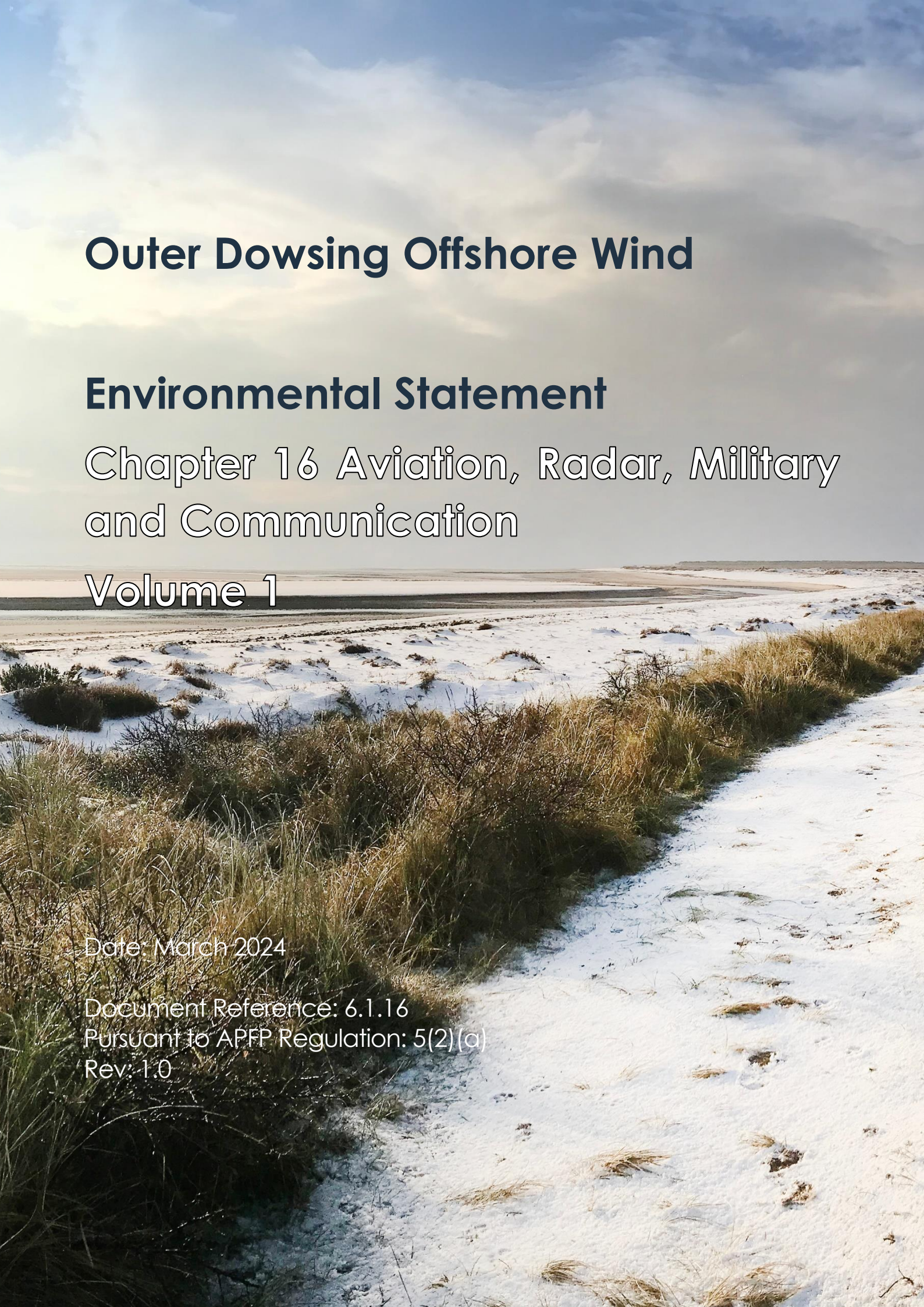

Outer Dowsing Offshore Wind

Environmental Statement

Chapter 16 Aviation, Radar, Military and Communication

Volume 1

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Acronyms & Terminology

Abbreviations/Acronyms

Abbreviation / Acronym	Description
AARA	Air-to-Air Refuelling Area
AD	Air Defence
AD&OW	Air Defence and Offshore Wind
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Service
AMA	Area Minimum Altitude
amsl	above mean sea level
ANO	Air Navigation Order
ANSP	Air Navigation Service Provider
ATA	Aerial Tactics Area
ATC	Air Traffic Control
ATS	Air Traffic Service
ATSOCAS	Air Traffic Services Outside Controlled Airspace
ATSU	Air Traffic Service Unit
AWR	Air Weapons Range
BEIS	Department for Business, Energy and Industrial Strategy (now the Department for Energy Security and Net Zero (DESNZ)
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CNS	Communications, Navigation and Surveillance
CTA	Control Area
DA	Danger Area
DASA	Defence and Security Accelerator
DCO	Development Consent Order
DECC	Department of Energy & Climate Change, now the Department for Energy Security and Net Zero (DESNZ)
DESNZ	Department for Energy Security and Net Zero, formerly Department of Business, Energy and Industrial Strategy (BEIS), which was previously Department of Energy & Climate Change (DECC)
DGC	Defence Geographic Centre
DIO	Defence Infrastructure Organisation
DLUHC	Department for Levelling Up, Housing and Communities
EAP	Early Adopters Programme
ECC	Export Cable Corridor
EEA	European Economic Area
EIA	Environmental Impact Assessment
ERCoP	Emergency Response and Cooperation Plan
ES	Environmental Statement
FIR	Flight Information Region
FL	Flight Level

Abbreviation / Acronym	Description
ft	feet
GASCo	General Aviation Safety Council
GT R4 Ltd	The Applicant. The special project vehicle created in partnership between Corio Generation (a wholly owned Green Investment Group portfolio company), Gulf Energy Development and TotalEnergies
HAT	Highest Astronomical Tide
HMRI	Helicopter Main Route Indicator
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
ILT	Inspectie Leefomgeving en Transport
km	kilometres
LARS	Lower Airspace Radar Service
LAT	Lowest Astronomical Tide
LMP	Lighting and Marking Plan
m	metres
MAA	Military Aviation Authority
MCA	Marine and Coastguard Agency
MDA	Managed Danger Area
MDS	Maximum Design Scenario
MGN	Marine Guidance Note
MOD	Ministry of Defence
NAIZ	Non-Auto Initiation Zone
NERL	NATS (En Route) plc
nm	nautical miles
NOTAM	Notice to Airmen
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NSL	NATS (Services) Limited
O&M	Operation and Maintenance
ODOW	Outer Dowsing Offshore Wind (The Project)
OREI	Offshore Renewable Energy Installation
