



# Hornsea Project Four: Preliminary Environmental Information Report (PEIR)

## Volume 2, Chapter 9: Aviation and Radar

**Prepared** Osprey Consulting Services Ltd, 05 July 2019  
**Checked** GoBe Consultants Ltd, 05 July 2019  
**Accepted** David King, Ørsted, 31 July 2019  
**Approved** Julian Carolan, Ørsted, 01 August 2019

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## Table of Contents

9.1	Introduction .....	7
9.2	Purpose .....	7
9.3	Planning and Policy Context .....	7
9.4	Consultation .....	10
9.5	Study area .....	11
9.6	Methodology to inform baseline .....	14
9.7	Baseline environment .....	15
9.8	Project basis for assessment .....	18
9.9	Maximum Design Scenario .....	20
9.10	Assessment methodology .....	24
9.11	Impact assessment .....	25
9.12	Cumulative effect assessment (CEA) .....	37
9.13	Transboundary effects .....	44
9.14	Inter-related effects .....	45
9.15	Conclusion and summary .....	47
9.16	References .....	49

## List of Tables

Table 9.1: Summary of NPS EN-1 provisions relevant to Aviation and Radar .....	8
Table 9.2: Summary of NPS EN-1 policy on decision making relevant to Aviation and Radar. ....	8
Table 9.3: Consultation Responses. ....	10
Table 9.4: Key Sources of aviation and radar data. ....	14
Table 9.5: Aviation receptors and stakeholders identified from the baseline study. ....	18
Table 9.6: Impacts scoped out of assessment and justification .....	19
Table 9.7: Relevant aviation and radar commitments .....	20
Table 9.8: Maximum design scenario for impacts on aviation and radar .....	22
Table 9.9: Definition of terms relating to receptor sensitivity. ....	24
Table 9.10: Definition of terms relating to magnitude of an impact. ....	24
Table 9.11: Matrix used for the assessment of the significance of the effect. ....	25
Table 9.12: Description of tiers of other developments considered for CEA (adapted from PINS Advice Note 17). ....	38
Table 9.13: Projects screened into the aviation and radar cumulative assessment. ....	39
Table 9.14: Cumulative MDS table .....	41
Table 9.15: Inter-related effects assessment for aviation and radar. ....	45
Table 9.16: Summary of potential impacts assessed for aviation and radar. ....	48

## List of Figures

Figure 9.1: Aviation and radar study area (not to scale). ..... 13  
Figure 9.2: Oil and Gas Platforms in the location of the study area (not to scale). Extract Reproduced from CAA digital map data © Crown copyright 2019 UK IAIP ENR..... 32

## Annexes

Annex	Heading
9.1	Aviation and Radar Technical Report

## Glossary

Term	Definition
Commitment	A term used interchangeably with mitigation. Commitments are embedded mitigation measures. Commitments are either primary (design) or tertiary (Inherent) and embedded within the assessment at the relevant point in the Environmental Impact Assessment (EIA) (e.g. at Scoping or Preliminary Environmental Information Report (PEIR)). The purpose of Commitments are to reduce and/or eliminate Likely Significant Effects (LSEs), in EIA terms.
Controlled Airspace (CAS)	Airspace in which Air Traffic Control exercises authority. In the UK, Class A, C, D and E airspace is controlled.
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.
Design Envelope	A description of the range of possible elements that make up the Hornsea Four design options under consideration, as set out in detail in the project description. This envelope is used to define Hornsea 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.
Flight Level	A standard nominal altitude of an aircraft, in hundreds of feet, based upon a standardized air pressure at sea-level.
Helicopter Main Route (HMR)	Routes which are established to facilitate safe helicopter flights in Instrument Flight Rules (IFR) conditions (i.e. when flight cannot be completed in visual conditions).
Hornsea Four	The proposed Hornsea Project Four offshore wind farm project; the term covers all elements within the Development Consent Order (i.e. both the offshore and onshore components).
Instrument Flight Rules (IFR)	The rules governing procedures for flights conducted with the crew making reference to aircraft cockpit instruments for situation awareness and navigation.
Instrument Meteorological Conditions (IMC)	Weather conditions which would preclude flight by the Visual Flight Rules, i.e. conditions where the aircraft is in or close to cloud or flying in visibility less than a specified minimum.

Term	Definition
Minimum Sector Altitude (MSA)	Under aviation flight rules, the altitude below which it is unsafe to fly in IMC owing to presence of terrain or obstacles within a specified area.
Mitigation	A term used interchangeably with Commitment(s) by Hornsea Four. Mitigation measures (Commitments) are embedded within the assessment at the relevant point in the EIA (e.g. at Scoping or PEIR).
Uncontrolled Airspace	Airspace in which Air Traffic Control does not exercise any executive authority, but may provide basic information services to aircraft in radio contact. In the UK, Class G airspace is uncontrolled.
Visual Flight Rules (VFR)	The rules governing flight conducted visually i.e. with the crew maintaining separation from obstacles, terrain and other aircraft visually.
Visual Metrological Conditions (VMC)	A flight category which allows flight to be conducted under Visual Flight Rules (VFR) defined by in flight visibility and clearance from cloud.

## Acronyms

Acronym	Definition
ACC	Area Control Centre
ADR	Air Defence Radar
agl	above ground level
amsl	Above mean sea level
ANO	The Air Navigation Order (ANO)2016 and Regulations
ASACS	Air Surveillance and Control System
ATC	Air Traffic Control
ATS	Air Traffic Service
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CAT	Commercial Air Traffic
CNS	Communications, Navigation or Surveillance
DCO	Development Consent Order
DGC	Defence Geographic Centre
dML	Deemed Marine Licence
ECC	Export Cable Corridor
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIA Report	Environmental Impact Assessment Report (note that the new EIA Directive refers to an EIA Report and not an Environmental Statement)
ERCoP	Emergency Response Co-operation Plan
FIR	Flight Information Region
FL	Flight Level
ft	Feet
GAAC	General Aviation Awareness Council

Acronym	Definition
HMR	Helicopter Main Route
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
IPC	Infrastructure Planning Commission
LAT	Lowest Astronomical Tide
LOS	Line of Sight
m	Metre
MCA	Maritime Coastguard Agency
MDS	Maximum Design Scenario
MOD	Ministry of Defence
MSA	Minimum Safe Altitude
NERL	NATS En Route Limited
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OGA	Oil and Gas Authority
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PINS	Planning Inspectorate
PSR	Primary Surveillance Radar
RAP	Recognised Air Picture
SAR	Search And Rescue
UKCS	UK Continental Shelf
UKIAIP	United Kingdom Integrated Aeronautical Information Publication
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
WTG	Wind Turbine Generator

## Units

Unit	Definition
ft	feet
m	metre
km	kilometre
nm	Nautical mile

## 9.1 Introduction

- 9.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the results of the Environmental Impact Assessment (EIA) for the potential impacts of the Hornsea Project Four offshore wind farm (hereafter Hornsea Four) on aviation and radar. Specifically, this chapter considers the potential impact of Hornsea Four during its construction, operation and maintenance, and decommissioning phases.
- 9.1.1.2 Ørsted Hornsea Project Four Limited (the Applicant) is proposing to develop Hornsea Four. Hornsea Four will be located approximately 65 kilometres (km) from the 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 1, Chapter 1: Introduction](#) for further details on the 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 1, Chapter 4: Project Description](#) for full details on the Project Design).
- 9.1.1.3 This chapter summarises information contained within a technical report, which is included at [Volume 5, Annex 9.1: Aviation and Radar Technical Report](#).

## 9.2 Purpose

- 9.2.1.1 The primary purpose of the Environmental Statement is to support the Development Consent Order (DCO) application for Hornsea Four under the Planning Act 2008 (the 2008 Act). This PEIR constitutes the Preliminary Environmental Information for Hornsea Four and sets out the findings of the EIA to date to support pre-application consultation activities required under the 2008 Act. The EIA will be finalised following completion of pre-application consultation and the Final Environmental Statement will accompany the application to the Planning Inspectorate (PINS) for Development Consent.
- 9.2.1.2 This PEIR chapter:
- Presents the existing environmental baseline established from desk studies, and consultation;
  - Presents the potential effects on aviation and radar arising from Hornsea Four, based on the information gathered and the analysis and assessments undertaken to date;
  - Identifies any assumptions and limitations encountered in compiling the environmental information; and
  - Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible effects identified in the EIA process.

## 9.3 Planning and Policy Context

- 9.3.1.1 Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to aviation and radar, is contained in the Overarching NPS for Energy (EN-1, DECC, 2011a).

9.3.1.2 NPS EN-1 includes guidance on what matters are to be considered in the assessment. These are summarised in [Table 9.1](#) below.

**Table 9.1: Summary of NPS EN-1 provisions relevant to Aviation and Radar.**

Summary of NPS EN-1 provisions	How and where considered in the PEIR
Civil and Military Aviation	
<i>"If the proposed development could have an effect on civil and military aviation (and/or other defence assets) an assessment of potential effects should be set out in the Environmental Statement (ES)" (Paragraph 5.4.10 of EN-1).</i>	Construction, operation and decommissioning phases of Hornsea Four have been assessed within the impact assessment at <a href="#">Section 9.11</a> .
<i>"Consultation with the Ministry of Defence (MOD), the Civil Aviation Authority (CAA) and NATS and any aerodrome - licensed or otherwise – likely to be affected by the proposed development should be completed" (Paragraph 5.4.11 of NPS EN-1).</i>	<a href="#">Section 9.4</a> which provides the results of consultation activity.
<i>"Any assessment of aviation or other defence interests should include potential impacts of the project upon the operation of Communication, Navigation or Surveillance (CNS) infrastructure, flight patterns (both civil and military), other defence assets and aerodrome operational procedures. It should also assess the cumulative effects of the project with other relevant projects in relation to aviation and defence" (Paragraph 5.4.12 of NPS EN-1).</i>	The assessment of civil and military aviation flight patterns and infrastructure is provided in <a href="#">Section 9.11</a> and cumulative impacts within <a href="#">Section 9.12</a> .

9.3.1.3 NPS EN-1 highlights several factors relating to the determination of an application and in relation to mitigation. These are summarised in [Table 9.4](#) below.

**Table 9.2: Summary of NPS EN-1 policy on decision making relevant to Aviation and Radar.**

Summary of NPS EN-1 decisions	How and where considered in the PEIR
Civil and Military Aviation	
<i>"The Infrastructure Planning Commission (IPC) should be satisfied that the effects on civil and military aerodromes, aviation technical sites and other defence assets have been addressed by the applicant and that any necessary assessment of the proposal on aviation or defence interests has been carried out. In particular, it should be satisfied that the proposal has been designed to minimise adverse impacts on the operation and safety of aerodromes and that reasonable mitigation is carried out. It may also be appropriate to expect operators of the aerodrome to consider making reasonable changes to operational procedures. When assessing the necessity, acceptability and reasonableness of operational changes to aerodromes, the IPC should satisfy itself that it has the necessary information regarding the operational procedures along with any demonstrable risks or harm of such changes, taking into account the cases put forward by all parties. When making such a</i>	Civil and military aviation and technical sites have been considered within <a href="#">Section 9.4</a> consultation and <a href="#">Section 9.11</a> within the assessment of impacts.

