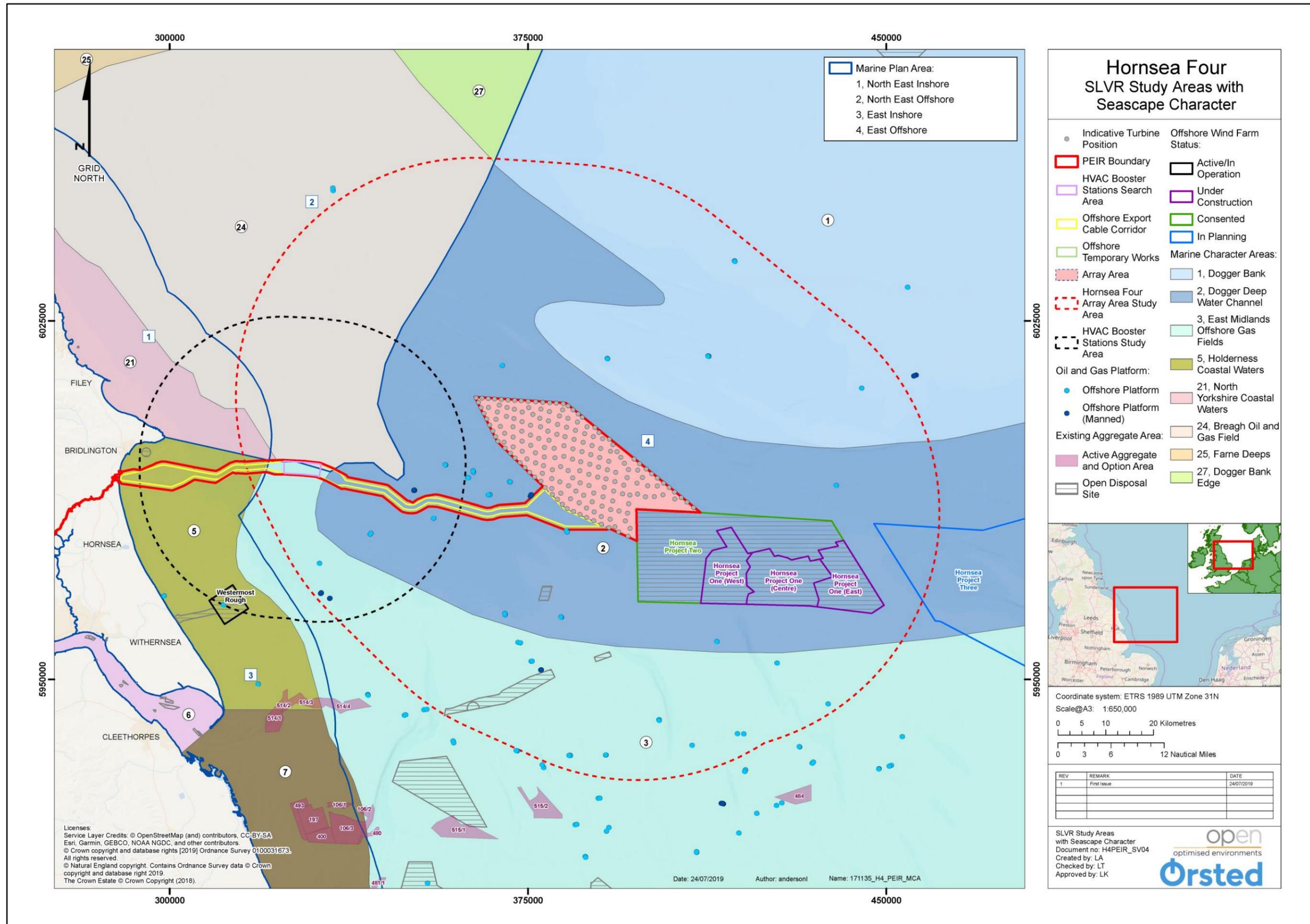


Figure 7: SLVR study areas with MCAs (not to scale)..

Table 2: Baseline character of MCAs within the SLVR assessment study areas (MMO (2012 & 2018)).

MCA	Baseline Characteristics	Predicted change in character
Dogger Bank	<p>Extensive and remote areas of relatively shallow waters.</p> <p>Visually unified and expansive open water character.</p> <p>Widespread sand bank habitat.</p> <p>Significant fisheries area because of important fish spawning and nursery habitats.</p> <p>Expansive seascape with few surface features.</p> <p>Important archaeological features present.</p> <p>The sea surface is used extensively by vessels. It is traversed by numerous navigational routes and is used extensively for bottom trawling and seine netting as well as for general fishing. There are numerous hydrocarbon installations.</p> <p>Hornsea Project One Offshore Wind Farm (hereafter Hornsea Project One) is located to the south of this MCA and has introduced relatively close-range offshore wind farm visibility to the perceived character as part of the context.</p>	<p>Hornsea Project Two and Hornsea Project Three Offshore Wind Farm (hereafter Hornsea Three) would be located beyond the boundary to the south of this MCA and would further alter the perceived character of this MCA through their visibility, as part of the wider context, during their construction and operation.</p>
Dogger Deep Water Channel	<p>West-to-east deep channel which cuts across the south of Dogger Bank, known as the Outer Silver Pit.</p> <p>Broad channel at its widest part is 125 to 175 km (75 to 105 miles) with waters deepening to between 60 and 70 metres in places.</p> <p>Expansive seascape with small concentrations of gas platforms.</p> <p>Significant fisheries area because of important fish spawning and nursery habitats.</p> <p>Once a lake with tributaries of melt-water supplied from glaciers to north of Dogger Bank.</p> <p>Designated as a military practice area.</p> <p>Major North Sea navigation route.</p> <p>Important archaeological features present.</p> <p>The sea surface is used extensively by vessels. It is traversed by numerous navigational routes and is used extensively for bottom trawling and drift netting, in the eastern sector, as well as for general fishing and areas of long lining.</p> <p>Hornsea Project One is located within this MCA and alters the character of the MCA through its physical presence and visibility from the wider area.</p>	<p>Hornsea Project Two and Hornsea Project Three would be located largely within this MCA and would alter its character during construction and operation through their physical presence and visibility from the wider area if they proceed.</p>
East Midlands Offshore Gas Fields	<p>Concentrations of offshore gas extraction and aggregate extraction activities.</p> <p>Extensive shallow offshore waters generally below 30 metres.</p> <p>Represents some of the UK's most extensive stores of shallow subtidal sediments.</p> <p>Series of submerged long straight sand banks and tidal sand ridges which pose navigational difficulties.</p>	<p>Hornsea Three is located partially within this MCA and will alter its character during its construction and operation if it proceeds due to physical</p>