OWIC	Offshore Wind Industry Council
PADS	Principal Areas of Disagreement Statement
PEIR	Preliminary Environmental Impact Report
PEXA	Practice and Exercise Area
PSR	Primary Surveillance Radar
RAF	Royal Air Force
RLoS	Radar Line of Sight
RRH	Remote Radar Head
S&IP	Strategy and Implementation Plan
SAR	Search and Rescue
SARPs	Standards and Recommended Practices
SMS	Safety Management System

Abbreviation / Acronym	Description
SSR	Secondary Surveillance Radar
TMZ	Transponder Mandatory Zone
TRA	Temporary Reserved Area
UK	United Kingdom
VFR	Visual Flight Rules
WTG	Wind Turbine Generator

Terminology

Term	Definition
Air Navigation Service Provider (ANSP)	A public or private entity managing air traffic on behalf of a company, region or country. NATS is the main ANSP in the UK.
Array area	The area offshore within which the generating station (including wind turbine generators (WTG) and inter-array cables), offshore accommodation platforms, offshore transformer substations and associated cabling will be positioned.
Baseline	The status of the environment at the time of assessment without the development in place.
Controlled airspace	Defined airspace within which pilots must follow Air Traffic Control instructions implicitly. In the UK, Classes A, C, D and E are areas of controlled airspace.
Cumulative effects	The combined effects of the Project acting additively with the effects of other developments, on the same single receptor/resource.
Cumulative impact	Impacts that result from changes caused by other past, present or reasonably foreseeable actions together with the Project.
Deemed Marine Licence (dML)	A marine licence set out in a Schedule to the Development Consent Order and deemed to have been granted under Part 4 (marine licensing) of the Marine and Coastal Access Act 2009.
Development Consent Order (DCO)	An order made under the Planning Act 2008 granting development consent for a Nationally Significant Infrastructure Project (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 sensitivity of the receptor, in accordance with defined significance criteria.
Environmental Impact Assessment (EIA)	A statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. It involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Regulations, including the publication of an Environmental Statement (ES).
Environmental Statement (ES)	The suite of documents that detail the processes and results of the EIA.
Evidence Plan	A voluntary process of stakeholder consultation with appropriate Expert Topic Groups (ETGs) that discusses and, where possible, agrees the detailed approach to the Environmental Impact Assessment (EIA) and information to support Habitats Regulations Assessment (HRA)