Summary of NPS EN-1 decisions	How and where considered in the PEIR
<p><i>judgement in the case of military aerodromes, the IPC should have regard to interests of defence and national security” (Paragraph 5.4.14 of EN-1).</i></p>	
<p><i>“The decision maker should expect that if there are conflicts between the Government’s energy and transport policies and military interests in relation to the application, then relevant parties have made appropriate efforts to work together to identify realistic and pragmatic solutions to the conflicts and in doing so that the parties have sought to protect the aims and interests of the other parties as far as possible” (Paragraph 5.4.15 of EN-1).</i></p>	<p>Mitigation solutions have been provided with paragraphs <a href="#">9.11.2.16</a> and <a href="#">9.11.2.19</a>.</p>
<p><i>“There are statutory requirements concerning lighting to tall structures where lighting is requested on structures that go beyond statutory requirements by any of the relevant aviation and defence consultees, the decision maker should satisfy itself of the necessity of such lighting taking into account the case put forward by the consultees. The effect of such lighting on the landscape and ecology may be a relevant consideration” (Paragraph 5.4.16 of EN-1).</i></p>	<p>Aviation lighting specifications are provided in <a href="#">Section 9.8.3</a> and will satisfy the requirements of Article 223 of Civil Aviation Publication (CAP) 393.</p>
<p><i>“Where after reasonable mitigation, operational changes, obligations and requirements have been proposed, the decision maker considers that:</i></p> <ul style="list-style-type: none"> <li>• A development would prevent a licensed aerodrome from maintaining its licence;</li> <li>• The benefits of the proposed development are outweighed by the harm to aerodromes serving business, training or emergency service needs, taking into account the relevant importance and needs for such aviation infrastructure; or The development would significantly impede or compromise the safe and effective use of defence assets or significantly limit military training; and The development would have an impact on the safe and efficient provision of en route Air Traffic Control (ATC) services for civil aviation, in particular through an adverse effect on the infrastructure required to support CNS systems then <i>consent should not be granted”</i></li> </ul> <p><i>(Paragraph 5.4.17 of EN-1).</i></p>	<p>Construction, operation and decommissioning phase of Hornsea Four have been considered in <a href="#">Section 9.11</a>.</p>
<p><i>“Where a proposed energy infrastructure development would significantly impede or compromise the safe and effective use of civil or military aviation or defence assets and or significantly limit military training, the IPC may consider the use of ‘Grampian’, or other forms of condition which relate to the use of future technological solutions, to mitigate impacts. Where technological solutions have not yet been developed or proven, the IPC will need to consider the likelihood of a solution becoming available within the time limit for implementation of the development consent. In this context, where new technologies to mitigate the adverse effects of wind farms on radar are concerned, the IPC should have regard to any Government guidance which emerges from the joint Government/Industry Aviation Plan” (Paragraph 5.4.18 of EN-1).</i></p>	<p>Mitigation solutions have been provided with <a href="#">paragraphs 9.11.2.15</a> and <a href="#">9.11.2.18</a>.</p>
<p><i>“Mitigation for effects on radar, communications and navigational systems may include reducing the scale of a project, although in some cases it is likely</i></p>	<p>Mitigation of the MDS is provided in <a href="#">Section 9.11</a>.</p>

Summary of NPS EN-1 decisions	How and where considered in the PEIR
<p><i>to be unreasonable for the IPC to require mitigation by way of a reduction in the scale of development, for example, where reducing the tip height of wind turbines in a wind farm would result in a material reduction in electricity generating capacity or operation would be severely constrained. However, there may be exceptional circumstances where a small reduction in such function will result in proportionately greater mitigation. In these cases, the IPC may consider that the benefits of the mitigation outweighs the marginal loss of function” (Paragraph 5.4.21 of EN-1).</i></p>	

## 9.4 Consultation

9.4.1.1 Consultation is a key part of the DCO application process. Consultation regarding aviation and radar has been conducted through the EIA scoping process (Hornsea Four, 2018). An overview of the project consultation process are presented within **Volume 1, Chapter 6: Consultation**.

9.4.1.2 A summary of the key issues raised during consultation specific to aviation and radar is outlined below in **Table 9.3**, together with how these issues raised have been considered in the production of this PEIR. Details of consultation undertaken with oil and gas operators to date is presented in **Section 12.4 of Chapter 12: infrastructure and Other Users**.

**Table 9.3: Consultation Responses.**

Consultee	Date, Document, Forum	Comment	Where addressed in the PEIR
PINS	26 November 2018 Scoping Opinion	As there is no pathway of effect on civil and military radar systems during construction as the turbines will not be rotating, The Planning Inspectorate agrees that this matter can be scoped out of the ES.	Impacts scoped out of this assessment are detailed in <b>Section 9.8.2</b> .
PINS	26 November 2018 Scoping Opinion	The Planning Inspectorate highlights the MOD recommendation that the assessment should consider the Royal Air Force (RAF) Staxton Wold Air Defence Radar (ADR) as a relevant receptor for the assessment of effects on radar systems during operation, in addition to the RAF Brizlee Wood and RAF Trimmingham ADRs.	Impacts on military radar systems are considered in <b>Section 9.11</b> .
Defence Infrastructure Organisation (DIO)	13 November 2018 Response to Scoping Report	On behalf of the MOD, DIO stated that subject to confirmation of the specification of aviation lighting to be used; the obstruction effect to military low flying activities created by Hornsea Four would be appropriately addressed. The onshore cable route as provided at Scoping does not affect MOD statutory	Noted.

Consultee	Date, Document, Forum	Comment	Where addressed in the PEIR
		safeguarded zones however; any amendment should consider the technical safeguarding zone surrounding the MOD Leconfield radio transmitter and receiver installations.	
NATS	31 October 2018 Response to Scoping Opinion.	NATS (formally National Air Traffic Services) stated that they have been unable to assess effects fully; however, NATS indicated that Hornsea Four would conflict with NATS safeguarding criteria and they would object to the proposal.	Impact to NATS radar systems are considered in <a href="#">Section 9.11.2.9</a> . Mitigation is discussed in <a href="#">Sections 9.11.2.15 to 9.11.2.17</a> .
	5 April 2019 Telephone	NATS stated that subject to feedback from NATS engineers, the NATS preferred mitigation solution for the impact Hornsea Four would create to NATS radar systems is likely to be blanking of the affected radar systems, together with a proposal to change airspace <sup>1</sup> above the array area.	
	11 June 2019 Email	Confirmation from NATS was provided that the preferred mitigation solution would be that outlined by telephone on the 5 April 2019; however, this would only be applied to the Claxby Primary Surveillance Radar (PSR).	

## 9.5 Study area

9.5.1.1 The aviation and radar study area is shown in [Figure 9.1](#). This includes the Hornsea Four array area, offshore Export Cable Corridor (ECC), HVAC booster stations, the onshore ECC, and the airspace between the Hornsea Four array area, the UK mainland from Norwich Airport to the south and RAF Brizlee Wood to the north. The Hornsea Four aviation and radar study area for undertaking the assessment of cumulative effects is the same, except for the assessment of radar cumulative effects which includes other offshore wind farms in the southern North Sea that could have potential cumulative effects on identified radar receptors. Specifically, the Hornsea Four aviation and radar study area covers:

- Aviation radar systems that potentially detect 370 metre (m) high (blade tip) wind turbines within the array area;
- Offshore helicopter operations including Helicopter Main Routes (HMRs) that are located within the proximity of the study area;
- Offshore oil and gas platform helideck destinations that are located within a nine nautical mile (nm) 'consultation buffer' that surrounds the Hornsea Four array area;
- Airborne Search and Rescue (SAR) flight operations;

<sup>1</sup> The airspace change process ensures that when the CAA decides whether or not to approve a proposal to change UK airspace, it does so in an impartial and evidence-based way that takes proper account of the needs and interests of all affected in which all options will be considered within the application.

- Military low flying areas and Practice and Exercise Areas (PEXA) that intersect or are adjacent to the Hornsea Four study area; and
- Aviation activities and aviation safeguarded areas that are adjacent to the onshore ECC.

9.5.1.2 As all offshore electrical cables associated with Hornsea Four will be below sea level, they will not have an impact on aviation interests and therefore are not assessed in this chapter. Up to three HVAC booster stations with a maximum height of 90 m LAT may be positioned within the HVAC booster station search area within the offshore ECC (see [Figure 9.1](#)). HMR 9 and HMR 10 cross the route of the offshore ECC (see [Figure 9.2](#)) however, the routes of the HMRs are at a sufficient distance not to be impacted by the Wind Turbine Generators (WTGs). The location of the HVAC booster stations will be reported to the Defence Geographic Centre (DGC) as part of notification procedures provided in [Section 9.14.2](#). Offshore infrastructure associated with Hornsea Four including accommodation platforms and substations do not pose any issue to radar systems as radar processing techniques remove stationary objects from the radar display.

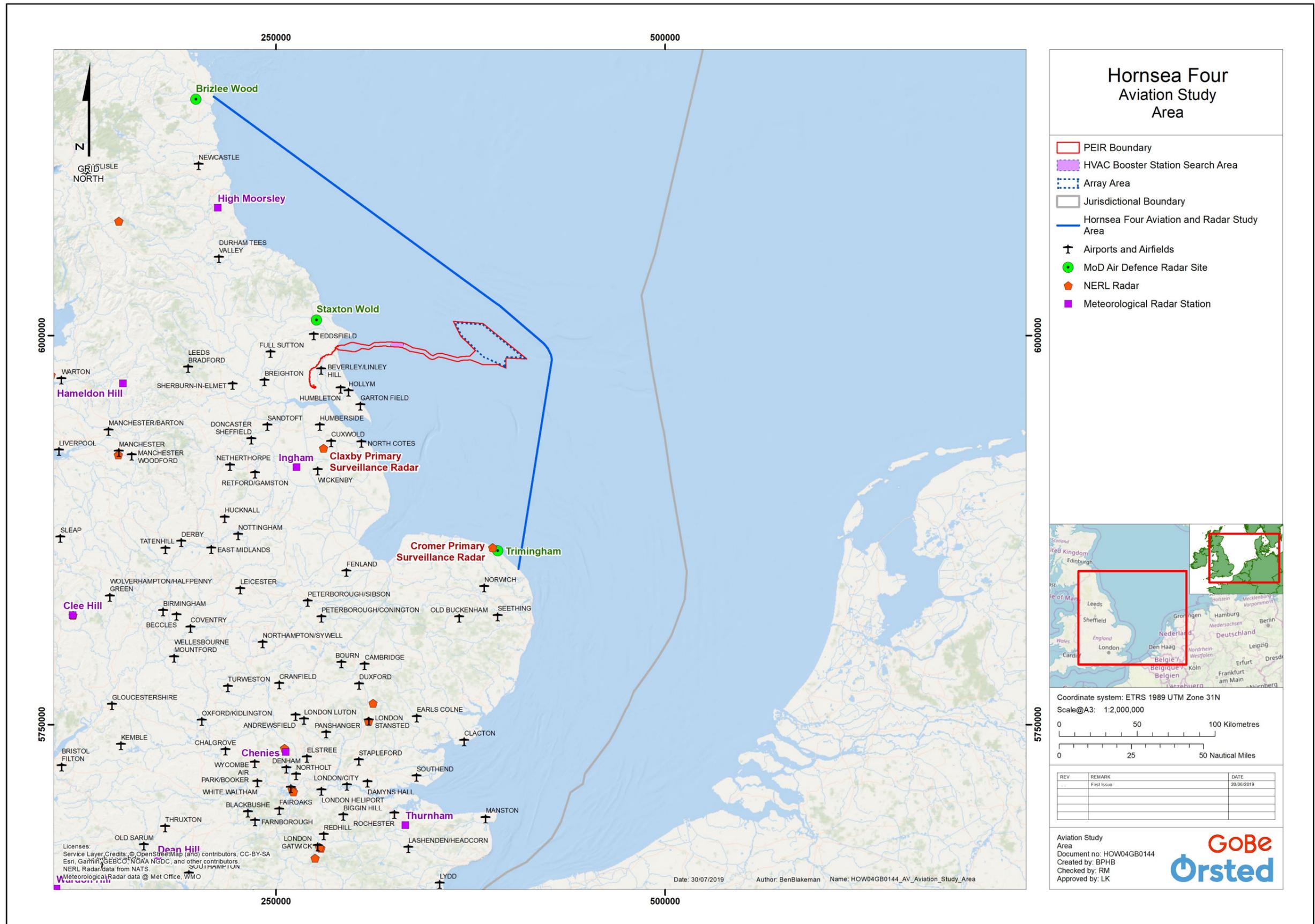


Figure 9.1: Aviation and radar study area (not to scale).

