



Hornsea Project Four: Additional Application Information

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F2.17: HVAC Booster Station Lighting Plan

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Glossary

Term	Definition
Design Envelope	A description of the range of possible elements that make up the Hornsea Project Four design options under consideration, as set out in detail in the project description. This envelope is used to define Hornsea Project Four for Environmental Impact Assessment (EIA) purposes when the exact engineering parameters are not yet known. This is also often referred to as the “Rochdale Envelope” approach.
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 Project Four offshore wind farm	The term covers all elements of the project (i.e. both the offshore and onshore). Hornsea Four infrastructure will include offshore generating stations (wind turbines), electrical export cables to landfall, and connection to the electricity transmission network. Hereafter referred to as Hornsea Four.
HVAC booster station(s)	Offshore HVAC booster station(s) are required in HVAC transmission systems only; they are not required in HVDC transmission systems. If required for Hornsea Four, they would be located entirely offshore.
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.
Orsted Hornsea Project Four Ltd.	The Applicant for the proposed Hornsea Project Four Offshore Wind Farm Development Consent Order (DCO).
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 within 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
CAA	Civil Aviation Authority
DCO	Development Consent Order
EBI	Electrical Balancing Infrastructure
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ERUA	East Riding Unitary Authority
ERYC	East Riding of Yorkshire Council
ES	Environmental Statement
FHHC	Flamborough Head Heritage Coast
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
LAT	Lowest Astronomical Tide
MCA	Marine and Coastguard Agency
MSL	Mean Sea Level
NSIP	Nationally Significant Infrastructure Project
OnSS	Onshore Substation
O&M	Operations and Maintenance
PEIR	Preliminary Environmental Information Report
SLVR	Seascape, Landscape and Visual Resources

Units

Unit	Definition
cd	Candela
km	Kilometre
m	Metres
NM	Nautical Mile

1 Introduction

1.1 Project Background

- 1.1.1.1 Orsted Hornsea Project Four Limited (hereafter the 'Applicant') is proposing to develop the Hornsea Project Four Offshore Wind Farm, (hereafter 'Hornsea Four') which will be located approximately 69 km from East Riding of Yorkshire in the Southern North Sea and will be the fourth project to be developed in the former Hornsea Zone (please see [Volume A1, Chapter 1: Introduction](#) for further details on the former Hornsea Zone). Hornsea Four will include both offshore and onshore infrastructure including an offshore generating station (wind farm), export cables to landfall, and connection to the electricity transmission network (please see [Volume A1, Chapter 4: Project Description](#) for full details on the Project Design).
- 1.1.1.2 The Hornsea Four Agreement for Lease (AfL) area was 846 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 has due consideration to the size and location (within the existing AfL area) of the final project that is being 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.
- 1.1.1.3 The combination of Hornsea Four's Proportionality in EIA and Developable Area process has resulted in a marked reduction in the array area taken forward at the point of DCO application. Hornsea Four adopted a major site reduction from the array area presented at Scoping (846 km²) to the Preliminary Environmental Information Report (PEIR) boundary (600 km²), with a further reduction adopted for the Environmental Statement (ES) and DCO application (468 km²) due to the results of the PEIR, technical considerations and stakeholder feedback. The evolution of the Hornsea Four Order Limits is detailed in [Volume A1, Chapter 3: Site Selection and Consideration of Alternatives](#) and [Volume A4, Annex 3.2: Selection and Refinement of the Offshore Infrastructure](#).
- 1.1.1.4 [Figure 1](#) illustrates the offshore location of Hornsea Four, including:
- Hornsea Four array area: This is where the offshore wind generating station will be located, which will include the turbines, array cables, offshore accommodation platform and a range of offshore substations as well as offshore interconnector cables and export cables;
 - Hornsea Four offshore export cable corridor (ECC): This is where the permanent offshore electrical infrastructure (offshore export cable(s), as well as the offshore High Voltage Alternating Current (HVAC) booster station(s) (if required), will be located; and
 - Hornsea Four intertidal area: This is the area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS) through which all of the offshore export cables will be installed.