Term	Definition
	for those relevant topics included in the process, undertaken during the pre-application period.
Export cables	High voltage cables which transmit power from the Offshore Substations (OSS) to the Onshore Substation (OnSS) via an Offshore Reactive Compensation Platform (ORCP) if required, which may include one or more auxiliary cables (normally fibre optic cables).
Flight Information Region (FIR)	Airspace managed by a controlling authority with responsibility for ensuring air traffic services are provided to aircraft flying within it.
Flight Level (FL)	An aircraft altitude expressed in hundreds of feet at a standard sea level pressure datum of 1013.25 hectopascals.
High Voltage Alternating Current (HVAC)	High voltage alternating current is the bulk transmission of electricity by alternating current (AC), whereby the flow of electric charge periodically reverses direction.
Impact	An impact to the receiving environment is defined as any change to its baseline condition, either adverse or beneficial.
Inter-array cables	Cable which connects the wind turbines to each other and to the offshore substation(s), which may include one or more auxiliary cables (normally fibre optic cables).
Landfall	The location at the land-sea interface where the offshore export cables and fibre optic cables will come ashore.
Maximum Design Scenario	The project design parameters, or a combination of project design parameters that are likely to result in the greatest potential for change in relation to each impact assessed.
Mitigation	Mitigation measures are commitments made by the Project to reduce and/or eliminate the potential for significant effects to arise as a result of the Project. Mitigation measures can be embedded (part of the project design) or secondarily added to reduce impacts in the case of potentially significant effects.
National Policy Statement (NPS)	A document setting out national policy against which proposals for Nationally Significant Infrastructure Projects (NSIPs) will be assessed nand decided upon.
The Offshore Export Cable Corridor (Offshore ECC)	The Offshore Export Cable Corridor (Offshore ECC) is the area within the Order Limits within which the export cables running from the array to Landfall will be situated.
Offshore Reactive Compensation Station (ORCP)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents) housing electrical reactors and switchgear for the purpose of the efficient transfer of power in the course of HVAC transmission by providing reactive compensation.
Offshore Substation (OSS)	A structure attached to the seabed by means of a foundation, with one or more decks and a helicopter platform (including bird deterrents), containing— (a) electrical equipment required to switch, transform, convert electricity generated at the wind turbine generators to a higher voltage and provide reactive power compensation; and (b) housing accommodation, storage, workshop