## 9.6 Methodology to inform baseline

### 9.6.1 Desktop Study

9.6.1.1 A desk study was undertaken to obtain information on aviation and radar receptors. A variety of aviation publications contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders. The following documents informed the desk-top study as listed in [Table 9.4](#).

**Table 9.4: Key Sources of aviation and radar data.**

Source	Summary	Coverage of Hornsea Four aviation and radar study area
CAA CAP 168: Licensing of Aerodromes.	Sets out the standards required at UK licensed aerodromes relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids.	Onshore ECC.
CAA CAP 393: The Air Navigation Order (ANO) 2016 and Regulations.	Sets out the provisions of the ANO as amended together with regulations made under the Order. It is prepared for those concerned with day to day matters relating to air navigation that require an up to date version of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. CAP 393 also includes application of aviation obstruction lighting to wind turbines in UK territorial waters.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 437: Standards for Offshore Helicopter Landing Areas.	Guidance on Standards provides the criteria applied by the CAA in assessing helicopter landing areas for worldwide use by helicopters registered in the UK. It includes design of winching area arrangements located on wind turbine platforms to represent current best practice.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 764 Policy and Guidelines on Wind Turbines.	Provides assistance to aviation stakeholders to help understand and address wind energy related issues thereby ensuring greater consistency in the consideration of the potential impact of proposed wind farm developments.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 670: Air Traffic Services Safety Requirements.	Sets out the safety regulatory framework and requirements associated with the provision of an Air Traffic Service (ATS).	Full coverage of the Hornsea Four aviation and radar study area.
CAP1616: Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements	Sets out the regulatory framework for the conduct of an Airspace Change Project.	Full coverage of the Hornsea Four aviation and radar study area.

Source	Summary	Coverage of Hornsea Four aviation and radar study area
CAA Visual Flight Rules Charts.	Topographical air chart providing information on aerodrome, airspace and areas of air traffic control responsibilities.	Full coverage of the Hornsea Four aviation and radar study area.
MOD Military Aeronautical Information Publication (Mil AIP).	The main resource for information and flight procedures at all military aerodromes as well as airspace, en-route procedures, charts and other air navigation information.	Full coverage of the Hornsea Four aviation and radar study area.
CAA CAP 032: UK Integrated Aeronautical Information Package (UKIAIP).	The main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information.	Full coverage of the Hornsea Four aviation and radar study area.
Maritime and Coastguard Agency (MCA) MGN 543 Safety of Navigation Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response.	Contains information for operators and developers in formulating their emergency response plans and site safety management.	Full coverage of the Hornsea Four aviation and radar study area.

9.6.1.2 No technical limitations or difficulties were encountered in compiling the information required for the completion of the aviation and radar baseline study. However, there is no radar currently installed at the MOD site Staxton Wold. As a result, the MOD have been unable to identify radar specifications against which this site should be baselined.

## 9.7 Baseline environment

### 9.7.1 Airspace designations

9.7.1.1 Hornsea Four will be situated in an area of Class G uncontrolled airspace, which is established from the surface up to Flight Level (FL) 195 (approximately 19,500 feet (ft)). Class C Controlled Airspace (CAS) is established above FL 195. Under these classifications of airspace, the following applies:

- Class G uncontrolled airspace; any aircraft can operate in this area of uncontrolled airspace without any mandatory requirement to be in communication with ATC. Pilots of aircraft operating under Visual Flight Rules<sup>2</sup> (VFR) in Class G airspace are ultimately responsible for seeing and avoiding other aircraft and obstructions; and
- Class C controlled airspace; all aircraft operating in this airspace must be in receipt of an ATS.

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<sup>2</sup> A set of regulations under which a pilot operates an aircraft in weather conditions clear enough to allow the pilot to see where the aircraft is going; the pilot must be able to operate the aircraft with visual reference to the ground, and by visually avoiding obstructions and other flying machines.

9.7.1.2 Above and surrounding the Hornsea Four array area, the Class G uncontrolled airspace below FL 195 is subdivided into areas with the following aviation stakeholder responsibility:

- Anglia Radar, based at Aberdeen Airport and employing NATS PSR systems, has its area of responsibility established for the provision of ATC services to Commercial Air Traffic (CAT) helicopter operations that support the offshore Oil & Gas Industry and other aircraft, from the surface up to FL 65 (approximately 6,500 ft);
- Military En-Route Area Control, military air traffic controllers located at the Swanwick Area Control Centre (ACC) utilise NATS radar for the provision of ATS to aircraft flying outside of CAS above FL 100 within radar and radio coverage; and
- MOD Air Surveillance and Control System (ASACS), uses its ADR resources in support of operational flights in the protection of UK airspace and for training exercises.

9.7.1.3 In aviation and airspace terms, the world is divided into Flight Information Regions (FIRs) for the responsibility of the provision of ATS to aircraft. Above FL 195 NATS En-route Limited (NERL) (which is a subsidiary of NATS) are the main ATS provider utilising several long-range PSR and Secondary Surveillance Radar (SSR) systems positioned to provide maximum coverage of UK airspace. Additionally, NATS has a licence obligation to provide radar data to other remote aviation stakeholders to a high quality and performance standard for the benefit of UK aviation. Any effect that Hornsea Four might have on NERL radar systems must be considered both in terms of effect on the civilian en-route services and in the context of its remote users such as Anglia Radar and the MOD.

## **9.7.2 Military Low Flying Operations**

9.7.2.1 The UK Low Flying System (UKLFS) used for Military Low Flying activity covers the open airspace over the entire UK land mass and surrounding sea areas generally out to 2 nm from the coastline, from the surface to 2,000 ft. agl (above ground level) or amsl (above mean sea level).

## **9.7.3 Military Practice and Exercise Areas (PEXA)**

9.7.3.1 Military PEXAs are areas available for training use primarily by the UK armed forces but also those of overseas nations. They can be over land or water, or both, and may involve the firing of live ammunition.

## **9.7.4 Helicopter Main Routes (HMR)**

9.7.4.1 A network of HMRs is established in the vicinity of the aviation and radar study area to support the transport of personnel and material to offshore oil and gas installations. Some HMR's cross the aviation and study area.

## **9.7.5 Predicted future baseline**

9.7.5.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with

reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the ES.

9.7.5.2 If Hornsea Four does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

9.7.5.3 It is difficult to define what the likely evolution of the aviation interests in the southern North Sea will be either with, or in the absence of, Hornsea Four. In 2016, The Oil and Gas Authority (OGA) Annual Report reported a continued decline in oil and gas production in the UK Continental Shelf (UKCS) (continuing a gradual decline seen since the year 2000). While this decline is predicted to continue, they report a range of possible outcomes because the future rate of production is dependent on many different and unknown factors, including the level of investment and the success of further exploration.

9.7.5.4 Operators continue to find it difficult to predict production accurately as older fields mature and their reliability reduces. A significant share of future oil and gas production is expected to come from new fields and major projects in existing fields. With the recent dramatic fall in oil prices the projections are even less certain than normal. As old fields are decommissioned helicopter use will decline. Consultation has advised that new marine technology using marine service and accommodation vessels equipped with walk-to-work systems is also offering an alternative to helicopters for the oil and gas industry.

9.7.5.5 Helicopter operations are however being used and being planned in the offshore wind industry particularly for operation and maintenance purposes. It should be noted that walk-to-work systems are also offering an alternative to helicopters for the offshore wind industry. It is considered a reasonable assumption therefore that helicopter numbers will remain fairly constant but that the providers may gradually shift from servicing one offshore industry (oil and gas) to another (wind) and may in time be reduced due to a shift to walk-to-work systems.

## 9.7.6 Data Limitations

9.7.6.1 The data used in this chapter are the most up to date publicly available information which can be obtained from the data sources as cited. Data have also been provided through consultation as detailed in [Section 9.4](#) above.

9.7.6.2 Given the scale of consultation undertaken on behalf of the former Hornsea Zone in general, for Hornsea Project One, Hornsea Project Two and for Hornsea Three, it is considered that the data employed in the assessment are of a robust nature and are of a standard equal to (but in areas greater than) that drawn for previous projects. It is assessed that data gathered is sufficient for this assessment.

9.7.6.3 As stated at [Section 9.6.1.2](#), there is no radar specification data available to baseline Staxton Wold. With this exception, all required data has been available.

## 9.8 Project basis for assessment

### 9.8.1 Aviation Stakeholders and Receptors

9.8.1.1 **Table 9.5** provides the conclusions of the baseline study, identifying the key aviation receptors and stakeholders. **Volume 5, Annex 9.1: Aviation and Radar Technical Report** provides further details.

**Table 9.5: Aviation receptors and stakeholders identified from the baseline study.**

Stakeholder	Operation
NERL	The NATS Claxby PSR, which is located in North Lincolnshire, provides radar coverage in the airspace above and surrounding the Hornsea Four array area which enables the provision of radar based ATS to those aircraft operating within and overflying the London FIR. Radar detectability of operational wind turbines will create a detrimental effect to operations utilising the subject radar system. A technical assessment concluded there will be no impact on the Cromer PSR.
MOD	Military Low-Level Operations take place over the sea from the surface to 2,000 ft amsl in the airspace surrounding the Hornsea Four array area. Above FL 50 (approximately 5,000 ft) military aircraft engage in air exercise operations in established PEXA. ADR systems provide radar coverage of the airspace above and surrounding the Hornsea Four array area for the protection of UK airspace and for the provision of radar services to aircraft operating in PEXAs. The onshore ECC route passes close to MOD communication facilities established for MOD Leconfield.
Offshore Helicopter Operators	A network of HMRs is established in the vicinity of the Hornsea Four array area to support the transport of personnel and material to offshore oil and gas installations.
Offshore Oil and Gas Platform Operators	A consultation zone of nine nm radius exists around offshore helicopter destinations. A number of Oil and Gas helideck platforms are located within the defined consultation zone. Volume 5, Annex 9.1, Figure 7 illustrates.
Airborne SAR Operations	The SAR force provides 24-hour aeronautical SAR cover in the UK which is provided from ten strategically located bases across the UK. The bases are positioned close to SAR hotspots so that aircraft can provide support as quickly and efficiently as possible. Bristow Helicopters were awarded the contract to provide SAR helicopter services for the UK in 2013; the closest SAR helicopter base is located at Humberside Airport.

9.8.1.2 The receptors (Claxby PSR, Trimmingham ADR and Boulmer ADR) for each impact are described within the text for each assessment and have been identified in **Table 9.5**. Those receptors which are not considered to have any potential to be impacted by Hornsea Four have not been presented within the baseline.

9.8.1.3 Aviation receptors were identified in accordance with CAP 764 (CAA, 2016). This assessment considers all radar systems within operational range of Hornsea Four, as well as military areas of operation. For each identified receptor, the physical obstruction and/or radar effect, and subsequently the operational impacts were considered with any other potential impacts.

- 9.8.1.4 The operational range of a radar system is dependent on the type of radar used and its operational requirement. CAP 764 provides a guide of 30 km for assessment of radar impact; however, any impact is dependent on radar detectability of operational wind turbines, the radars operational range and the use of airspace in which the development sits. The operational impact considers the approach and departure flight paths, physical safeguarding of flight, airspace characteristics and flight procedures as published in the UK IAIP (NATS, 2019) and the Mil AIP (MOD, 2019a). This assessment has been informed by the results of baseline studies and consultation, with reference to the existing evidence base regarding the effects of offshore wind farm development.
- 9.8.1.5 **Volume 5, Annex 9.1: Aviation and Radar Technical Report** provides details of the radar line of sight (LOS) analysis completed to provide a predicted theoretical indication of those radar systems that could theoretically be impacted by the operation of Hornsea Four. The response to scoping from the MOD indicates the onshore ECC does not impact safeguarding criteria; however, the route passes close to MOD Leconfield, and any amendment to the onshore ECC route should consider the technical safeguarding zone surrounding the MOD Leconfield radio transmitter and receiver installations. Since there has been no change to the route since scoping the onshore ECC is not considered further in this assessment.