MCA	Baseline Characteristics	Predicted change in character
	<p>Widespread sand bank habitats that support large fish spawning and fish nursery grounds.</p> <p>Commercial offshore activities such as fishing, dredging and dumping have a localised influence on benthic and pelagic environments.</p> <p>Significant fisheries areas.</p> <p>Important archaeological features present.</p> <p>There are a numerous navigational routes crossing this MCA. There is a large fishing ground as well as areas where longlining and seine netting fishing practices are followed. There are numerous hydrocarbon installations.</p> <p>Hornsea Project One is located relatively close to the northern boundary of this MCA and will alter its visual context through its visibility to the north.</p>	<p>alterations and views as part of the wider context.</p> <p>Hornsea Project Two is located close to the northern boundary of this MCA and will alter its visual context visibility to the north during construction and operation if it proceeds.</p>
<p>Holderness Coastal Waters</p>	<p>Expansive, sweeping coastline undergoing dynamic natural coastal processes of erosion.</p> <p>Extensive soft glacial till cliffs.</p> <p>Heritage Coasts of Flamborough Head and Spurn Head to the northern and southern extents.</p> <p>Open, exposed character by merit of low-lying coastal topography and an absence of vegetation.</p> <p>Large and featureless seaward horizon.</p> <p>Flat topography results in the views of the seascape from land being generally restricted to coastal towns and immediate cliff edges.</p> <p>Heavily potted coastal waters with strong fishing heritage.</p> <p>Generally shallow waters which preclude commercial shipping.</p> <p>Submerged gas pipelines and Easington Gas refinery.</p> <p>Military practice area.</p> <p>Extensive WW1 and WW2 coastal defences, subject to coastal erosion.</p> <p>Variety of roosting and feeding seabirds dispersing from nesting areas.</p> <p>This MCA has large area around the Bridlington coast used extensively for leisure sailing. A navigational route cuts across the outer edge of this MCA. The inner coastal waters are part of an extensive fishing ground with some area of longlining further out. There is a limited number of hydrocarbon installations close to the shore and numerous wreck hazards with some popular as dive sites. There is also an area of water turbulence to the west of the Westernmost Rough offshore wind farm.</p> <p>The Westernmost Rough and Humber Gateway offshore wind farms are located within the southern part of this MCA and have altered its character (since the 2012 study was undertaken) through physical and visual changes to it through the introduction of large scale, moving structures.</p>	<p>No substantial change anticipated within the study areas.</p>

Hornsea 4



MCA	Baseline Characteristics	Predicted change in character
<p>North Yorkshire Coastal Waters</p>	<p>Gently shelving coastal waters off the rugged coast of North Yorkshire between Flamborough Head and Saltburn-by-the-Sea. Flamborough Head, a prominent headland, is the northernmost coastal outcrop of chalk in Europe, forming a complex coastline of cliffs with numerous caves, arches and platforms. Low-lying coast south of Scarborough, including the broad and shallow crescent-shaped Filey Bay, contrasting with the high cliffs to the north.</p> <p>Unique combination of coastal and seabed limestone geology, with exposures of internationally important Jurassic and Cretaceous strata along the coast and evident in associated plant and animal fossil sites.</p> <p>Underlying seabed geology of chalk below Flamborough Head, and mudstones and limestones elsewhere.</p> <p>'Aggressive' North Sea currents and tides actively erode the coastline, particularly at Scarborough and Runswick Bay, requiring intervention with extensive man-made sea defences.</p> <p>Important vegetated sea cliffs, chalk reef and sea cave communities around Flamborough Head Special Area of Conservation (SAC). The area is also internationally important for its seabird populations (designated as a part of the Flamborough Head and Bempton Cliffs Special Protection Area (SPA) with nesting colonies of kittiwake, guillemot, fulmar, razorbill and puffins.</p> <p>Offshore, the Runswick Bay MCZ recognises diverse rocky and sediment seabed and sea cave habitats.</p> <p>Complex tidal patterns associated with Flamborough Head and Filey Point, as well as submerged rocks form hazards to navigation.</p> <p>This area was formerly part of Doggerland: dry land connecting the UK with Europe during Paleolithic times – inundated after the last Ice Age.</p> <p>Lighthouses (Flamborough Head and Whitby) provide prominent navigation marks, as do the ruined Whitby Abbey and Scarborough Castle which are prominent landmarks in views to and along the cliffs.</p> <p>Large number of wrecked merchant and fishing vessels, and minor warships – casualties of WWI and WWII or lost are testament to hazardous sea conditions. The protected site of the Filey Bay Wreck, Bonhomme Richard, an American privateer, dates from the late 18th century.</p> <p>Major historic fishing ports include Scarborough and Whitby as well as smaller ports at Filey, Flamborough, Straithe and Robin Hood's Bay where large quantities of shellfish (crab and lobster) are landed. Brightly painted vernacular open coble fishing boats are still in use along parts of this coast.</p> <p>Historic importance of fishing to the local communities along the coast including whaling from Whitby, the great herring fleets of the 19th and early 20th century and sport fishing for tuna out of Scarborough in the 1930s.</p> <p>War Channels of the East Coast (WWI & WWII), essential routes for the maritime traffic of coal and civilian shipping via mine-free channels connect the Tyne to the Thames, and beyond. The coast at Scarborough and Whitby was subject to bombardment by German warships in 1914.</p> <p>Important industrial heritage associated with coastal mining of both of Alum and ironstone. A number of quarries are designated Scheduled Monuments; Boulby mine being one of the best national examples of a technically advanced alum</p>	<p>No substantial change anticipated within the study areas.</p>

MCA	Baseline Characteristics	Predicted change in character
	<p>quarrying complex. A railway tunnel and harbour at Port Mulgrave are reminders of the area's important ironstone industry and links to coastal trade/shipping.</p> <p>Hilda of Whitby, Christian saint and founding abbess of the Whitby monastery, played a significant role in establishing Christianity in the North East, along with religious centres at Lindisfarne (MCA23) and Wearmouth-Jarrow (MCA22), all linked by waterborne route ways.</p> <p>Whitby, Filey and Scarborough are important historic ports/harbours and key religious/military sites and centres of trade, recognised in their built heritage and character. A long heritage as popular tourist destinations: today, the area continues to attract visitors to explore the local history, literary heritage or natural environment, with whale watching tours operating from Whitby.</p> <p>Popular walking route – the Cleveland Way National Trail forms part of the Filey Brigg to Newport Bridge section of the England Coast Path.</p> <p>Expansive views from the coast across undeveloped North Sea horizons, frequently marked by cargo ships, tankers and fishing vessels. Vistas along the coastline to settlements clinging to the cliffs such as to Robin Hood's Bay and Runswick Bay, as well as views back from the sea to the rugged coast with distinctive landmarks.</p> <p>The smooth elevated moorlands of the North York Moors National Park provide a remote and dramatic backdrop to the MCA, in turn this largely undeveloped seascape forms part of its setting, particularly views north of Flamborough.</p> <p>North Yorkshire and Cleveland Heritage Coast defines stretches of undeveloped coast, characterised by 'dark skies' and 'elevated levels of tranquillity.'</p> <p>There is an area to the north of Flamborough Head that is popular for leisure fishing and further north the inner coastal waters are extensively used for leisure sailing. A navigational route cuts across the outer edge of this MCA. There is a limited number of hydrocarbon installations close to the shore and numerous wreck hazards as well as areas of water turbulence and some submerged rocks close to the shore.</p>	
Breagh Oil and Gas Field	<p>Undulating marine plain of approximately 50-70m depth, the deepest waters associated with Whitby Fine Ground in the north. Area formerly part of the Palaeolithic landscape of Doggerland – dry land connecting the UK with Europe, subsequently inundated following the last Ice Age. Peat and remains of a mammoth dredged up by fishing trawlers, are evidence for Doggerland's ancient location above sea level.</p> <p>Chalk seabed beneath Flamborough Head Ground; a band extending from the coast to Dogger Bank and running beneath the eastern part of the MCA. The remainder is underlain by mudstones. Seafloor topped by sand and gravel sediments.</p> <p>The area experiences moderate wave action with weak tidal currents. Low wave heights are characteristic across the MCA. Stable environment and uniform sea temperatures of the North Sea allow spring and autumn phytoplankton blooms.</p>	No substantial change anticipated within the study areas.