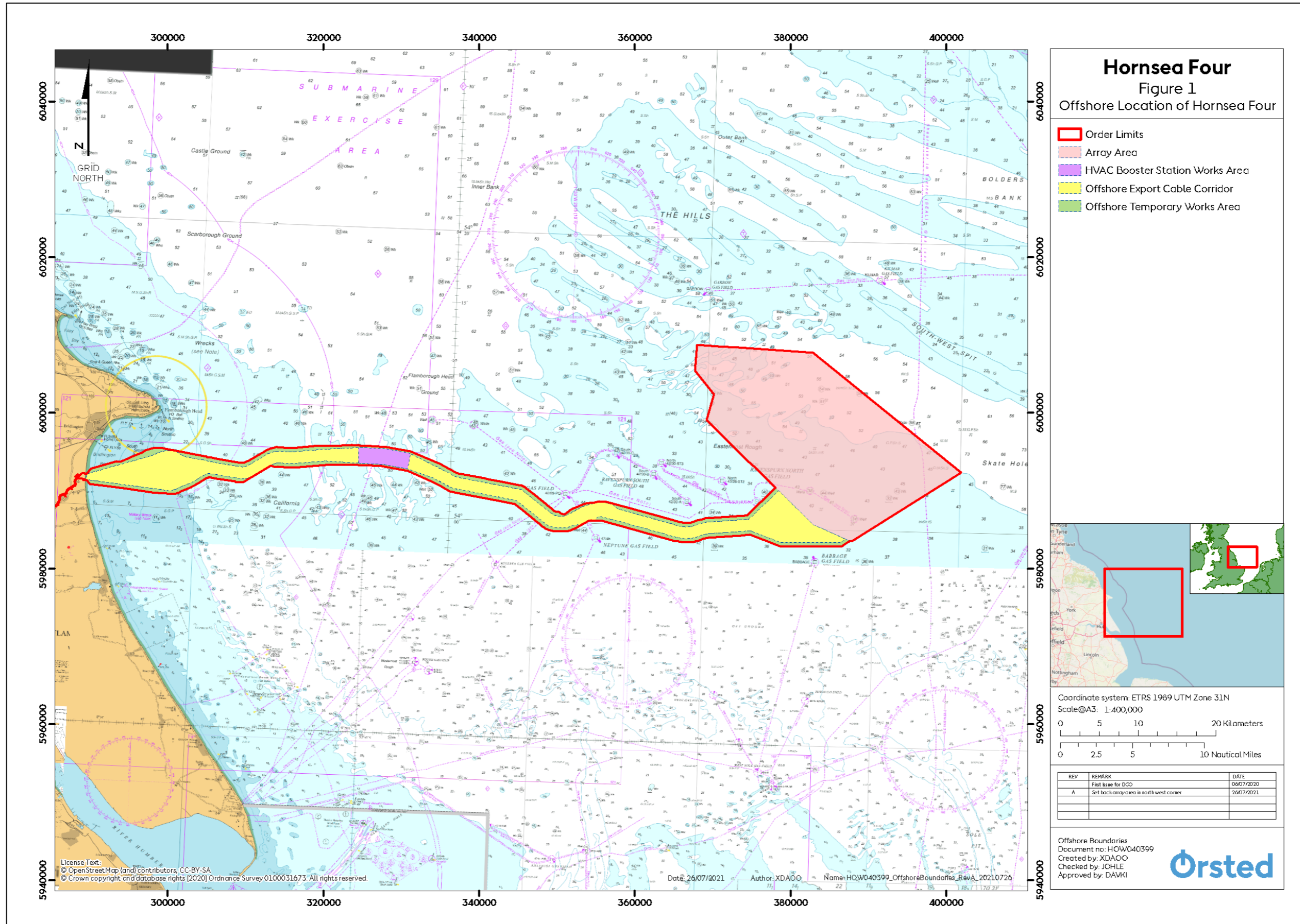
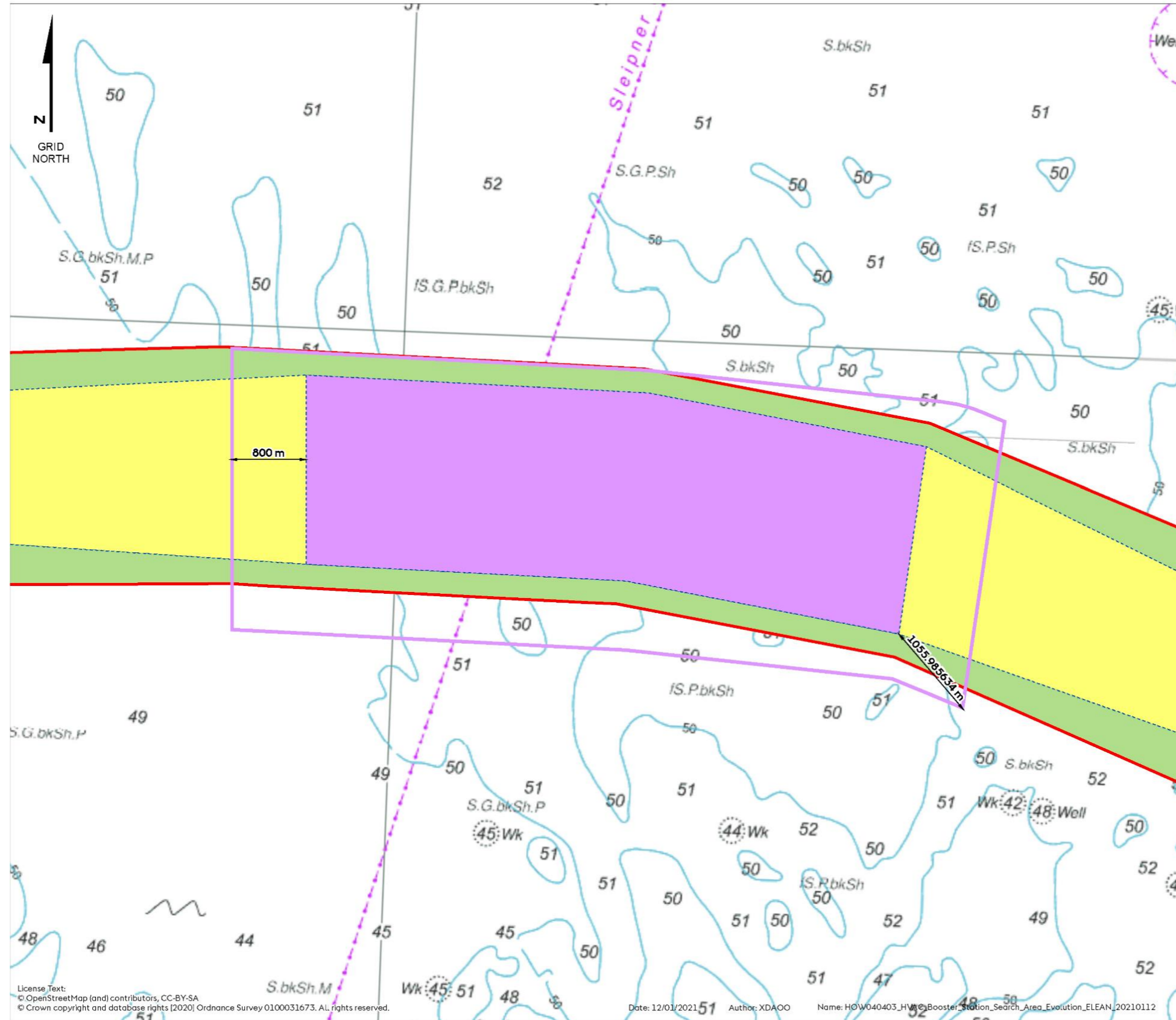