Term	Definition
	auxiliary equipment, radar and facilities for operating, maintaining and controlling the substation or wind turbine generators.
Order Limits	The area subject to the application for development consent. The limits shown on the works plan within which the Project may be carried out.
Outer Dowsing Offshore Wind (ODOW)	The Project.
Preliminary Environmental Information Report (PEIR)	The PEIR was written in the style of a draft Environmental Statement (ES) and provided information to support and inform the statutory consultation process during the pre-application phase.
Primary Surveillance Radar (PSR)	A radar system that measures the bearing and distance of targets using the detected reflections of radio signals.
Project Design Envelope	A description of the range of possible elements that make up the Project's design options under consideration, as set out in detail in the project description. This envelope is used to define the Project 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.
Receptor	A distinct part of the environment on which effects could occur and can be the subject of specific assessments. Examples of receptors include species (or groups) of animals or plants, people (often categorised further such as 'residential' or those using areas for amenity or recreation), watercourses etc.
Secondary Surveillance Radar (SSR)	A radar system that transmits interrogation pulses and receives transmitted responses from suitably equipped targets.
Study Area	Area(s) within which environmental impact may occur – to be defined on a receptor-by-receptor basis by the relevant technical specialist.
Subsea	Subsea comprises everything existing or occurring below the surface of the sea.
The Applicant	GT R4 Ltd. The Applicant making the application for a DCO. The Applicant is GT R4 Limited (a joint venture between Corio Generation, TotalEnergies and Gulf Energy Development (GULF)), trading as Outer Dowsing Offshore Wind. The Project is being developed by Corio Generation (a wholly owned Green Investment Group portfolio company), TotalEnergies and GULF.
The Planning Inspectorate	The agency responsible for operating the planning process for Nationally Significant Infrastructure Projects (NSIPs).
The Project	Outer Dowsing Offshore Wind, an offshore wind generating station together with associated onshore and offshore infrastructure.
Transboundary impacts	Transboundary effects arise when impacts from the development within one European Economic Area (EEA) state affects the environment of another EEA state(s).

Term	Definition
Uncontrolled Airspace	Defined airspace in which Air Traffic Control does not exercise exclusive authority but may provide basic information services to aircraft in radio contact. In the UK, Class G is uncontrolled airspace.
Wind turbine generator (WTG)	A structure comprising a tower, rotor with three blades connected at the hub, nacelle and ancillary electrical and other equipment which may include J-tube(s), transition piece, access and rest platforms, access ladders, boat access systems, corrosion protection systems, fenders and maintenance equipment, helicopter landing facilities and other associated equipment, fixed to a foundation.

Reference Documentation

Document Number	Title
5.1	Consultation Report
6.1.6	Technical Consultation
6.3.18.1	Helicopter Access Report

16 Aviation, Radar, Military and Communication

16.1 Introduction

1. This chapter of the Environmental Statement (ES) presents the results of the Environmental Impact Assessment (EIA) process for the potential impacts of Outer Dowsing Offshore Wind ("the Project") on Aviation, Radar, Military and Communication. Specifically, this chapter considers the potential impact of the Project on aviation, radar, military and communication receptors during the construction, operation and maintenance, and decommissioning phases.
2. Potential receptors include the aviation interests of the United Kingdom (UK) Civil Aviation Authority (CAA), Ministry of Defence (MOD), regional airports, local aerodromes, NATS (that currently comprises NATS (En Route) plc (NERL) and NATS (Services) Limited (NSL)), and other UK aviation stakeholders.
3. GT R4 Limited (trading as Outer Dowsing Offshore Wind) hereafter referred to as the 'Applicant', is proposing to develop the Project. The Project will be located approximately 54km from the Lincolnshire coastline in the southern North Sea. The Project will include both offshore and onshore infrastructure including an offshore generating station (windfarm), export cables to Landfall, onshore cables, connection to the electricity transmission network, and ancillary and associated development (see Volume 1, Chapter 3: Project Description for full details). The Project also includes areas for the potential delivery of compensation measures if these are deemed to be required.
4. This chapter has been written by Cyrrus Limited, with the assessment undertaken with specific reference to the relevant legislation and guidance, of which the primary sources are the National Policy Statements (NPS). Details of these and the methodology used for the Environmental Impact Assessment (EIA) are presented in sections 16.2 and 16.6.
5. This chapter should be read alongside the following chapters and documents:
   - Volume 1, Chapter 15: Shipping and Navigation (due to marine activities associated with Search and Rescue (SAR) operations);
   - Volume 1, Chapter 17: Seascape, Landscape and Visual Assessment (due to the impact of aviation lighting);
   - Volume 1, Chapter 18: Infrastructure and Other Marine Users (which includes detailed assessment of impacts on helicopter access to oil and gas platforms); and
   - Volume 3, Appendix 16.1: Airspace Technical Report.
6. Appendix 16.1 identifies the radars liable to detect Wind Turbine Generators (WTGs) within the array area and gives details of the Radar Line of Sight (RLoS) analyses. It also sets out a detailed analysis of the airspace occupied by the array area and summarises the effects that the Project is likely to have on aviation activities in the vicinity.