MCA	Baseline Characteristics	Predicted change in character
	<p>Area influenced by the Flamborough Front, an upwelling of nutrients where the cooler northern and warmer southern waters of the North Sea mix, providing an important food source for marine mammals. Southern North Sea cSAC, covering a vast area (36,951km²), is important for its harbour porpoise population. Atlantic white-sided dolphins are also present.</p> <p>Historically important as part of the wider North Sea: early Roman explorations recorded in 12 BC; Viking raiding for two centuries from 793 AD; and maritime trade between the North East and Scandinavia and the Baltic from the medieval period onwards.</p> <p>WWI naval engagements, including the First Battle of the Atlantic, marking the first submarine war patrols in history when German U-boats attacked the Royal Navy, and the later Battle of Dogger Bank – Blucher sunk by British battlecruisers in the North Sea.</p> <p>The East Coast War Channels were vital for transporting coal and other goods from the Tyne to the Thames and France, during WWI and WWII.</p> <p>The Greater North Sea is one of the busiest sea areas in the world, important for marine transport with busy shipping lanes linking ports in Europe with the North East.</p> <p>Relatively small number of recorded wrecks due to the vast open, deep seas and calmer waters.</p> <p>Popular fishing area, despite part of the area being known as 'Heartbreak Ridge' due to the unpredictable fish catches in this area. The wider MCA is also exploited for stocks of Queen scallops, deep water prawns and whelks.</p> <p>Important spawning area for commercially fished cod and plaice across Flamborough Head Ground, with herring, lemon sole, sand eel and sprat also spawning in the MCA.</p> <p>Breagh oil and gas field is located in the centre of the MCA, with additional wells associated with Flamborough Head Ground. These sites are connected to the mainland by submerged pipelines crossing the seafloor.</p> <p>Busy waters for shipping, with major routes crossing from the Port of Tyne and Teesport, connecting to mainland Europe or southern English ports.</p> <p>Waters licenced for military use, including air-to-air firing practice at Staxton and submarine exercise areas at Castle and Scarborough Grounds.</p> <p>Uniform, open waters with high levels of tranquillity and remoteness in spite of the range of dynamic human activities present.</p> <p>MCA forms part of the wider, remote maritime setting to the eastern edge of North York Moors National Park and Flamborough Headland Heritage Coast</p> <p>There are numerous navigational routes crossing this MCA. There are large areas where longlining and seine netting fishing practices are followed. There is a limited number of hydrocarbon installations.</p>	

5 Landscape Character Receptors

- 5.1.1.1 The HVAC booster station study area covers an area of land that lies entirely within the East Riding of Yorkshire with the HVAC booster station SLVR study area covering part of both the Yorkshire Wolds and the Holderness National Character Areas (Natural England, 2015). A Landscape Character Assessment has been updated by AECOM for this area namely AECOM (2018) East Riding of Yorkshire Council Landscape Character Assessment Update.
- 5.1.1.2 This identifies Landscape Character Types (LCT) and Landscape Character Areas (LCA) and provides updated descriptions of these. These are shown in [Figure 8](#), illustrating that the landscape character receptors located within the HVAC booster station study area are Landscape Character Area 13E: Bempton, Grindal and Wold Newton Farmland and 13F: Flamborough Headland Farmland, which are both sub-types of LCT 13: Open High Rolling Farmland; and LCA 19C; North Holderness Open Farmland, which is a sub-type of LCT 19: Open Farmland.
- 5.1.1.3 The Horizontal Field of View ZTV on [Figure 5](#) indicates that there is the potential for these areas, some of which are elevated, to be affected by Hornsea Four through visibility of the HVAC booster stations and ECC construction, operation and maintenance and decommissioning phases through their visibility.
- 5.1.1.4 The key characteristics of the Open High Rolling Farmland LCT are listed in the Landscape Character Assessment as follows:
- Elevated rolling landform of the Yorkshire Wolds dip slope falling east;
 - Large scale open landscape with long distance views and dominated by the sky;
 - Sparsely populated area with scattered villages and farmsteads;
 - Large and very large rectilinear regular arable fields;
 - Fragmented hedgerows that are severely clipped;
 - Very few trees resulting in an open landscape;
 - Shelterbelts around farmsteads on the hill tops are a prominent feature;
 - Pockets of parkland and estate land to the east on the lower slopes provide diversity;
 - Enclosure roads that conform to the enclosure field pattern alongside older routes are well spaced;
 - Numerous Public Rights of Way; and
 - South Dalton Church spire is a prominent landmark in the relatively featureless landscape.
- 5.1.1.5 Also of note within the descriptions of the LCT are that *'Turbine developments, communications masts and pylons are the main detractors in this LCT'*.
- 5.1.1.6 Under the headings of Evaluation and Quality it is evaluated in the LCA that *'This LCT is part of the distinctive chalk lands of the Wolds and contributes to the diversity of the Yorkshire Wolds from the escarpment landform to the steep sided dry vales and the rolling arable farmland. The coastal landscape is also a highly valued recreation and landscape resource*

that is recognised in the Heritage Coast designation at Flamborough Head. The LCT is assessed to be high quality.'

5.1.1.7 Positive landscape features of the Open High Rolling Farmland LCT have been identified by AECOM in the evaluation section of the Landscape Character Assessment as follows:

- Varied rolling landform offering extensive views;
- Views east over Holderness and to the North Sea at Flamborough;
- Scattered farmsteads with shelterbelts;
- Large rectilinear parliamentary enclosure fields; and
- Views of South Dalton Church Spire and Flamborough Lighthouse.

5.1.1.8 Of note in undertaking this SLVR are the references to views within and from this landscape.

5.1.1.9 The LCT is also described as containing a large number of areas of conservation interest (wildlife, earth science, archaeological, historic, cultural). The description for LCA 13E: Bempton, Grindal and Wold Newton Farmland is set out below:

'This LCA is located northwest of Bridlington and is separated from other LCA's in the LCT by the Great Wolds Valley which dissects the Wolds dip slope in the Northeast of the East Riding west of Bridlington.

Buckton contains village earthworks showing medieval depopulation and there are a number of scheduled monuments associated to medieval settlements at Newsham, Grindale and Argam. Flamborough Headland Heritage Coast noted for its impressive chalk cliffs overlaps this LCA, and is part of the Flamborough Heritage Coast Important Landscape Area. Agricultural land use dominates the LCA and a number of developments associated with the tourism and recreation industry are present nearer the coast line.