## 9.8.2 Impact register and impacts “scoped out”

- 9.8.2.1 Based on the baseline environment, the project description outlined in **Volume 1, Chapter 4: Project Description** and **Volume 4, Annex 5.2: Commitments Register**, several impacts are proposed to be “scoped out” of the PEIR assessment for aviation and radar. These impacts are outlined, together with a justification for scoping them out, in **Table 9.6**. Further detail is provided in **Volume 4, Annex 5.1: Impacts Register**.
- 9.8.2.2 Please note that the term “scoped out” relates to the Likely Significant Effect (LSE) in EIA terms and not “scoped out” of the EIA process *per se*. All impacts “scoped out” of LSE are assessed for magnitude, sensitivity of the receiving receptor and conclude an EIA significance in the Impacts Register (see **Volume 4, Annex 5.1**). This approach is aligned with the Hornsea Four Proportionate approach to EIA (see **Volume 1, Chapter 5: EIA Methodology**).

**Table 9.6: Impacts scoped out of assessment and justification.**

Project activity and impact	Likely significance of effect	Approach to assessment	Justification
Construction: Wind turbine effects on aviation radar systems during the construction process (AV-C-1).	No likely significant effect.	Scoped Out	The static nature of the wind turbine will not be presented onto radar screens.

**Notes:**

Grey - Potential impact is scoped out and both PINS and Hornsea Four agree.

## 9.8.3 Commitments

9.8.3.1 Hornsea Four has made several Commitments (primary design principles inherent as part of the project, installation techniques and engineering designs/modifications as part of their pre-application phase, to avoid a number of impacts or reduce impacts as far as possible). Further Commitments (adoption of best practice guidance) are also embedded as an inherent aspect of the EIA process. The commitments adopted by Hornsea Four in relation to aviation and radar are presented in [Table 9.7](#). Full details of commitments are included within the [Volume 4, Annex 5.2: Commitments Register](#).

**Table 9.7: Relevant aviation and radar commitments.**

Commitment ID	Measure Proposed	How the measure will be secured
Co93	Tertiary: Aids to navigation (marking and lighting) will be deployed in accordance with the latest relevant available standard industry guidance and as advised by Trinity House, MCA and Civil Aviation Authority (CAA) and MoD as appropriate. This will include a buoyed construction area around the array area and the HVAC booster station in consultation with Trinity House.	DCO Schedule 11, Part 2 - Condition 7 and; DCO Schedule 12, Part 2 - Condition 7 (Aids to navigation)  DCO Schedule 11, Part 2 - Condition 12(1)(j) and; DCO Schedule 12, Part 2 - Condition 14(1)(j) (Aid to navigation management plan)
Co99	Tertiary: Hornsea Four will ensure compliance with MGN543 where appropriate.	DCO Schedule 11, Part 2 - Condition 14 and; DCO Schedule 12, Part 2 - Condition 14 (Offshore safety management)
Co102	Tertiary: The Defence Geographic Organisation will be informed of the locations, heights and lighting status of the wind turbines, including estimated and actual dates of construction and the maximum height of any construction equipment to be used, prior to the start of construction, to allow inclusion on Aviation Charts.	DCO Schedule 11, Part 2 - Condition 6 and; DCO Schedule 12, Part 2 - Condition 6 (Notifications and Inspections)

## 9.9 Maximum Design Scenario

9.9.1.1 The assessment of potential impacts on aviation and radar is based on the Maximum Design Scenario (MDS) as identified from a design envelope and is specific to the potential impacts identified in this chapter. The key parameters for the MDS include consideration of the maximum number of wind turbines across the largest area and the maximum blade tip height of 370 m above Lowest Astronomical Tide (LAT).

9.9.1.2 The maximum design scenario for impacts on aviation radar services assumes that the entirety of the Hornsea Four array area will be populated with wind turbines (180) and

other electrical infrastructure (10 positions) at the maximum blade tip height of 370 m above LAT. This is because the largest area of the highest wind turbines will create the largest impact from a physical obstruction and radar interference perspective, leading to a greater effect on aviation services. Any aspects of the infrastructure that are lower in height than the wind turbines (10 electrical infrastructure positions for offshore substations and accommodation platforms) and less than the extent of the Hornsea Four array area will not create an incremental effect on aviation interests. [Table 9.8](#) provides the maximum design scenario for impacts to aviation and radar.

**Table 9.8: Maximum design scenario for impacts on aviation and radar.**

Impact and Phase	Embedded Mitigation Measures	Maximum Design Scenario / Rochdale Envelope	Justification
<i>Construction</i>			
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-C-2).	Tertiary: Co93 Co99 Co102	<b>Array:</b> <ul style="list-style-type: none"> <li>• 190 x positions at 370m amsl (180 x WTGs and 10 x other electrical infrastructure).</li> <li>• Impact starting from a point of zero infrastructures present to full presence over an indicative maximum 3 year construction window.</li> </ul>	Maximum number of wind turbines in the Hornsea Four array area. Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area.
Increased air traffic in the area related to wind farm activities in the construction phase may affect the available airspace for other users (AV-C-3).	Tertiary: Co93 Co99 Co102	<b>Array:</b> <ul style="list-style-type: none"> <li>• 190 x positions at 370m amsl (180 x WTGs and 10 x other electrical infrastructure).</li> <li>• Impact starting from a point of zero infrastructures present to full presence over an indicative maximum 3 year construction window.</li> </ul>	Maximum number of helicopter trips as a result of being engaged on works for Hornsea Four causing an increased possibility of aircraft to aircraft collision.
<i>Operation</i>			
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-O-1).	Tertiary: Co93 Co99 Co102	<b>Array:</b> <ul style="list-style-type: none"> <li>• 190 x positions at 370m amsl (180 x WTGs and 10 x other electrical infrastructure).</li> <li>• Impact throughout the Operation phase of 35 years.</li> </ul>	Maximum number of wind turbines in the Hornsea Four array area. Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area.
Wind turbines causing permanent interference on civil and military radar systems (AV-O-2).	None	<b>Array:</b> <ul style="list-style-type: none"> <li>• 180 wind turbines with a maximum blade tip height of 370 m above LAT.</li> <li>• Impact throughout the Operation phase of 35 years.</li> </ul>	ATC and Air Defence controllers may be unable to provide an effective surveillance service due to interference on radar displays. Impact duration present during operational period.
Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms (AV-O-3).	None	<b>Array:</b> <ul style="list-style-type: none"> <li>• 180 wind turbines with a maximum blade tip height of 370 m above LAT.</li> <li>• Impact throughout the Operation phase of 35 years.</li> </ul>	Wind turbines with the maximum possible blade tip height creating a physical obstruction to aviation operations due to size of above sea level infrastructure. Offshore platforms will be below the

Impact and Phase	Embedded Mitigation Measures	Maximum Design Scenario / Rochdale Envelope	Justification
Disruption to aircraft using HMRs (AV-O-4).	Tertiary: Co102	<b>Array:</b> <ul style="list-style-type: none"> <li>• 190 x positions at 370m amsl (180 x WTCs and 10 x other electrical infrastructure).</li> <li>• Impact throughout the Operation phase of 35 years.</li> </ul>	height of the wind turbines but may require aviation lighting.  Wind turbines with the maximum possible blade tip height creating a physical obstruction to aviation operations due to size of above sea level infrastructure. Offshore platforms will be below the height of the wind turbines but may require aviation lighting.
<i>Decommissioning</i>			
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-D-1).	Tertiary: Co93 Co99 Co102	<b>Array:</b> <ul style="list-style-type: none"> <li>• 190 x positions at 370m amsl (180 x WTCs and 10 x other electrical infrastructure).</li> <li>• Impact starting from a point of full presence of infrastructure to zero presence over a decommissioning period of approximately 3 years.</li> </ul>	Maximum number of wind turbines in the Hornsea Four array area.  Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the Hornsea Four array area.

## 9.10 Assessment methodology

9.10.1.1 The assessment methodology for aviation and radar is consistent with that presented in Annex C of the Scoping Report (Ørsted, 2018).

### 9.10.2 Impact assessment criteria

9.10.2.1 The criteria for determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts. [Table 5.3](#) in [Volume 1, Chapter 5: Environmental Impact Assessment Methodology](#) details this approach. The criteria for defining sensitivity in this chapter are outlined in [Table 9.9](#).

**Table 9.9: Definition of terms relating to receptor sensitivity.**

Sensitivity	Definition used in this chapter
Very High	Receptor or the activities of the receptor, is of critical importance to the local, regional or national economy and/or the receptor or the activities of the receptor, is highly vulnerable to impacts that may arise from the project and/or recoverability is long term or not possible.
High	Receptor or the activities of the receptor, is of high value to the local, regional or national economy and/or the receptor or the activities of the receptor, is generally vulnerable to impacts that may arise from the project and/or recoverability is slow and/or costly.
Medium	Receptor or the activities of the receptor, is of moderate value to the local, regional or national economy and/or the receptor or the activities of the receptor, is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high levels of recoverability.
Low	Receptor or the activities of the receptor, is of low value to the local, regional or national economy and/or the receptor or the activities of the receptor, is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.

9.10.2.2 The criteria for defining magnitude in this chapter are outlined in [Table 9.10](#).

**Table 9.10: Definition of terms relating to magnitude of an impact.**

Magnitude of impact	Definition used in this chapter
Major	Total loss of ability to carry on activities and/or impact is of extended physical extent and/or long-term duration (i.e. total life of project and/or frequency of repetition is continuous and/or effect is not reversible for project).
Moderate	Loss or alteration to significant portions of key components of current activity and/or physical extent of impact is moderate and/or medium-term duration (i.e. operational period) and /or frequency of repetition is medium to continuous and/or effect is not reversible for project phase.
Minor	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken and/or physical extent of impact is low and/or short to medium term duration (i.e. construction period) and/or frequency of repetition is low to continuous and/or effect is not reversible for project phase.
Negligible	Very slight change from baseline condition and/or physical extent of impact is negligible and/or short-term duration (i.e. less than two years) and/or frequency of repetition is negligible to continuous and/or effect is reversible.

- 9.10.2.3 The significance of the effect upon aviation and radar is determined by correlating the magnitude of the impact and the sensitivity of the receptor as shown in [Table 9.11](#). [Table 5.3](#) in [Volume 1, Chapter 5: Environmental Impact Assessment Methodology](#) details this approach.
- 9.10.2.4 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of the EIA Regulations.

**Table 9.11: Matrix used for the assessment of the significance of the effect.**

		Magnitude of Impact/Degree of Change			
		Negligible	Minor	Moderate	Major
Value, Importance, Sensitivity	Low	Not Significant	Not Significant or Minor (Not Significant)	Minor (Not Significant)	Minor (Not Significant) or Moderate (Significant)
	Medium	Not Significant	Minor (Not Significant)	Moderate (Significant)	Moderate (Significant) or Major (Significant)
	High	Not Significant	Minor (Not Significant) or Moderate (Significant)	Moderate (Significant) or Major (Significant)	Major (Significant) or Substantial (Significant)
	Very High	Not Significant	Moderate (Significant) or Major (Significant)	Major (Significant) or Substantial (Significant)	Substantial (Significant)

## 9.11 Impact assessment

### 9.11.1 Construction

- 9.11.1.1 The impacts of the offshore construction of Hornsea Four have been assessed on aviation and radar. The impacts arising from the construction of Hornsea Four are listed in [Table 9.8](#) along with the MDS against which each construction phase impact has been assessed.
- 9.11.1.2 A description of the potential effect on aviation and radar receptors caused by each identified impact is given below.

#### Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-C-2).