Figure 1: Offshore Location of Hornsea Four.

1.2 Consultation Background

- 1.2.1.1 The Hornsea Four Preliminary Environmental Information Report (PEIR) assessed the impact of Hornsea Four on the Seascape, Landscape and Visual Resources (SLVR) (Orsted, 2019). In their Section 42 response (see [Volume B1, Annex 1.4: Applicant Regard to Section 42 Consultation Responses](#)), Natural England indicated that *"the key issue for Natural England is the potential for HVAC offshore booster stations to adversely affect the seascape setting of the FHHC [Flamborough Head Heritage Coast] and therefore the special character of the coast in this location. ...Our knowledge of similar existing structures (offshore substations) suggests that they are frequently lit at night; both with yellow marine navigational lighting and white personnel access lighting. At night and within an otherwise completely dark seascape this light (as it is intended too) is visible for a considerable distance. Dark skies are a part of the special seascape character of the FHHC and NE is concerned that this aspect of the scheme has the potential to adversely affect this."*
- 1.2.1.2 The Applicant consulted with Natural England via written correspondence on 15/10/2019 to clarify aspects of the special characteristics of the FHHC. Natural England confirmed via written communication of 08/11/2019 that the *"ERUA [East Riding Unitary Authority] has policy responsibility for Flamborough Head Heritage Coast and should be contacted in order that those special characteristics which define the nature of the coast can be established."*
- 1.2.1.3 The Applicant therefore contacted East Riding of Yorkshire Council (ERYC) by email on 03/12/2019 to request further background information and descriptions of the special characteristics of the FHHC. The information provided by ERYC (by email dated 03/12/19) was derived from the Local Plan (supporting text to policies ENV2 and A2) and the following document sources referenced to *"highlight the features that make up the special character of the Heritage Coast"*:
- East Riding of Yorkshire Landscape Character Assessment (2018);
 - Flamborough Head Management Plan (2007); and
 - Flamborough Headland Heritage Coast Management Strategy (2002).
- 1.2.1.4 It is noted that none of the information provided contains any mention of darkness, dark skies, or dark skies out to sea as being special characteristics of the FHHC landscape or its setting.
- 1.2.1.5 Between the PEIR and Development Consent Order (DCO) application, the HVAC Booster Station Search Area was refined and is now situated approximately 0.8 km further from the coastline, as illustrated in [Figure 2](#). The Applicant also updated the lighting requirements of the HVAC Booster Station(s) in order to avoid the effects of night-time lighting on the special characteristics of the FHHC. The Applicant consulted with Natural England and ERYC on the refined lighting requirements (by written correspondence on 17/04/2020). Natural England confirmed their acceptance of the measures in a written response of 04/05/20 which stated: *"We accept that these measures will reduce the adverse effects of night-time lighting on the special characteristics of the FHHC to the extent that these affects so that these effects are no longer significant."* ERYC also confirmed their acceptance of the measures in an email response dated 27/04/2020 which stated: *"I am satisfied that with the inclusion of the*