16.2 Statutory and Policy Context

7. The Air Navigation Order 2016/765 (CAA, 2022) implements the UK's obligations under the Convention on International Civil Aviation (Chicago Convention) (1944) and regulates aspects of aviation safety. It provides regulatory and enforcement powers for the CAA needed in respect of retained aviation safety legislation and includes the application of lighting to WTGs in UK territorial waters.
8. The assessment of potential significant effects upon aviation, radar, military and communication has been made with specific reference to the relevant NPS. These are the principal decision making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to the Project and aviation are:
   - Overarching NPS for Energy (EN-1) (Department for Energy Security and Net Zero (DESNZ), 2023); and
   - NPS for Renewable Energy Infrastructure (EN-3) (DESNZ, 2023a).
9. The relevant legislation and planning policy for offshore renewable energy NSIPs, specifically in relation to aviation, is outlined in Table 16.1 below:

Table 16.1 Legislation and policy context

Legislation/policy	Key provisions	Section where comment addressed
Air Navigation Order (ANO) 2016/765 (2022)	Article 222 details the requirements for the lighting of en route obstacles that are 150 metres (m) or more above ground level.	Lighting is addressed in section 16.5.3.2 and Table 16.5.
	Article 223 modifies the requirements of Article 222 with respect to WTGs in UK territorial waters of 60m or more above the level of the sea at the highest astronomical tide.	
	Article 225A details the requirements for notifying the CAA of any planned works to erect new en route obstacles that are 100m or more above sea level.	Notification of en route obstacles is addressed in section 16.5.3.1 and Table 16.5.
Overarching National Policy Statement for Energy (NPS EN-1) (2023)	Paragraph 5.5.37: Where the proposed development may affect the performance of civil or military aviation CNS [Communications, Navigation and Surveillance], meteorological radars and/or	Potential effects are set out in section 16.5.

Legislation/policy	Key provisions	Section where comment addressed
	other defence assets an assessment of potential effects should be set out in the ES.	
	Paragraph 5.5.39: The applicant should consult the MOD, Met Office, Civil Aviation Authority (CAA), NATS and any aerodrome – licensed or otherwise – likely to be affected by the proposed development in preparing an assessment of the proposal on aviation, meteorological or other defence interests.	Consultation undertaken with relevant civil and military aviation stakeholders is detailed in section 16.3.
	Paragraph 5.5.40: Any assessment of effects on aviation, meteorological or other defence interests should include potential impacts of the project upon the operation of CNS infrastructure, flight patterns (both civil and military), generation of weather warnings and forecasts, other defence assets (including radar) and aerodrome operational procedures. It should also assess the demonstratable cumulative effects of the project with other relevant projects in relation to aviation, meteorological and defence.	Effects on civil and military aviation during the Project phases are assessed in section 16.7. Cumulative impacts are assessed in Section 16.8.
	Paragraph 5.5.53: If there are conflicts between the government's energy and transport policies and military interests in relation to the application, the Secretary of State should expect the relevant parties to have made appropriate efforts to work together to identify realistic and pragmatic solutions to the conflicts. In so doing, the parties	Potential mitigation for impacts on military radars are discussed in paragraphs 125 to 137. Engagement with the MOD will continue throughout the Development Consent Order (DCO) pre-application phase.

Legislation/policy	Key provisions	Section where comment addressed
	should seek to protect the aims and interests of the other parties as far as possible, recognising simultaneously the evolving landscape in terms of the UK's energy security and the need to tackle climate change, which necessitates the installation of wind turbines and the need to maintain air safety and national defence and the national weather warning service.	
	Paragraphs 5.5.54 and 5.5.55: There are statutory requirements concerning lighting to tall structures. Where lighting is requested on structures that goes beyond statutory requirements by any of the relevant aviation and defence consultees, the Secretary of State should be satisfied 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. Lighting must also be designed in such a way as to ensure that there is no glare or dazzle to pilots and/or ATC, aerodrome ground lighting is not obscured and that any lighting does not diminish the effectiveness of aeronautical ground lighting and cannot be confused with aeronautical lighting. Lighting may also need to be compatible with night vision devices for military low flying purposes.	Marking and lighting requirements are discussed in section 16.5.3.2. In accordance with ANO Article 223, lighting intensity will be reduced at and below the horizontal and further reduced when visibility in all directions from every WTG is more than 5km.