##### Magnitude of impact

- 9.11.1.3 Wind turbine construction infrastructure above LAT could pose a physical obstruction to flight operations in the vicinity and specifically to helicopters operating to offshore platforms. Construction infrastructure, HVAC booster stations and erected wind turbines can be difficult to see from the air, particularly in poor meteorological conditions leading to potential increased obstacle collision risk. Furthermore, during the construction phase,

the presence and movement of construction infrastructure may present a potential obstacle collision risk to aircraft flight operations.

- 9.11.1.4 A range of mitigation measures, in the form of appropriate notification to aviation stakeholders, lighting and marking to minimise effects to aviation flight operations would apply to the development of Hornsea Four. These will comply with current guidelines and be agreed with the appropriate stakeholders and are outlined in [Section 9.8.3](#). Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In VMC conditions, pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware through notification procedures of the proposed project. Furthermore, when flying in IMC pilots will be utilising on board radar which detects obstructions and be under the control of ATC with an appropriate level of radar service. The impact is predicted to be of regional spatial extent and of short-term duration and intermittent. It is predicted that the impact will affect the receptor directly, the magnitude is considered to be **minor**.

#### Sensitivity of the receptor

- 9.11.1.5 Helicopter operators, the MOD and ATC service providers will be consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of construction infrastructure.
- 9.11.1.6 The ability of aviation stakeholders to continue using the southern North Sea airspace is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

#### Significance of the effect

- 9.11.1.7 Overall, the sensitivity of the receptor is considered to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
- 9.11.1.8 Note that more detailed assessments of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) are planned as part of an overarching oil and gas assessment which will accompany the final application; further details are provided in [Chapter 12: Infrastructure and other users](#).

#### Future Monitoring

- 9.11.1.9 No aviation and radar monitoring to test the predictions made within the construction phase impact assessment is considered necessary.

## Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-C-3).

### Magnitude of impact

- 9.11.1.10 Under aviation flight rules, the Minimum Safety Altitude (MSA) is the altitude below which it is unsafe to fly in Instrument Meteorological Conditions (IMC) (i.e. in poor visibility/cloud) owing to presence of terrain or obstacles within a specified area. This will result in an increase in helicopters routinely operating in the area; any increase could impact on existing aviation activities and air traffic operating in the area.
- 9.11.1.11 When helicopters are operating offshore in support of Hornsea Four, aircraft can be in receipt of an ATS and may be provided with traffic information on other aircraft, but ultimately pilots are responsible for their own separation from other aircraft, obstacles and terrain. Due to the localised area of operation of support helicopter activities in one area of the southern North Sea, the procedures existing for ATC radar provision and the availability of existing ATS; the impact is expected to be of medium-term duration and continuous. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

### Sensitivity of the receptor

- 9.11.1.12 The ATS provided in the southern North Sea and standard operating procedures of aircraft operation ensure a safe separation distance to be maintained between aircraft, obstacles and terrain. Improvements in radar surveillance and radio coverage infrastructure have enhanced the offshore ATC service provided. The same rules of the air and ATC services will continue to apply to helicopter operators operating aircraft within the southern North Sea. The provision of a service to helicopters completing activities in support of Hornsea Four is not considered to affect the provision of a service to another user of the airspace. Best practice offshore aviation guidance has been developed for the offshore wind energy sector which will be taken into consideration by Hornsea Four.
- 9.11.1.13 The ability of the support helicopter operator and other airspace users to continue using available airspace is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **low**.

### Significance of the effect

- 9.11.1.14 Overall, the sensitivity of the receptor is considered to be **low** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
- 9.11.1.15 Note that more detailed assessments of the potential impacts on helicopter operations and impacts on airspace are planned as part of an overarching oil and gas assessment

which will accompany the final application; further details are provided in [Volume 2, Chapter 12: Infrastructure and Other Users](#).

### Future monitoring

- 9.11.1.16 No aviation and radar monitoring to test the predictions made within the construction phase impact assessment is considered necessary.

## **9.11.2 Operation and Maintenance**

- 9.11.2.1 The impacts of the offshore operation and maintenance of Hornsea Four have been assessed on aviation and radar. The environmental impacts arising from the operation and maintenance of Hornsea Four are listed in [Table 9.8](#) along with the MDS against which each operation and maintenance phase impact has been assessed.

### **Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-O-1).**

#### Magnitude of impact

- 9.11.2.1 During the operational phase of Hornsea Four, wind turbines and the HVAC booster stations could pose a physical obstruction to the flight of aircraft operating in the vicinity of the Hornsea Four array area, specifically to offshore helicopters and low flying aircraft. Helicopter operators, the MOD and ATC service providers will be consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of the wind turbines and the HVAC booster stations.
- 9.11.2.2 A range of mitigation measures, in the form of appropriate notification to aviation stakeholders, lighting and marking to minimise effects to aviation flight operations would apply to the development of Hornsea Four, as included in the commitments set out under [Section 9.8.3](#). These commitments will comply with current guidelines and be agreed with the appropriate stakeholders.
- 9.11.2.3 Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In VMC conditions, pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware through notification procedures of the proposed project. When operating IMC pilots will be utilising on board radar which detects obstructions and be under the control of ATC with an appropriate level of radar service. The impact is predicted to be of regional spatial extent and of permanent duration. It is predicted that the impact will affect the receptor directly however, the magnitude is considered to be **minor**.

#### Sensitivity of the receptor

- 9.11.2.4 Helicopter operators, the MOD and ATC service providers will be consulted with regard to the potential for Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of the operational wind turbines.

- 9.11.2.5 The ability of aviation stakeholders to continue using the southern North Sea airspace is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

*Significance of the effect*

- 9.11.2.6 Overall, the sensitivity of the receptors is considered to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
- 9.11.2.7 A more detailed assessment of the potential impacts on helicopter operations, particularly those servicing relevant oil and gas platforms (and service vessels) are planned as part of an overarching oil and gas assessment which will accompany the final application; further details are provided in [Chapter 12: Infrastructure and Other Users](#).

**Wind turbines causing permanent interference on civil and military radar systems (AV-O-2).**

*Magnitude of impact*

- 9.11.2.8 The operational wind turbines of the Hornsea Four array would be theoretically detectable by the NATS Claxby PSR and the MOD ADR located at Trimingham.<sup>3</sup> Wind turbines detectable by a PSR or ADR system might degrade the system by creating false targets, reduce system sensitivity, create radar shadowing behind the wind turbines and saturate the radar receiver leading to clutter potentially concealing real aircraft targets.

*Claxby PSR*

- 9.11.2.9 The Hornsea Four array area is within the operational range (370 km) of the NERL Claxby PSR located in North Lincolnshire. Radar LOS analysis (provided in [Volume 5, Annex 9.1: Aviation and Radar Technical Report](#)), which assessed a blade tip height of 370 m above LAT, concluded that the operational wind turbines of Hornsea Four will be theoretically detectable by the Claxby PSR system, leading to a degradation of the system and the presentation of radar clutter. The impact is predicted to be of regional spatial extent and of permanent duration. It is predicted that the impact will affect the receptor directly, the magnitude is considered to be **moderate**.

*Trimingham and Staxton Wold ADRs*

- 9.11.2.10 Military ADRs have a range of 370 km and are used to protect the security interests of the UK. The Trimingham ADR located in North Norfolk provides radar surveillance above the Hornsea Four array area. The MOD confirmed in their response to the scoping process that the site at Staxton Wold should be included as a relevant receptor. However, there is

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<sup>3</sup> Other offshore infrastructure associated with Hornsea Four including offshore transformer substations and offshore accommodation platforms do not pose any issue to radar systems as radar processing removes stationary objects from the radar display.

presently no ADR located at Staxton Wold and therefore Staxton Wold is not considered further in the assessment.

- 9.11.2.11 Radar LOS analysis (provided in [Volume 5, Annex 9.1: Aviation and Radar Technical Report](#)), which assessed a blade tip height of 370 m above LAT, concluded that the operational wind turbines placed in the southern part of the Hornsea Four array area would be theoretically detectable by the Trimmingham ADR, leading to potential interference to the radar system whilst areas further north within the array area will be unlikely to be detectable. The impact is predicted to be of regional spatial extent and of permanent duration. It is predicted that the impact will affect the receptor directly, the magnitude is considered to be moderate.

#### Sensitivity of the receptors

- 9.11.2.12 The ability of NERL and the MOD to accurately use their respective radar systems for the provision of an ATS, and in the case of the MOD to compile a Recognised Air Picture (RAP) to monitor the airspace in and around the UK in order to launch a response to any potential airborne threat, could be impacted in the presence of wind turbine interference and the production of radar clutter onto radar displays.
- 9.11.2.13 Both NERL and the MOD aim to ensure 'clutter free' radar to continue to deliver a safe and effective ATS and to monitor UK airspace. The radar stakeholders are considered to be of high vulnerability, low recoverability and high value. The sensitivity of these receptor is therefore, considered to be **high**.

#### Significance of the effect

- 9.11.2.14 Overall, the sensitivity of all of the receptors assessed is considered to be **high** and the magnitude of the impact is deemed to be **moderate**. The effect for all of the receptors considered will, therefore, be of **moderate adverse** significance.

#### Further Mitigation

##### Claxby PSR

- 9.11.2.15 Suitable mitigation of the effects on the Claxby PSR has been identified by NATS during the consultation completed to date (see [Table 9.3](#)).
- 9.11.2.16 The mitigation solution will be implemented in two stages. The first stage will be radar blanking of the Claxby PSR which will remove all wind turbine radar returns; the second stage will require an application to the UK regulator (the CAA) under an airspace change proposal detailed in CAP 1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements (CAA 2018b).
- 9.11.2.17 With this mitigation in place the residual effect to the Claxby PSR will be **not significant**.

## Trimingham ADR

- 9.11.2.18 On the 24 August 2018, the MOD released information regarding ADR mitigation (MOD, 2018) in which it stated that the receipt and assessment of any technical mitigation reports/submissions reports, relating to the TPS 77 ADRs and multi-turbine wind farms will be paused with immediate effect. An update to this statement was provided on the 12 June 2019 (MOD, 2019b) in which the MOD stated that it continues to work collaboratively with Government and wind farm developers to “...fully understand and mitigate all risks to our current and future military air surveillance capabilities”.
- 9.11.2.19 The MOD confirmed that they will “...continue to work with industry to resolve the current issues and will, on a case by case basis, consider certain developments where impacts on operational capability is deemed to be acceptable”.
- 9.11.2.20 Hornsea Four will continue to engage with the MOD prior to Application and will seek to identify agreed mitigation for the ADR system. The assumption that suitable mitigation will be agreed with the MOD removes the impact created by Hornsea Four; with mitigation in place the residual effects to the Trimingham ADR system will be **not significant**.

## **Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms (AV-O-3).**

### Magnitude of impact

- 9.11.2.21 In order to help achieve a safe operating environment, a consultation zone of 9 nm radius (CAA, 2016) exists around offshore helicopter installations. This consultation zone is not considered a prohibition on wind turbine development within a 9 nm radius of offshore operations but a trigger for consultation between platform operators, the offshore helicopter operators, the operators of existing installations and wind developers to maintain a safe coexistence between wind turbines and offshore helicopter operations. Details of consultation undertaken with oil and gas operators to date is presented in [Section 12.4](#) of [Chapter 12: Infrastructure and Other Users](#). The individual consultation zones of several installations are located within the consultation zone of Hornsea Four as illustrated in [Figure 9.2](#).