mitigation measures that you have set out in Table 1 that the night-time effects of the HVAC Booster Station lighting on the FHC would not be significant and this topic is not required to be considered further in the Hornsea Four ES".



Hornsea Four

Figure 2

HVAC Booster Station Search Area Design Evolution from PEIR and DCO

- Order Limits
- HVAC Booster Station Search Area (DCO)
- HVAC Booster Station Search Area (PEIR)
- Offshore Export Cable Corridor
- Offshore Temporary Works Area

Coordinate system: ETRS 1989 UTM Zone 31N
 Scale@A3: 1:40,000

0 0.5 1 2 Kilometers
 0 0.25 0.5 1 Nautical Miles

REV	REMARK	DATE
1	First Issue for DCO	12/01/2021

HVAC Booster Station Search Area Design Evolution from PEIR and DCO
 Document no: HOW040403
 Created by: JOHLE
 Checked by: XDAO
 Approved by: ELEAN

License Text: © OpenStreetMap (and) contributors, CC-BY-SA © Crown copyright and database rights [2020] Ordnance Survey 0100031673. All rights reserved.
 Date: 12/01/2021 Author: XDAO Name: HOW040403_HVAC_Booster_Station_Search_Area_Evolution_ELEAN_20210112

Figure 2: HVAC Booster Station Search Area – Design Evolution from PEIR and DCO.

1.3 Purpose

- 1.3.1.1 The purpose of this HVAC Booster Station Lighting Plan is to present and secure the lighting requirements as consulted and agreed with Natural England and ERYC to ensure the night-time effects of the HVAC Booster Station lighting on the setting of the FHHC will be not significantly adverse
- 1.3.1.2 These lighting requirements are also secured through project commitment Co200 ([Volume A4, Annex 5.2: Commitments Register](#)), which states: "Lighting at the HVAC Booster Station(s) will accord with the design set out in the HVAC Booster Station Lighting Plan to ensure that the night-time effects of the HVAC Booster Station lighting on the special characteristics of the Flamborough Head Heritage Coast will be not significant".
- 1.3.1.3 The HVAC Booster Station Lighting Plan is included within Condition 22 (Schedule 12) of the Transmission Assets deemed Marine Licence of the draft Development Consent Order (DCO) ([Volume C1, Chapter 1: Draft DCO including Draft DML](#)).
- 1.3.1.4 It is noted that the Hornsea Four design envelope currently includes both HVAC and High Voltage Direct Current (HVDC) transmission technologies to allow a necessary degree of flexibility. Hornsea Four may use HVAC or HVDC transmission or could use a combination of both technologies in separate electrical systems. If HVDC technologies are chosen, there will be no Offshore HVAC Booster Station(s) present within the offshore ECC. Therefore, if HVAC technologies are not taken forward, the lighting requirements associated with the HVAC Booster Station(s) herein will no longer be relevant.

2 HVAC Booster Station Lighting Design

2.1.1.1 **Table 1** below presents the lighting requirements for the HVAC Booster Station(s).

Table 1: Lighting requirements for HVAC Booster Station(s).