A patchwork of large to very large rectilinear fields covers the LCA, the fields becoming smaller nearer the coast. Settlement comprises hamlets and nucleated villages with Bempton the largest village. Wold Newton has a Conservation Area designation. Scattered farmsteads with wooded shelterbelts are prominent throughout the LCA. Tree cover is low with sporadic small woodlands scattered across the LCA.

The Flamborough railway cutting runs through the farmland of this area, with an associated shallow chalk quarry nearby. These areas have been designated a SSSI and support a species-rich chalk flora which includes a variety of grasses and typical chalk herbs. The expansive and simple landscape has little industrial or commercial development and is rural with a remote and quiet character'.

5.1.1.10 The description for LCA 13F: Flamborough Headland Farmland is set out below:

'This LCA comprises elevated farmland overlooking the coastline to the east around Flamborough. The influence of the coast and views of the North Sea make this area distinctive

from the other farmland in this LCT. The area is also distinctive as a result of its geology. The headland is covered with glacial till from the Devensian period.

Although dominated by agriculture, like adjoining LCA, there are a number of developments associated with the tourism and recreation industries that distinguish this LCA. These are predominantly caravan parks and camping areas which are generally situated close to the coast line.

The only village within the LCA is Flamborough, approximately 2 miles northeast of Bridlington, which has a Conservation Area designation. Scattered farmsteads are also present within the LCA.

Inland from the cliff tops, the land consists of a considerable area of permanent grassland, with fields bound by hedgerows and fencing. Fields are large and rectilinear becoming smaller approaching the coast, in a structured pattern.

Tree cover is very low with very few small groups scattered over the LCA and a notable strip of woodland along Danes Dyke which extends across the headland west of Flamborough.

Flamborough was a significant port in the Middle Ages but fell into decay in the 16th Century. It contains the ruins of a fortified manor house surrounded by earthworks. Danes Dyke is an ancient linear earthwork which crosses the Flamborough Headland from north to south. A designated scheduled monument, it is thought to have been constructed in the Iron Age as a defence. World War II pill boxes are located in the LCA as modern defence features.

The headland is bound by tall chalk cliffs and the area is a Designated Heritage Coast and is part of the Flamborough Heritage Coast Important Landscape Area.

Flamborough Head is also designated Special Area of Conservation (SAC), Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI) due to its conservational and ecological importance.'

5.1.1.11 The key characteristics of the Open Farmland LCT are listed in the Landscape Character Assessment as follows:

- Gently undulating topography, hummocky in places;
- Very open landscape with few trees overall;
- Irregular field pattern of pre-parliamentary enclosure;
- Dispersed villages linked by winding roads;
- Red brick buildings with pantile roofs sometimes painted white;
- Churches are often prominent features on the skyline;
- Irregular drainage pattern overall;
- Hedgerow field boundaries with few trees;
- Intensive farmed arable landscape; and
- Large number of wind developments visible across the landscape both within LCT 19 and adjoining LCTs.

5.1.1.12 There is no mention of views out to sea being important within the LCT description or evaluation of positive landscape features.

5.1.1.13 The description for LCA 19C: North Holderness Open Farmland is set out below:

'This LCA includes numerous well scattered settlements that vary in size. The area extends from Burton Agnes in the north to Brandesburton and Seaton in the south. Industrial land uses include Carnaby Industrial Estate south west of Bridlington in the north and Catfoss Airfield and associated buildings in the south. The northern section of this LCA overlaps the Flamborough Headland Heritage Coast and Important Landscape Area along with the Flamborough Head Special Area of Conservation.

The area contains three disused airfields at Carnaby, Lisset and Brandesburton. The majority of the area is under intensive arable production. There are very few woodland blocks.

Burton Agnes Hall is an Elizabethan House located on the northern boundary of this LCA with the Yorkshire Wolds. The Hall is located on the north side of the A614. The village has a pond, noted for its ecological value. St Martins Church is a Norman building over 900 years old. Carnaby Industrial Estate is a large development on the northern edge of this LCA that also impacts upon views from the edge of the Yorkshire Wolds to the north. The area is the location of a large Iron Age square barrow cemetery.

Typical of Holderness, the land use consists of open agricultural land, mainly intensively managed arable, with generally large fields and very little woodland. Settlements are well scattered, numerous and varied in size.

Farmsteads are common and field pattern comprises large rectilinear fields bordered by hedgerows and tracks.

This is a large-scale landscape where the sky dominates views over a gently undulating landform. Panoramic views to the east coast and the neighbouring Wolds are available from this LCA.

The small blocks of semi-natural woodland present are composed of tree species such as ash, field maple and rowan, and in wetter areas alder and various willows. This LCA contains a large number of turbine developments (approximately 15) ranging from small to very large in scale, most of which are visible within the landscape.'

5.1.1.14 AECOM has prepared an Annex A – Wind turbine Sensitivity and Capacity Study as part of the Landscape Character Area Update 2018. The LCTs are used to inform the study and to identify 'areas of significant constraint', 'areas of potential constraint' and 'areas of search' for onshore wind energy developments. However, the study relates only to onshore wind energy and the only reference to offshore wind energy developments is a reference to views of existing offshore wind energy developments being influential from within the Coastal Farmland LCT, which extends along the coast from south of Bridlington to the Humber Estuary.