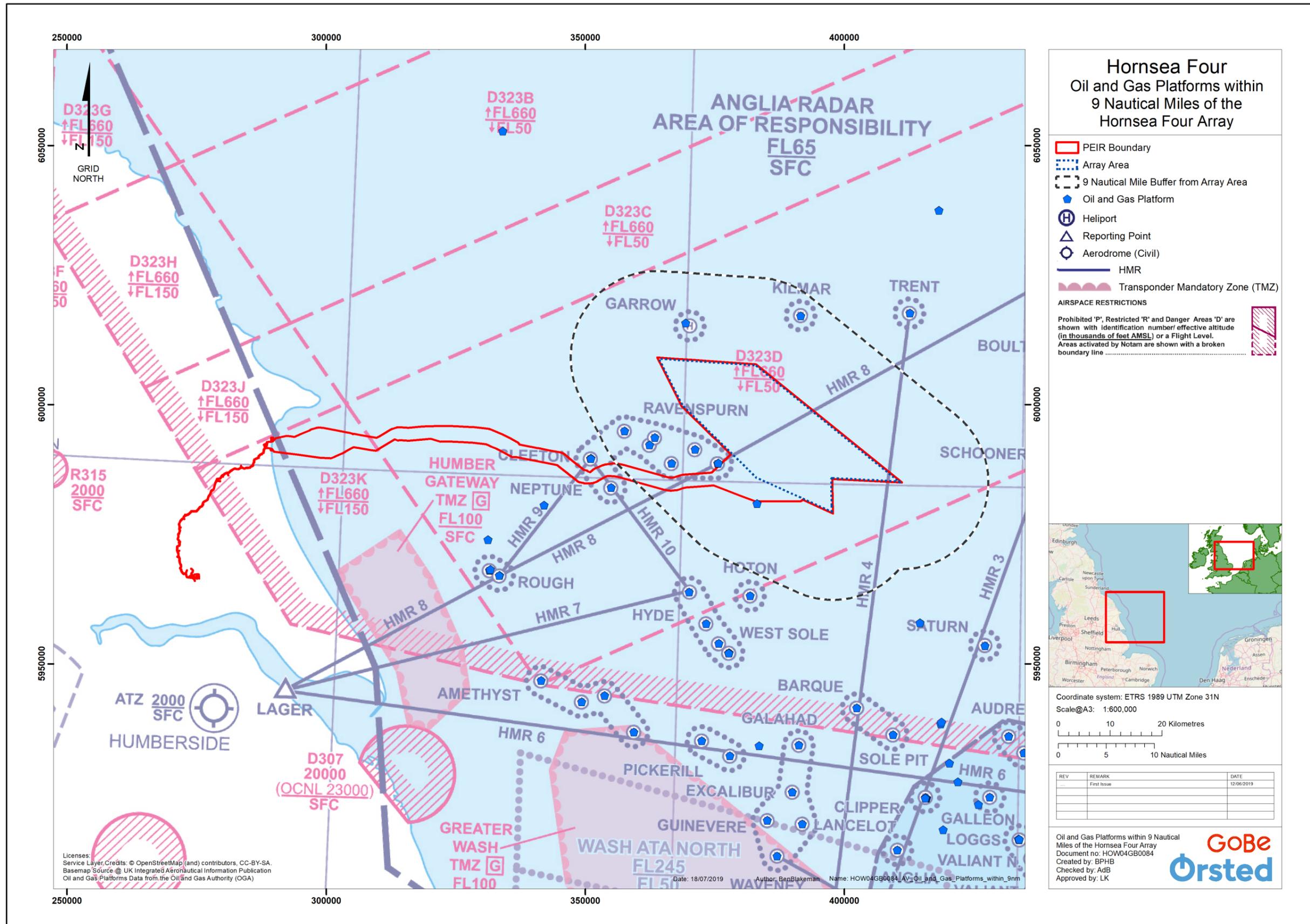


Figure 9.2: Oil and Gas Platforms in the location of the study area (not to scale). Extract Reproduced from CAA digital map data © Crown copyright 2019 UK IAIP ENR.

- 9.11.2.22 Wind turbines are considered as physical obstructions and helicopters must be operated in accordance with applicable separation regulations in both Visual Meteorological Conditions (VMC) and IMC. If higher altitude flights are required during normal weather conditions, flights can be flown in VMC. In IMC and in certain wind conditions, which dictate the area of approach to an installation, instrument approach procedures might be restricted due to the proximity of wind turbine structures to the flight approach path.
- 9.11.2.23 When flying in VMC a helicopter must maintain a 150 m (500 ft) separation distance from all obstacles. Access requirements in VMC are not considered to be affected at a distance of greater than 1 nm from WTG's. At a distance of less than 1 nm access requirements in VMC are considered possible but may be affected when considering other factors such as wind conditions and turbulence.
- 9.11.2.24 When operating IMC, helicopters must operate to minimum separation distances as published by EASA AMC 1 SPA.HOFO.125 (currently Final Approach Fix at  $\geq 4$ nm and the Intermediate Fix at  $\geq 6$ nm). A helicopter must maintain a 1,000 ft vertical clearance from all obstacles as it lines up its final descent and a one nm lateral separation from all radar contacts (including WTGs). On this basis access requirements in IMC are potentially affected at a distance of between 1 nm and a range from which the instrument approach is commenced, depending upon direction of approach, and restricted at a distance of less than one nautical mile.
- 9.11.2.25 Hornsea Four will complete consultation with the operators of impacted offshore helideck platforms, together with those offshore helicopter operators that may operate to the platforms in the affected area. The impact is predicted to be of regional spatial extent and of short to medium term duration. It is predicted that the impact will affect the receptor directly; at this stage the magnitude is **moderate** for all relevant platforms.

#### Sensitivity of the receptor

- 9.11.2.26 The sensitivity of the operator is dependent on the frequency and dependency to which their existing helicopter platform requiring access is affected which will be informed once consultation with applicable platform operators is complete. Consultation with platform operators has been undertaken and helicopter operators have been approached through direct contact and questionnaire. At this stage, responses have not been received to questionnaires, in the absence of the required information to define sensitivity that a blanket **low** sensitivity has been applied. This will be updated when responses to the questionnaires are received;

#### Significance of the effect

- 9.11.2.27 As stated, fully detailed consultation has not been completed with platform operators to date. However, at this stage it is anticipated that the overall, the sensitivity of the receptor will be deemed to be **low** and the magnitude of the impact will be deemed to be **moderate**. The preliminary assessment therefore predicts an effect of **minor adverse**

significance, which is not significant in EIA terms. This assessment will be updated once stakeholder responses are received.

- 9.11.2.28 Note, however, that more detailed and specific assessments of the potential impacts on helicopter operations at relevant oil and gas platforms (and service vessels) are planned as part of an overarching oil and gas assessment which will accompany the final application; further details are provided in [Chapter 12: Infrastructure and Other Users](#). The assessments will be supported by ongoing consultation with relevant operators.

#### Disruption to aircraft using HMRs (AV-O-4).

##### *Magnitude of impact*

- 9.11.2.29 Offshore Oil and Gas platforms in the North Sea are supported by a number of helicopter operators who ferry crews and supplies to and from the mainland. The routes taken by helicopters on such flights may follow HMRs which form a network of corridors between offshore platforms and the main support bases at Norwich Airport and Humberside Airport.
- 9.11.2.30 [Figure 9.2](#) provides an illustration of the HMR structure surrounding the Hornsea Four array area. HMR 4 routes from the North Norfolk coast, clipping the study area to the east towards to/from the Trent platform; whilst HMR 8 which routes from the Lincolnshire coast to the Munro Platform, bisects the Hornsea Four array area. HMRs are established to both provide an identification of common flight paths and to facilitate safe helicopter flights when flying in IMC (i.e. when flight cannot be completed in visual conditions). CAP 764 recommends HMRs should ideally be free of obstacles 2 nm either side of the centre line but where planned should be consulted upon with the helicopter operators and the air navigation service provider (Anglia Radar).
- 9.11.2.31 Previously for Hornsea Three, consultation with helicopter operators has advised that the HMR network is not widely used in the southern North Sea and that helicopter operators choose to route directly to their destination. HMR 8 crosses the Hornsea Four array area ([Figure 9.2](#)). The presence of the turbines in HMR 8 would preclude the use of this route when the weather requires flight at a lower altitude which would not provide the required obstacle clearance of 1,000 ft. The altitude that the helicopter can fly is based on obstacle clearance criteria and may also be dictated by the icing level or 0° isotherm (the level at which the air temperature reaches freezing). Flight into known icing conditions can be prohibiting, and is generally time-limited, depending upon the aircraft type. Thus, a low freezing level can pose problems for helicopter operations. As the helicopters are IFR equipped, the only weather factor which would preclude use of the HMR is an icing level below 2000 ft. The impact is predicted to be of regional spatial extent and of short to medium term duration. It is predicted that the impact will affect the receptor directly, the magnitude is considered to be **minor**.

## Sensitivity of the receptor

- 9.11.2.32 Helicopter flights offshore can be flown in visual conditions (i.e. in weather conditions in which pilots will be able to see and avoid obstructions) or in IMC when the icing level is high enough. In these weather conditions, due to the presence of Hornsea Four wind turbines, helicopters would be required to transit at a higher MSA over the Hornsea Four array area. Should weather conditions exist whereby either VMC or IMC transits cannot be continued above the Hornsea Four array area, helicopters operating in support of the Oil and Gas industry may choose to reroute to the HMR network however, HMR 8 may not be available for use by crew change helicopters if the icing level is <2,000 ft. Helicopters can route around the array area, but this will have an economic impact due to the increased length of flight, higher fuel loads required and consequent lower client payloads. However, it will not present a safety issue. UK SAR helicopters have a full icing clearance and therefore an icing level <2,000 ft will not restrict a transit by a SAR helicopter.
- 9.11.2.33 In regard to the use of HMR 8 the helicopter operator has low vulnerability as it is able to adapt to an increased MSA; furthermore, the helicopter may also have a certain level of icing protection and there are alternative routes that can be flown avoiding the Hornsea Four array area albeit there may be, as a consequence of the raised MSA, an increased journey time due to the requirement to fly at a greater height or to deviate around the Hornsea Four array area.
- 9.11.2.34 In regard to the use of HMR 4, the helicopter operator has low vulnerability as it able to continue to fly this route with very minor deviations.
- 9.11.2.35 The sensitivity of the helicopter operator to be able to transit the Hornsea Four array area has therefore been assessed as low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore considered to be **low**.

## Significance of the effect

- 9.11.2.36 Overall, the sensitivity of the receptor is considered to be **low** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.
- 9.11.2.37 Note that more detailed assessments of the potential impacts on helicopter operations and the use of HMRs are planned as part of an overarching oil and gas assessment which will accompany the final application; further details are provided in [Chapter 12: Infrastructure and Other Users](#).

## Future monitoring

- 9.11.2.38 No aviation and radar monitoring to test the predictions made within the construction phase impact assessment is considered necessary.

## 9.11.3 Decommissioning

9.11.3.1 The impacts of the offshore decommissioning of Hornsea Four have been assessed on aviation and radar. The environmental impacts arising from the decommissioning of Hornsea Four are listed in [Table 9.8](#) along with MDS against which each decommissioning phase impact has been assessed.

### Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-D-1).

#### Magnitude of impact

9.11.3.2 During the decommissioning phase, the presence and movement of decommissioning infrastructure may present a potential collision risk to aircraft in the vicinity and potentially specifically to helicopters operating to offshore oil and gas platforms. The confidence in the assessment is high. A range of mitigation measures (notification, lighting and marking) to minimise environmental effects would apply to the decommissioning of the proposed project. These will comply with current guidelines and be agreed with the appropriate stakeholders and are outlined in [Section 9.8.3](#). Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. Pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and decommissioning infrastructure and will be aware through notification procedures of the proposed project. It is expected that any mitigation implemented will remain in place until the last wind turbine has been removed. The impact is predicted to be of regional spatial extent and of short-term duration and intermittent. It is predicted that the impact will affect the receptor directly, the magnitude is therefore, considered to be **minor**.

#### Sensitivity of the receptor

9.11.3.3 Helicopter operators, the MOD and ATC service providers will be consulted with regard to the potential of Hornsea Four to create an obstruction to aviation activities conducted in the vicinity of decommissioning infrastructure.