Lighting Considered	Requirement
<p>Civil Aviation Authority (CAA) aviation lighting in accordance with Article 222 of CAP 393: The Air Navigation Order 2016 and Regulations (CAA, 2019).</p>	<p>Medium intensity (2000 cd) steady red lights will not be installed on the uppermost location of the HVAC Booster Station(s).</p> <p>Article 222 of CAP 393 states that this lighting is only required for en-route obstacles 150 m or more above Mean Sea Level (MSL).</p> <p>Consultation with the CAA (telephone conversation dated 24/01/2020 and email dated 17/02/2020) confirmed that Article 222 of CAP 393 covers offshore substations. Whilst large structures like substations do not require this lighting, the CAA highlighted (in the same correspondence) that depending on their height, ancillary structures such as meteorological masts without this lighting may pose an aviation hazard. The CAA advised discussion of this matter with Orsted’s helicopter specialists internally. Orsted’s internal helicopter specialists undertook a detailed review of the technical design and confirmed that an aviation warning light on meteorological masts would not be required. Note, the maximum height of the offshore surface HVAC booster station(s) and its associated structures will be a maximum of 100 m above Lowest Astronomical Tide (LAT).</p>
<p>CAA aviation lighting in accordance with CAP 437: Standards for offshore helicopter landing areas (CAA, 2016).</p>	<p>Perimeter lighting (omni directional green) will be included. This lighting is on all the time, of an intensity to be visible and useable at night from a minimum range of 0.75 NM (1.4 km).</p> <p>Perimeter lighting, spaced at intervals of not more than 3 m, is a minimum of 30cd green lights which are visible down to 0 degrees but not below the level of the helideck.</p> <p>This lighting will be visible from on or above the periphery of the landing area. It will not be visible from below the landing area and will not be visible from the coast.</p> <p>Helideck status light system: maximum 1000 candela red flashing light (or lights) visible to the pilot from any direction of approach and on any post-landing heading from a range of c. 2 km.</p> <p>This lighting will not be included as night-time flying will be infrequent and there is no requirement for helicopter landings in poor visibility conditions for Operations and Maintenance (O&M) activities.</p>

Lighting Considered	Requirement
	<p>Lit touchdown/positioning circle, lit heliport identification 'H' marking will be installed.</p> <p>This lighting will only be on infrequently during night-time use of the helipad only. Heliport identification 'H' marking to be visible and usable at night from a range of 0.25 NM (0.5 km), which is not visible from the coast.</p> <p>Ancillary floodlighting will be installed, as a source of illumination for on-deck operations such as refuelling and passenger handling. It is not visible from the coast.</p> <p>This lighting will be on infrequently during night-time use of the helipad only.</p> <p>Obstacle lighting: steady red 200 candela obstacle lights will be fixed to the tallest structure around the helipad i.e. less than 100 m above LAT.</p> <p>Secondary floodlighting, to illuminate such elements as the installation name and other safety signage, will not be installed.</p>
<p>Marine Navigation Lighting to conform to Maritime and Coastguard Agency (MCA) requirements</p>	<p>Navigational lighting will be installed in accordance with MCA requirements. The navigational lighting will likely be positioned on each of the four corners of the lower deck(s) or collision zone.</p> <p>This lighting will be installed to be visible within a nominal range of 3-5 NM (5.6-9.3 km) so it will not be visible from coast.</p>
<p>Walkway/stairway/task lighting located around the periphery of each deck</p>	<p>Walkway/stairway/task lighting is required. This has low levels of lighting intensity, which will be triggered in hours of darkness by movement of personnel.</p> <p>This lighting is on infrequently and not visible from coast.</p>
<p>Signage illumination</p>	<p>Signage illumination is required. This has low levels of lighting intensity.</p> <p>This lighting is not visible from coast.</p>

2.1.1.2 As illustrated in [Table 1](#), the brightest light on each HVAC Booster Station(s) would be a red 200 candela obstacle light on the tallest structure, a maximum height of 100 m above LAT, in accordance with CAP 437 Standards for offshore helicopter landing areas. These lights would be on at night and including the hours defined as Civil Twilight, which occurs approximately 30 mins before sunrise and after sunset. The brightest light of 200 candela represents a significant reduction from the 2000 candela light proposed at PEIR.

3 References

CAA (2016). Standards for offshore helicopter landing areas, CAP 437. Edition 8, Amendment 01/2018 dated September 2018. Available at:

[http://publicapps.caa.co.uk/docs/33/CAP437\(SEP2018\)E8_A1.pdf](http://publicapps.caa.co.uk/docs/33/CAP437(SEP2018)E8_A1.pdf) (accessed: June 2020).

CAA (2019). The Air Navigation Order 2016 and Regulations, CAP 393. Available at:

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Orsted (2019). Hornsea Project Four: Preliminary Environmental Information Report (PEIR) Volume 2, Chapter 11: Seascape, Landscape and Visual Resources. Available at:

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