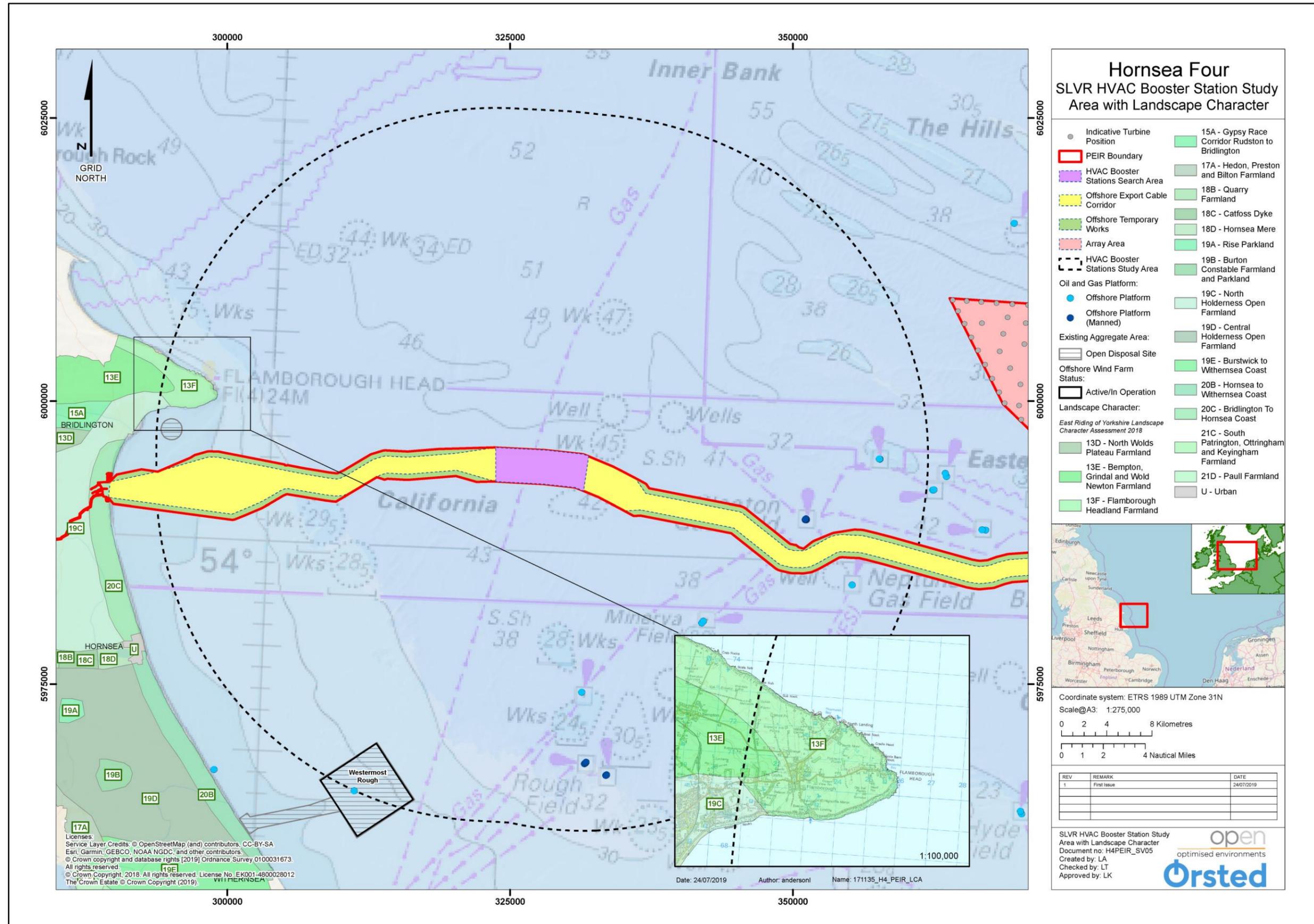


Figure 8: HVAC booster stations study area with LCAs (not to scale).

6 Visual receptors

- 6.1.1.1 The visual characteristics of the Hornsea Four array area study area could be described as relatively homogenous due to the distance of the Hornsea Four array area to the coast. Views consist mainly of open seas with occasional views of offshore structures, such as platforms. There is regular passage of use by sea-going vessels for a variety of purposes, including recreational cruising, commercial ferry routes, commercial fishing activities, tankers and cargo vessels with such activity introducing movement and change within the views. Overhead combat training in aeroplanes furthers this characteristic of movement and change.
- 6.1.1.2 **Figure 9** and **Figure 10** illustrate the potential locations of visual receptors within the SLVR array area and HVAC booster stations study areas respectively.
- 6.1.1.3 Visual receptors within the Hornsea Four array area study area can be broadly defined as people that are undertaking recreational travel and those that are working.
- 6.1.1.4 People undertaking recreational travel include those on yachts and other vessels who are doing so partly with the intention of enjoyment of their surroundings. The pattern of the Royal Yachting Association (RYA) cruising routes shows that vessels may pass into the array area study area from the west close to the HVAC booster station search area.
- 6.1.1.5 Other recreational travellers may be on a day cruise or travelling on a ferry, which may be as part of a holiday, where they will pass from the shore to the open sea. The majority of the views obtained by these people are of the open sea with occasional glimpses of gas platforms or associated infrastructure and other vessels. In the future they may also gain close range views of the operational and under construction offshore wind farms.
- 6.1.1.6 Ferries carry many people that are working. Air combat training also takes place over the study areas. Fishing of many types occurs extensively. There are also numerous manned oil and gas platforms within the study areas and a number of aggregate areas and open disposal areas, in the south west of the Hornsea Four array area study area.
- 6.1.1.7 The types of visual receptors known to be present within the array area study area can therefore be described as follows:
- Sailors following the cruising routes identified by the RYA, which are largely located close to the coast;
 - Passengers and workers on board commercial ferries or cruise liners;
 - People at their place of work on passing cargo, tanker or other commercial vessels;
 - People at their place of work on manned static oil and gas platforms or travelling to the platforms;
 - People at their place of work on commercial fishing vessels;
 - People at their place of work on aggregate vessels; and
 - Military personnel using identified Military Practice Areas.

- 6.1.1.8 The main ferry routes through the SLVR array area study area are used by the Newcastle to Amsterdam Cruise Ferries which generally pass through the study area twice each day. The cruise ferry departs Newcastle daily at 17:00 and the return journey arrives back at Newcastle at 09:00 or 09:30. Based on the published departure times and a cruising speed of 21 knots it is possible to estimate the approximate times the ferries will pass through the SLVR array area study area.
- 6.1.1.9 Based on average cruising speeds and the scheduled 17:00 daily departure time of the cruise ferry from Newcastle, this suggests that the cruise ferry would pass through the Hornsea Four array area study area during the hours of darkness for much of the year i.e. arriving at the northern edge of the study area at 20.15 and leaving the southern edge at 00.25.
- 6.1.1.10 On the scheduled journey leaving Amsterdam at 17:30, for the majority of the year, the cruise ferry will pass through the study area during the hours of darkness i.e. arriving at the southern edge of the study area at 22.50 and leaving the northern edge at 03.00.
- 6.1.1.11 The HVAC booster stations study area is more visually influenced by coastal views and a higher density of recreational vessels and smaller fishing boats using the inshore waters. The location of the General Boating Areas indicates that most leisure boating would occur close to the shore. The leisure and recreational boating intensity information has been prepared by the RYA UK from Automatic Identification Systems (AIS) data and indicates higher levels of activity close to the shore to the north of Flamborough Head and extending south-eastwards away from the headland.
- 6.1.1.12 The character of the views from these locations will be defined both by the landscape of the coast and the open sea.
- 6.1.1.13 On the land at Flamborough Head there are a number of public rights of way along the coast around the headland and connecting inland to the small settlement of Flamborough. The coastal footpath is known as the "Headland Way", forming part of the "East Riding Heritage Way" which runs 80 miles from Hull to Filey Brigg.
- 6.1.1.14 There are also numerous paths through and around the Nature Reserves with a bird hide also located close to Flamborough Head lighthouse.
- 6.1.1.15 Beaches are accessible to pedestrians via steps at Selwicks Bay, Thornwick Bay, via minor roads or tracks at Danes Dyke and South Landing, and via a steep concrete ramp at North Landing. There are car parks and facilities at Thornwick Bay, North Landing, Selwicks Bay, South Landing and Danes Farm as well as various facilities such as cafes and benches as well as the lighthouse, which is sometimes open to the public, at Flamborough Head. However, some parts of the headland have only limited access to the public.
- 6.1.1.16 The Flamborough Head Management Plan (2007) notes that *'The majority of visitors to the Heritage Coast come simply to enjoy the scenery and sea air; many go for short walks or visit the beach although a fair number may not leave the car park at all. There are, however, a number of other activities that relate to the special characteristic of this area.'*

Large numbers of bird-watchers visit each year, many to see the spectacular seabird colonies on the north side of the headland, but also because the headland is very well known as an area for observing migrant birds in spring and autumn.'