9.11.3.4 The ability of aviation stakeholders to continue using the southern North Sea airspace during decommissioning activities is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

#### Significance of the effect

9.11.3.5 Overall, the sensitivity of the receptor is considered to be **medium** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

9.11.3.6 A more detailed assessments of the potential impacts on helicopter operations and impacts on airspace during the decommissioning phase are planned as part of an

overarching oil and gas assessment which will accompany the final application; further details are provided in [Chapter 12: Infrastructure and Other Users](#).

## 9.12 Cumulative effect assessment (CEA)

### 9.12.1 Cumulative Effect Assessment Methodology

- 9.12.1.1 Cumulative effects can be defined as effects upon a single receptor from Hornsea Four when considered alongside other developments. This includes all projects that result in a comparative effect that is not intrinsically considered as part of the existing environment and is not limited to offshore wind projects.
- 9.12.1.2 A screening process has identified a number of reasonably foreseeable projects and developments which may act cumulatively with Hornsea Four. The full list of such projects that have been identified in relation to the offshore environment are set out in [Volume 4, Annex 5.3: Offshore Cumulative Effects](#) and are presented in a series of maps within [Volume 4, Annex 5.4: Location of Offshore Cumulative Schemes](#).
- 9.12.1.3 In assessing the potential cumulative impacts for Hornsea Four, it is important to bear in mind that some projects, predominantly those 'proposed' or identified in development plans, may not actually be taken forward, or fully built out as described within their MDS. There is therefore a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, those projects under construction are likely to contribute to cumulative impacts (providing effect or spatial pathways exist), whereas those proposals not yet approved are less likely to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.
- 9.12.1.4 All projects and plans considered alongside Hornsea Four have been allocated into 'tiers' reflecting their current stage within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. This approach also allows appropriate weight to be given to each scenario (tier) when considering the potential cumulative impact. The proposed tier structure that is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in the Hornsea Four PEIR. An explanation of each tier is included in [Table 9.12](#).

**Table 9.12: Description of tiers of other developments considered for CEA (adapted from PINS Advice Note 17).**

	<b>Project under Construction.</b>
Tier 1	Permitted applications, whether under the Planning Act 2008 or other regimes, but not yet implemented.
	Submitted applications, whether under the Planning Act 2008 or other regimes, but not yet determined.
Tier 2	Projects on the Planning Inspectorate’s Programme of Projects where a Scoping Report has been submitted.
Tier 3	Projects on the Planning Inspectorate’s Programme of Projects where a Scoping Report has not been submitted.
	Identified in the relevant Development Plan (and emerging Development Plans with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.
	Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

9.12.1.5 The plans and projects selected as relevant to the CEA of impacts to aviation and radar are based on an initial screening exercise undertaken on a long list (see [Volume 4, Annex 5.3: Offshore Cumulative Effects](#)). A consideration of effect-receptor pathways, data confidence and temporal and spatial scales has been given to select projects for a topic-specific short-list. By virtue of its distance from centres of aviation activity, the proposed project produces fewer direct adverse effects on aviation operations than an equivalent onshore development. In the case of Hornsea Four, aviation cumulative impacts are confined to the effect of wind turbine detection by the Claxby PSR and the Trimmingham ADR system.

9.12.1.6 The specific projects scoped into the CEA for aviation and radar, as well as the tiers into which they have been allocated are presented in [Table 9.13](#). The operational projects included within the table are included due to their completion/ commissioning subsequent to the data collection process for Hornsea Four and as such not included within the baseline characterisation. Note that this table only includes the projects screened into the assessment for aviation and radar based on the criteria outlined above. For the full list of projects considered, including those screened out; please see [Volume 4, Annex 5.3: Offshore Cumulative Effects](#).

9.12.1.7 It is noted that offshore wind farms seek consent for a maximum design scenario and the ‘as built’ offshore wind farm will be selected from the range of consented scenarios. In addition, the maximum design scenario quoted in the application (and the associated Environmental Report) are often refined during the determination period of the application. For example, it is noted that the application for Hornsea Project One considered a maximum of 332 turbines within the Environmental Statement but was awarded consent for 240 turbines. In addition, it is now known that Hornsea Project One ‘as built’ will consist of 174 turbines. Similarly, Hornsea Project Two has gained consent for an overall maximum of 300 turbines, as opposed to 360 considered in the Environmental Statement and the as built number of turbines is likely to be less than this. A similar pattern of reduction in the project envelope from that assessed in the Environmental Statement, to the consented envelope and the ‘as built’ project is also seen

across other offshore wind farms of relevance to this CEA. This process of refinement can result in a reduction to associated project parameters, for example the number and length of cables to be installed and the number of offshore substations.

9.12.1.8 The potential for cumulative impact created by the radar detection of Hornsea Four exists to those radar systems that will also detect the wind farm developments listed in [Table 9.13](#) below.

9.12.1.9 The CEA presented in this aviation and radar chapter has been undertaken on the basis of information presented in the Environmental Statements for the other projects, plans and activities. Given that this broadly represents a maximum design scenario, the level of cumulative impact on aviation and radar would highly likely be reduced from those presented here. [Table 9.13](#) provides those projects screened into the aviation and radar cumulative assessment.

**Table 9.13: Projects screened into the aviation and radar cumulative assessment.**

Tier	Project/plan	Date of construction (if applicable)	Distance to Hornsea Four Array (km)	Distance to Hornsea Four ECC (km)	Distance to Hornsea Four HVAC Booster Area (km)	Reason for inclusion in CEA
1	Hornsea Two	2020 to 2022	0.00	5.84	66.43	Impact to available airspace and radar cumulative effect
	Hornsea One	2019 (under construction)	5.08	21.32	82.50	Impact to available airspace and radar cumulative effect
	Westermost Rough	N/A (Operational)	62.75	21.63	25.40	Impact to radar cumulative effect
	Hornsea Three	2024 to 2028	36.34	55.47	116.10	Impact to available airspace and radar cumulative effect
	Humber Gateway	N/A (Operational)	66.37	40.96	42.02	Impact to radar cumulative effect
	Triton Knoll	2019 to 2021	56.99	49.70	60.33	Impact to radar cumulative effect
	Dogger Bank Creyke Beck A	2021 to 2023	65.86	83.65	107.52	Impact to radar cumulative effect
	Dudgeon	N/A (operational)	70.83	72.72	101.65	Impact to radar cumulative effect
	Dogger Bank Creyke Beck B	2021 to 2024	76.14	94.18	111.26	Impact to radar cumulative effect
	Race Bank	N/A (operational)	78.83	72.40	82.66	Impact to radar cumulative effect
Lincs	N/A (operational)	96.62	83.65	89.25	Impact to radar cumulative effect	

Tier	Project/plan	Date of construction (if applicable)	Distance to Hornsea Four Array (km)	Distance to Hornsea Four ECC (km)	Distance to Hornsea Four HVAC Booster Area (km)	Reason for inclusion in CEA
	Teesside	N/A (operational)	136.72	86.37	108.47	Impact to radar cumulative effect
	Inner Dowsing	N/A (operational)	101.63	88.07	92.99	Impact to radar cumulative effect
	Sheringham Shoal	N/A (operational)	83.51	88.65	106.44	Impact to radar cumulative effect
	Sofia	2023 to 2026	97.75	113.14	143.26	Impact to radar cumulative effect
	Lynn	N/A (operational)	107.20	94.96	100.34	Impact to radar cumulative effect
3	Dudgeon Extension	N/A	64.98	67.17	91.76	Impact to radar cumulative effect

9.12.1.10 Certain impacts assessed for the project alone are not considered in the cumulative assessment due to:

- The highly localised nature of the impacts (i.e. they occur entirely within the Hornsea Four boundary only);
- Management measures in place for Hornsea Four will also be in place on other projects reducing their risk of occurring; and/or
- Where the potential significance of the impact from Hornsea Four alone has been assessed as negligible.

9.12.1.11 The impacts excluded from the CEA for the above reasons are:

- Increased air traffic in the area related to wind farm activities;
- Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms; and
- Distribution to aircraft using HMRs due to the highly localised nature of the impact.

9.12.1.12 Therefore, the impact that is considered in the CEA is as follows:

- Creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore; and
- Wind turbines causing permanent interference on civil and military radar systems.

9.12.1.13 The cumulative MDS described in [Table 9.14](#) have been selected as those having the potential to result in the greatest cumulative effect on an identified receptor group. The cumulative impacts presented and assessed in this section have been selected from the details provided in the project description for Hornsea Four (summarised for aviation and radar in [Table 9.8](#)), as well as the information available on other projects and plans in order to inform a cumulative maximum design scenario. Effects of greater adverse significance

are not predicted to arise should any other development scenario, based on details within the project design envelope to that assessed here, be taken forward in the final design scheme.

**Table 9.14: Cumulative MDS table.**

Project Phase	Potential Impact	Maximum Design Scenario	Justification
Construction	Creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore.	<p>Maximum design scenario for Hornsea Four plus the cumulative full development of the following projects within 40 km of Hornsea Four:</p> <p><b>Tier 1:</b></p> <ul style="list-style-type: none"> <li>• Hornsea Project One;</li> <li>• Hornsea Project Two; and</li> <li>• Hornsea Three.</li> </ul> <p><b>Tier 2:</b></p> <ul style="list-style-type: none"> <li>• No Tier 2 projects identified.</li> </ul> <p><b>Tier 3:</b></p> <ul style="list-style-type: none"> <li>• No Tier 3 projects identified.</li> </ul>	This includes the presence of other developments which will have the potential to create a cumulative aviation obstacle and affect the available airspace for other users in the same region.
Operation	Wind turbines causing permanent interference on civil and military radar systems.	<p>Maximum design scenario for Hornsea Four plus the cumulative full development of the following projects within 100 km of Hornsea Four:</p> <p><b>Tier 1:</b></p> <ul style="list-style-type: none"> <li>• Hornsea Project One;</li> <li>• Hornsea Project Two;</li> <li>• Hornsea Three;</li> <li>• Westermost Rough;</li> <li>• Humber Gateway;</li> <li>• Triton Knoll;</li> <li>• Dogger Bank Creyke Beck A;</li> <li>• Dogger Bank Creyke Beck B;</li> <li>• Dudgeon;</li> <li>• Lincs;</li> <li>• Teesside;</li> <li>• Inner Dowsing;</li> <li>• Race Bank</li> <li>• Sheringham Shoal;</li> <li>• Sofia; and</li> <li>• Lynn.</li> </ul> <p><b>Tier 2:</b></p> <ul style="list-style-type: none"> <li>• No Tier 2 projects identified.</li> </ul> <p><b>Tier 3:</b></p> <ul style="list-style-type: none"> <li>• Dudgeon Extension</li> <li>• Race Bank Extension</li> </ul>	Maximum aviation and radar cumulative effect is calculated within a representative 100 km buffer of Hornsea Four.

## 9.12.2 Cumulative Effect Assessment

9.12.2.1 A description of the significance of cumulative effects on aviation and radar arising from each identified impact is given below.

## 9.12.3 Construction Phase

### Creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore.

#### Tier 1

- 9.12.3.1 There is potential for cumulative effect as a result of construction activities associated with Hornsea Four and other projects ([Table 9.13](#)). For the purposes of this PEIR, this additive impact has been assessed within 40 km from Hornsea Four, which is considered to be the maximum range where the creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore may occur although some impacts are likely to be localised to the Hornsea Four array area. The Tier 1 projects are listed in [Table 9.14](#).
- 9.12.3.2 The offshore oil and gas industry is served by daily helicopter flights from both Humberside and Norwich Airports. Other offshore projects that will contribute to increased helicopter flights in the region of Hornsea Four include Hornsea One, Two and Three. The cumulative increase in helicopter operations from the Hornsea offshore projects is noticeable, particularly as flights will be concentrated in a regional area and may impact other users of the airspace including military low flying aircraft and airborne SAR flights.
- 9.12.3.3 The impact is predicted to be of regional spatial extent, short to medium term duration, continuous and not reversible for the lifetime of Hornsea Four. It is predicted that the impact will affect the aviation receptors operating in the airspace directly. The magnitude is therefore, considered to be **moderate**.
- 9.12.3.4 Aviation operations in the UK are highly regulated. The Hornsea Four study area is located in airspace where the provision of an ATS is routine. The same rules of the air which maintain a safe operating environment in the current baseline will apply in the southern North Sea during all phases of Hornsea Four and the provision of the ATS will not be affected.

9.12.3.5 The impact to aviation receptors operating offshore is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptors is therefore, considered to be **low**.

9.12.3.6 Overall, the sensitivity of the receptor is considered to be low and the magnitude of impact is deemed to be moderate. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

### Tier 2

9.12.3.7 There are no Tier 2 developments identified that would result in increased helicopter numbers in shared airspace with Hornsea Four. The assessment for Tier 2 therefore remains the same as for Tier 1 above.

### Tier 3

9.12.3.8 There are no Tier 3 developments identified that would result in increased helicopter numbers in shared airspace with Hornsea Four. The assessment for Tier 3 therefore remains the same as for Tier 1 above.

## **9.12.4 Operation and Maintenance Phase**

### **Wind turbines causing permanent interference on civil and military radar systems.**

9.12.4.1 There is potential for cumulative effect as a result of operational activities associated with Hornsea Four and other projects ([Table 9.13](#)). For the purposes of this PEIR, this additive impact has been assessed within 100 km from Hornsea Four, which is considered to be the maximum range where aviation and radar cumulative effect may occur although some impacts are likely to be localised to the Hornsea Four array area. The projects identified for this tier are listed at [Table 9.14](#).

### Tier 1

9.12.4.2 Theoretical radar LOS analysis for the Claxby PSR and the Trimmingham ADR (see [Volume 5, Annex 9.1: Aviation and Radar Technical Report](#)) indicates that Hornsea Four wind turbines with a tip height of 370 m LAT, would be considered to be detectable (by varying degrees) to the radar systems.

9.12.4.3 Other offshore wind farms that are considered likely to be detected by the radar systems include Hornsea One, Hornsea Two, Hornsea Three, Westermost Rough, Humber Gateway, Triton Knoll, Dogger Bank Creyke Bank A, Dogger Bank Creyke Bank B, Dudgeon, Race Bank, Lincs, Teesside, Inner Dowsing, Sheringham Shoal, Sofia and Lynn. The potential cumulative effect will be to add to the radar clutter and possibly an increase in the individual signal processing demands of the three radar systems.

- 9.12.4.4 The impact is predicted to be of regional spatial extent, medium term duration, intermittent and not reversible for the lifetime of Hornsea Four. It is predicted that the impact will affect the receptor directly. The magnitude is considered to be moderate.
- 9.12.4.5 Although there appears to be a large cumulative impact, it should be noted that the listed Tier 1 wind farms have all agreed mitigation with NERL and MOD. Therefore, when considering cumulative mitigation, it is more a case of considering cumulative effect on mitigation availability rather than a direct cumulative effect on radar systems.
- 9.12.4.6 Both NERL and the MOD aim to ensure 'clutter free' radar to continue to deliver a safe and effective ATS and to monitor UK airspace. The radar stakeholders are considered to be of high vulnerability, low recoverability and high value. The sensitivity of these receptor is therefore, considered to be High.
- 9.12.4.7 Overall, the sensitivity of all of the receptors considered is considered to be high and the magnitude of the impact is deemed to be minor. The effect for all of the receptors considered will, therefore, be of moderate significance.

#### Tier 2

- 9.12.4.8 There are no Tier 2 developments identified that would result in increased radar impact to radar systems. The assessment for Tier 2 therefore remains the same as for Tier 1 above.

#### Tier 3

- 9.12.4.9 In addition to the Tier 1 projects noted in [paragraph 9.12.4.3](#) above, the Dudgeon Extension and Race Bank Extension may also be detectable by the three radar systems and may add a degree of radar clutter and an increase in signal processing demands.

### **9.13 Transboundary effects**

- 9.13.1.1 Transboundary effects are defined as those effects upon the receiving environment of other European Economic Area (EEA) states, whether occurring from Hornsea Four alone or cumulatively with other projects in the wider area. A transboundary screening exercise was undertaken at Scoping (Annex K of the Scoping Report), which identified that there was potential for significant transboundary effects to occur in relation to aviation and radar.
- 9.13.1.2 There is the potential for transboundary impacts to arise from the presence of the wind turbines during the operation and maintenance phase disrupting civil and military radar coverage from The Netherlands. The probability of impact (due to radar detectability of the Hornsea Four wind turbines) is low due to the range of applicable Netherlands radar systems from the Hornsea Four array area, although the extent cannot be determined at this stage. Applicable Netherlands radar systems are operated by the Dutch Ministerie Van Defensie (Netherlands MOD) and Luchtverkeersleiding Nederland (LVNL) (the

Netherlands equivalent of UK NATS); both agencies will be consulted to establish if Hornsea Four will impact Netherlands radar and infrastructure.

9.13.1.3 This effect could occur over a range of approximately 84 km from Hornsea Four and could therefore interact with The Netherlands radar systems. Overall, the sensitivity of the receptor is considered to be **low** and the magnitude of the impact is deemed to be **negligible**.

9.13.1.4 Therefore, the potential transboundary impact of disruption of civil and military aviation radar coverage interference on aviation and radar is concluded to be of **negligible** significance, and therefore, subject to the results of consultation, is considered to be not significant in EIA terms.

## 9.14 Inter-related effects

9.14.1.1 Inter-related effects consider impacts from the construction, operation or decommissioning of Hornsea Four on the same receptor (or group). The potential inter-related effects that could arise in relation to aviation and radar are presented in [Table 9.15](#). Such inter-related effects include both:

- Project lifetime effects: i.e. those arising throughout more than one phase of the project (construction, operation, and decommissioning) to interact to potentially create a more significant effect on a receptor than if just one phase were assessed in isolation; and
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor (or group). Receptor-led effects might be short term, temporary or transient effects, or incorporate longer term effects.

9.14.1.2 A description of the process to identify and assess these effects is presented in [Section 5.8](#) of [Volume 1, Chapter 5: Environmental Impact Assessment Methodology](#).

**Table 9.15: Inter-related effects assessment for aviation and radar.**

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
<i>Project-lifetime effects</i>			
Construction, operation and decommissioning.	Creation of an aviation obstacle.	Minor adverse	Aircraft operating at a level to be in conflict with the Hornsea Four offshore array area will be impacted by construction and decommissioning infrastructure and wind turbines across all project phases. Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter and will be notified of all project phases through notification procedures outlined in <a href="#">Section 9.7.3</a> . Therefore, across the project lifetime, the effects on aviation and radar receptors are not

Project phase(s)	Nature of inter-related effect	Assessment alone	Inter-related effects assessment
			anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.
Construction and operation	Increased air traffic related to wind farm activities may affect the available airspace for other users.	Minor adverse	Helicopters will be used during the construction, operational and maintenance and decommissioning phases of Hornsea Four and these flights would be in addition to existing helicopter traffic levels in the southern North Sea. The effect can be considered to be continuous across all project phases however only construction and operation and maintenance are considered here. Helicopter flights in the UK are highly regulated. The same rules of the air and ATC services will continue to apply to helicopter operators within the southern North Sea and the provision of a service to Hornsea Four support helicopters is not considered to affect the provision of a service to another user of the airspace. Therefore, across the project lifetime, the effects on aviation and radar receptors are not anticipated to interact in such a way as to result in combined effects of greater significance than the assessments presented for each individual phase.

### Receptor-led effects

The interaction of other aircraft operating at low level with wind farm infrastructure and increased air traffic related to wind farm activities.	The greatest potential for spatial and temporal interactions is likely to occur due to interaction of an aviation obstacle and the reduction of airspace due to increased wind farm related air traffic for other users. The individual standalone impacts were assigned significance of minor adverse. ATS provision and the rules of air, including the see and be seen principle, will mean reduced potential for interaction between inter-related effects. It is therefore anticipated the significance of these combined effects on airspace users will not be of any greater significance than the effects when assessed in isolation (i.e. minor adverse).
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9.14.1.3 There are no inter-related effects that are of greater significance than those assessed in isolation.

### 9.14.2 Notification of Activity

9.14.2.1 RenewableUK advise members that it is good practice to notify aviation stakeholders of the location and dimension of a wind energy development and the associated construction activities. Information regarding construction should be passed to DGC and the General Aviation Awareness Council (GAAC) at least ten weeks in advance of the erection of the first wind turbine and to follow up on the day with a confirmation that the activity has taken place. The data should include:

- Location, height (of all structures over 150 ft, dates of erection, dates of removal and lighting type (none, infra-red or lighting brightness); and
- Local aerodromes identified during consultation should be notified, particularly any police helicopter or air ambulance unit.

9.14.2.2 Information should be circulated to relevant aviation stakeholders including NATS and the MOD. Information on potential aviation obstructions would be promulgated within the UK IAIP (NATS 2019) and notified to DGC for marking on aeronautical related charts and documentation.

## 9.15 Conclusion and summary

9.15.1.1 **Table 9.16** presents a summary of the significant impacts assessed within this PEIR, any mitigation and the residual effects.

**Table 9.16: Summary of potential impacts assessed for aviation and radar.**

Impact and Phase	Receptor and value/sensitivity	Magnitude and significance	Mitigation	Residual impact
<i>Construction</i>				
Creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-C-2).	Aircraft operating in the vicinity of the Hornsea Four array area Medium	Minor Minor adverse	None proposed beyond existing commitments	Not significant
Increased air traffic in the area related to wind farm activities may affect the available airspace for other users (AV-C-3).	Helicopters operating in support of wind farm activities Low	Moderate Minor adverse	None proposed beyond existing commitments	Not significant
<i>Operation</i>				
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-O-1).	Aircraft operating in the vicinity of the Hornsea Four array area Medium	Minor Minor adverse	None proposed beyond existing commitments	Not significant
Wind turbines causing permanent interference on civil and military radar systems (AV-O-2).	NERL and the MOD High	Moderate Major adverse	NERL – Radar blanking and Airspace Change Proposal MOD – The present position of the MOD regarding mitigation of ADR is discussed in <a href="#">paragraph 9.11.2.18</a> . With agreed mitigation in place impact will be reduced.	Not significant
Wind turbines creating an impact to offshore helicopter operations to oil and gas platforms (AV-O-3).	Oil and Gas platform operators Low	Moderate Minor adverse	None proposed beyond existing commitments	Not significant
Disruption to aircraft using HMRs (AV-O-4).	Helicopter operators operating in support of the oil and gas industry Low	Moderate Minor adverse	None proposed beyond existing commitments	Not significant
<i>Decommissioning</i>				
Creation of aviation obstacle to fixed wing and rotary aircraft operating offshore (AV-D-1).	Aircraft operating in the vicinity of the Hornsea Four array area Medium	Minor Minor adverse	None proposed beyond existing commitments	Not significant

## 9.16 References

DECC (2011a) EN-1 Overarching NPS for Energy

Ørsted (2018) Hornsea Four Scoping Report

CAA (2019a) Licensing of Aerodromes

CAA (2016) CAP 764 Policy and Guidelines on Wind Turbines

NATS (2019) CAP 032 United Kingdom Integrated Aeronautical Information Publication

MOD (2019a) Military Aeronautical Information Package

CAA (2019b) CAP 393 The Air Navigation Order 2016 and Regulations

CAA (2014) CAP 670 Air Traffic Services Safety Requirements

CAA (2018a) CAP 437 Standards for Offshore Helicopter Landing Areas

CAA (2018b) CAP 1616 Airspace Design: Guidance on the Regulatory Process for Changing Airspace Design including Community Engagement Requirements

MOD (2019b) Air Defence Radar Mitigation Update including Annex A (August 2018 release)

MCA (2016) Safety of Navigation: Offshore Renewable Energy Installations OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response

CAA (2018b) CAP 1616 Airspace Design: Guidance on the regulatory process for changing airspace design including community engagement requirements