7 Cumulative Development

7.1.1.1 **Table 3** sets out the cumulative developments that are within the study area and are thereby considered in the cumulative SLVR assessment. These are shown on **Figure 11**. Some of these are active/operational, under construction or in place although inactive and are thereby part of the baseline seascape character. Where the development is located within 30 km of the HVAC booster stations search area or within 50 km of the Hornsea Four array area they are considered in the cumulative assessment.

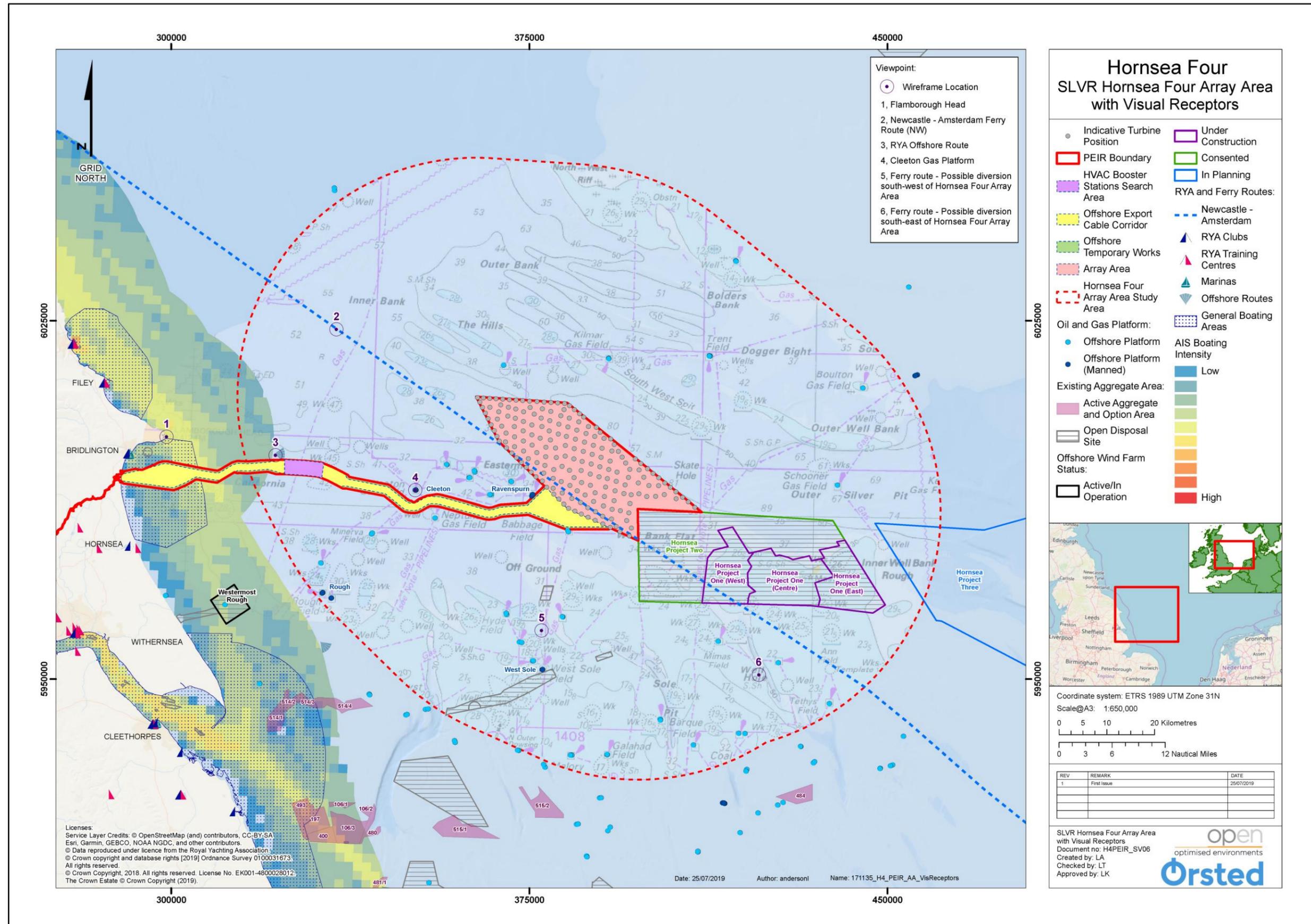


Figure 9: Hornsea Four array area study area with visual receptors (not to scale).

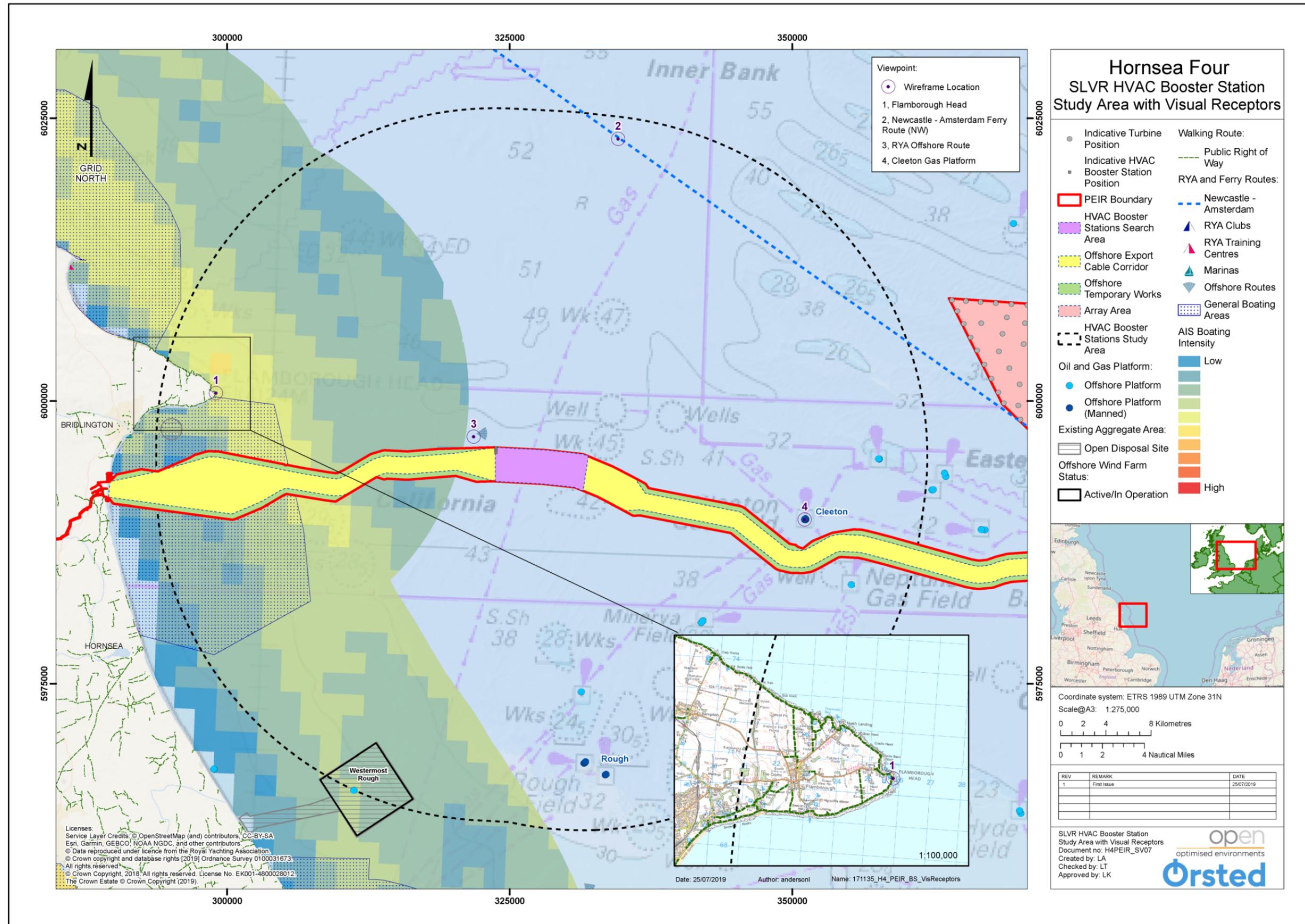


Figure 10: HVAC booster stations study area with visual receptors (not to scale).

Table 3: Cumulative developments.

Development	Status	Blade Tip Height (m)	No. of WTCs	Distance (km) from:	
				Hornsea Four array area	HVAC booster station search area
<i>Aggregates and Disposal</i>					
Humber 4 and 7	Active	NA	NA	36.65	>50
Hornsea Project One Subzone 1	Active	NA	NA	5.05	>50
Babbage	Active	NA	NA	15.87	>50
Hornsea Disposal Area 1	Active	NA	NA	44.64	>50
<i>Offshore Energy</i>					
Hornsea Project Two Offshore Wind Farm	Consented (March 2019 layout)	204.5	165	0.00	66.43
Hornsea Project One Offshore Wind Farm	Under construction (assumed to become operational)	191.9	174	5.08	82.50
Westermost Rough Offshore Wind Farm	Operational	179	35	62.75	25.40
Hornsea Three Offshore Wind Farm	In planning	325	161	36.34	116.10
<i>Oil and Gas</i>					
Ravenspurn North CCW	Active	NA	NA	2.95	44.22
Ravenspurn North CC	Active	NA	NA	3.05	44.14
Ravenspurn North ST2	Active	NA	NA	4.16	39.47
Babbage	Active	NA	NA	4.31	52.87
Garrow NUI	Active	NA	NA	6.96	42.76
Ravenspurn North ST3	Active	NA	NA	7.95	31.55
Ravenspurn South A	Active	NA	NA	9.25	35.33
Ravenspurn South B	Active	NA	NA	9.69	30.65
Ravenspurn South C	Active	NA	NA	11.95	25.69
Kilmar NUI	Active	NA	NA	12.65	63.56
Cleeton Cc	Active	NA	NA	20.19	19.80
Cleeton WLTR	Active	NA	NA	20.20	19.76
Cleeton PA	Active	NA	NA	20.24	19.75
Neptune	Active	NA	NA	20.77	24.89

Development	Status	Blade Tip Height (m)	No. of WTGs	Distance (km) from:	
				Hornsea Four array area	HVAC booster station search area
Hoton	Active	NA	NA	21.07	58.12
Hyde	Active	NA	NA	25.39	47.83
Trent	Active	NA	NA	26.36	83.81
48/9a Mimas	Active	NA	NA	27.02	89.88
Mimas MN	Active	NA	NA	27.02	89.88
Schooner A	Active	NA	NA	28.97	107.69
West Sole C	Active	NA	NA	29.47	54.15
West Sole B	Active	NA	NA	31.97	58.50
Minerva	Active	NA	NA	32.70	15.62
West Sole PP	Active	NA	NA	32.78	61.21
West Sole A (8 Leg)	Active	NA	NA	32.82	61.18
West Sole A (6 Leg)	Active	NA	NA	32.84	61.17
West Sole SP	Active	NA	NA	32.87	61.13
Saturn ND	Active	NA	NA	35.38	103.18
Barque PB	Active	NA	NA	37.86	87.16
Boulton	Active	NA	NA	42.52	113.94
Barque PL	Active	NA	NA	44.30	95.85
Galahad	Active	NA	NA	45.20	83.15
Cavendish	Active	NA	NA	45.29	96.14
Unnamed surface structure operated by Spirit Energy	Active	NA	NA	45.38	18.16
Ensign Platform	Pre-commission	NA	NA	45.47	102.34
Ensign	Proposed	NA	NA	45.69	102.37
Malory	Active	NA	NA	47.07	77.89
49/11b Tethys	Pre-commission	NA	NA	47.93	116.08
Rough AP	Active	NA	NA	47.96	25.13
Rough AD	Active	NA	NA	48.03	25.17
Rough CD	Active	NA	NA	48.56	23.92

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Development	Status	Blade Tip Height (m)	No. of WTGs	Distance (km) from:	
				Hornsea Four array area	HVAC booster station search area
Rough BP	Active	NA	NA	48.65	23.99

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Appendix A: Frequency of Visibility Observations from Donna Nook

Table A 1 and **Table A 2** set out the maximum optical range measured every hour over the ten years between January 2009 and December 2018. **Table A 1** shows the frequency of the observations within the different distance bands and their occurrence by month. **Table A 2** illustrates this frequency as a percentage of all the observations made within the ten-year period. Notably the observations occur throughout a 24-hour period and do not take account of the hours of darkness when unlit objects would not be visible to people.

Table A 1: Frequency of Visibility Observations by Month and Distance from Donna Nook.

Visibility (metres)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ALL OBS
< 1000	108	150	154	180	75	96	52	28	87	72	119	125	1246
1000 to 1999	80	89	159	108	57	68	37	26	61	64	95	66	910
2000 to 2999	139	152	203	123	59	65	73	48	93	91	147	115	1308
3000 to 3999	214	167	208	144	88	100	57	43	119	153	188	168	1649
4000 to 4999	290	204	252	186	94	94	79	66	118	195	241	193	2012
5000 to 5999	273	218	220	206	138	125	86	94	158	189	258	205	2170
6000 to 6999	305	227	209	175	144	100	104	96	147	187	243	204	2141
7000 to 7999	237	173	170	184	179	130	113	132	172	199	216	230	2135
8000 to 8999	262	196	223	194	196	135	131	152	160	192	202	233	2276
9000 to 9999	219	165	195	181	186	136	140	139	120	168	173	170	1992
10000 to 10999	200	151	188	168	227	143	168	193	175	189	195	212	2209
11000 to 11999	198	146	206	181	262	165	228	223	161	174	193	163	2300
12000 to 12999	243	177	219	200	268	190	258	297	229	226	194	173	2674
13000 to `13999	236	172	202	223	264	223	273	267	266	204	184	190	2704
14000 to 14999	264	158	230	211	277	276	333	272	314	240	206	205	2986
15000 to 15999	218	212	255	185	301	293	327	289	303	224	221	179	3007

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Visibility (metres)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ALL OBS
16000 to 16999	249	176	257	201	317	278	393	294	293	236	245	180	3119
17000 to 17999	229	191	226	218	270	293	390	257	254	237	232	184	2981
18000 to 18999	222	198	249	216	271	335	390	235	254	247	232	188	3037
19000 to 19999	212	186	211	214	250	340	321	246	217	231	219	192	2839
20000 to 20999	255	247	259	221	308	406	333	295	242	301	239	253	3359
21000 to 21999	179	202	214	201	242	326	256	212	195	192	208	256	2683
22000 to 22999	196	189	194	208	213	305	198	201	193	218	185	221	2521
23000 to 23999	186	183	170	207	228	309	190	234	156	204	141	252	2460
24000 to 24999	178	165	188	201	238	297	226	211	157	168	139	237	2405
25000 to 25999	183	183	210	213	248	290	233	259	215	230	178	255	2697
26000 to 26999	148	150	162	166	189	229	151	171	151	187	118	199	2021
27000 to 27999	115	159	142	153	182	193	158	208	158	195	133	195	1991
28000 to 28999	137	150	139	146	156	154	170	176	153	182	117	158	1838
29000 to 29999	129	137	105	140	150	138	135	181	158	146	119	172	1710
30000 to 34999	504	552	550	654	657	500	626	768	749	850	542	666	7618
35000 to 39999	312	336	361	450	357	184	344	453	479	549	432	423	4680
40000 to 44999	221	239	201	278	193	103	236	291	286	240	347	255	2890
45000 to 49999	110	140	97	150	93	67	114	149	130	46	157	156	1409
50000 to 59999	140	144	114	95	51	31	55	122	70	8	88	110	1028
60000 to 69999	38	43	22	15	5	0	5	25	3	2	7	29	194
>= 70000	9	16	6	0	1	1	0	1	0	0	2	5	41
All OBS	7438	6743	7370	7196	7434	7118	7383	7354	7196	7436	7155	7417	87240

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Version A

Table A 2: Percentage of Visibility Observations by Month and Distance from Donna Nook.

Visibility (metres)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ALL OBS
< 1000	1.45	2.22	2.09	2.50	1.01	1.35	0.70	0.38	1.21	0.97	1.66	1.69	1.43
1000 to 1999	1.08	1.32	2.16	1.50	0.77	0.96	0.50	0.35	0.85	0.86	1.33	0.89	1.04
2000 to 2999	1.87	2.25	2.75	1.71	0.79	0.91	0.99	0.65	1.29	1.22	2.05	1.55	1.50
3000 to 3999	2.88	2.48	2.82	2.00	1.18	1.40	0.77	0.58	1.65	2.06	2.63	2.27	1.89
4000 to 4999	3.90	3.03	3.42	2.58	1.26	1.32	1.07	0.90	1.64	2.62	3.37	2.60	2.31
5000 to 5999	3.67	3.23	2.99	2.86	1.86	1.76	1.16	1.28	2.20	2.54	3.61	2.76	2.49
6000 to 6999	4.10	3.37	2.84	2.43	1.94	1.40	1.41	1.31	2.04	2.51	3.40	2.75	2.45
7000 to 7999	3.19	2.57	2.31	2.56	2.41	1.83	1.53	1.79	2.39	2.68	3.02	3.10	2.45
8000 to 8999	3.52	2.91	3.03	2.70	2.64	1.90	1.77	2.07	2.22	2.58	2.82	3.14	2.61
9000 to 9999	2.94	2.45	2.65	2.52	2.50	1.91	1.90	1.89	1.67	2.26	2.42	2.29	2.28
10000 to 10999	2.69	2.24	2.55	2.33	3.05	2.01	2.28	2.62	2.43	2.54	2.73	2.86	2.53
11000 to 11999	2.66	2.17	2.80	2.52	3.52	2.32	3.09	3.03	2.24	2.34	2.70	2.20	2.64
12000 to 12999	3.27	2.62	2.97	2.78	3.61	2.67	3.49	4.04	3.18	3.04	2.71	2.33	3.07
13000 to 13999	3.17	2.55	2.74	3.10	3.55	3.13	3.70	3.63	3.70	2.74	2.57	2.56	3.10
14000 to 14999	3.55	2.34	3.12	2.93	3.73	3.88	4.51	3.70	4.36	3.23	2.88	2.76	3.42
15000 to 15999	2.93	3.14	3.46	2.57	4.05	4.12	4.43	3.93	4.21	3.01	3.09	2.41	3.45
16000 to 16999	3.35	2.61	3.49	2.79	4.26	3.91	5.32	4.00	4.07	3.17	3.42	2.43	3.58
17000 to 17999	3.08	2.83	3.07	3.03	3.63	4.12	5.28	3.49	3.53	3.19	3.24	2.48	3.42
18000 to 18999	2.98	2.94	3.38	3.00	3.65	4.71	5.28	3.20	3.53	3.32	3.24	2.53	3.48
19000 to 19999	2.85	2.76	2.86	2.97	3.36	4.78	4.35	3.35	3.02	3.11	3.06	2.59	3.25
20000 to 20999	3.43	3.66	3.51	3.07	4.14	5.70	4.51	4.01	3.36	4.05	3.34	3.41	3.85

Hornsea 4



Visibility (metres)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ALL OBS
21000 to 21999	2.41	3.00	2.90	2.79	3.26	4.58	3.47	2.88	2.71	2.58	2.91	3.45	3.08
22000 to 22999	2.64	2.80	2.63	2.89	2.87	4.28	2.68	2.73	2.68	2.93	2.59	2.98	2.89
23000 to 23999	2.50	2.71	2.31	2.88	3.07	4.34	2.57	3.18	2.17	2.74	1.97	3.40	2.82
24000 to 24999	2.39	2.45	2.55	2.79	3.20	4.17	3.06	2.87	2.18	2.26	1.94	3.20	2.76
25000 to 25999	2.46	2.71	2.85	2.96	3.34	4.07	3.16	3.52	2.99	3.09	2.49	3.44	3.09
26000 to 26999	1.99	2.22	2.20	2.31	2.54	3.22	2.05	2.33	2.10	2.51	1.65	2.68	2.32
27000 to 27999	1.55	2.36	1.93	2.13	2.45	2.71	2.14	2.83	2.20	2.62	1.86	2.63	2.28
28000 to 28999	1.84	2.22	1.89	2.03	2.10	2.16	2.30	2.39	2.13	2.45	1.64	2.13	2.11
29000 to 29999	1.73	2.03	1.42	1.95	2.02	1.94	1.83	2.46	2.20	1.96	1.66	2.32	1.96
30000 to 34999	6.78	8.19	7.46	9.09	8.84	7.02	8.48	10.44	10.41	11.43	7.58	8.98	8.73
35000 to 39999	4.19	4.98	4.90	6.25	4.80	2.58	4.66	6.16	6.66	7.38	6.04	5.70	5.36
40000 to 44999	2.97	3.54	2.73	3.86	2.60	1.45	3.20	3.96	3.97	3.23	4.85	3.44	3.31
45000 to 49999	1.48	2.08	1.32	2.08	1.25	0.94	1.54	2.03	1.81	0.62	2.19	2.10	1.62
50000 to 59999	1.88	2.14	1.55	1.32	0.69	0.44	0.74	1.66	0.97	0.11	1.23	1.48	1.18
60000 to 69999	0.51	0.64	0.30	0.21	0.07	0.00	0.07	0.34	0.04	0.03	0.10	0.39	0.22
>= 70000	0.12	0.24	0.08	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.03	0.07	0.05
ALL OBS	100												

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