Legislation/policy	Key provisions	Section where comment addressed
	Paragraph 5.5.59 and 5.5.60: Where, after reasonable mitigation, operational changes, obligations and requirements have been proposed, the Secretary of State should consider whether: ▪ a development would prevent a licensed aerodrome from maintaining its licence and the operational loss of the said aerodrome would have impacts on national security and defence, or result in substantial local/national economic loss, or emergency service needs ▪ it would cause harm to aerodromes' training or emergency service needs ▪ the development would impede or compromise the safe and effective use of defence assets or unacceptably limit military training ▪ the development would have a negative impact on the safe and efficient provision of en-route air traffic control services for civil aviation, in particular through an adverse effect on CNS infrastructure ▪ the development would compromise the effective provision of weather warnings by the NSWWS [National	The Project has the potential to generate clutter on radar displays and thus have an effect on the safe and efficient provision of en route air traffic control services for civil aviation. However, mitigation options are available as outlined in paragraph 123. Once mitigation has been implemented, there will be no significant effects on any of the stated infrastructure or services.

Legislation/policy	Key provisions	Section where comment addressed
	Severe Weather Warning Service], or flood warnings by the UK's flood agencies Provided that the Secretary of State is satisfied that the impacts of proposed energy developments do not present risks to national security and physical safety, and where they do, provided that the Secretary of State is satisfied that appropriate mitigation can be achieved, or appropriate requirements can be attached to any Development Consent Order to secure those mitigations, consent may be granted.	
National Policy Statement for Renewable Energy Infrastructure (NPS EN-3) (2023)	Paragraph 2.8.240: Aviation and navigation lighting should be minimised and/or on demand to avoid attracting birds, taking into account impacts on safety.	Proposed lighting is discussed in section 16.5.3.2. In accordance with ANO Article 223, lighting intensity will be reduced at and below the horizontal and further reduced when visibility in all directions from every WTG is more than 5km.
	Paragraphs 2.8.261 to 2.8.262: Detailed discussions between the applicant for the offshore windfarm and the relevant consultees should have progressed as far as reasonably possible prior to the submission of an application. As such, appropriate mitigation should be included in any application, and ideally agreed between relevant parties. In some circumstances, the Secretary of State may wish to consider the potential to use requirements involving arbitration as a means of	Further engagement with NATS, the MOD and other relevant aviation stakeholders will continue throughout the EIA process in order to agree appropriate mitigations prior to application submission.

Legislation/policy	Key provisions	Section where comment addressed
	resolving how adverse impacts on other commercial activities will be addressed.	
	Paragraphs 2.8.342 to 2.8.344: Where a proposed offshore windfarm potentially affects other offshore infrastructure or activity, a pragmatic approach should be employed by the Secretary of State. Much of this infrastructure is important to other offshore industries as is its contribution to the UK economy. In such circumstances, the Secretary of State should expect the applicant to work with the impacted sector to minimise negative impacts and reduce risks to as low as reasonably practicable.	Potential effects during the various phases are assessed in section 16.7. Negative impacts will be minimised and risks reduced through the embedded mitigation measures outlined in section 16.1.1 and by continuing engagement with relevant stakeholders to agree any appropriate additional mitigation measures.
	Paragraphs 2.8.345 to 2.8.346: As such, the Secretary of State should be satisfied that the site selection and site design of a proposed offshore windfarm and offshore transmission has been made with a view to avoiding or minimising disruption or economic loss or any adverse effect on safety to other offshore industries. Applicants will be required to demonstrate that risks to safety will be reduced to as low as reasonably practicable. The Secretary of State should not consent applications which pose intolerable risks to safety after mitigation measures have been considered.	Potential effects on offshore helicopter operations are assessed in section 16.7. Consultation with relevant platform operators and offshore helicopter operators is ongoing to ensure offshore oil and gas operations in the vicinity of the array area are not unduly affected.
	Paragraph 2.8.348: Providing proposed schemes have been carefully designed,	Embedded mitigation measures are outlined in section 16.1.1

Legislation/policy	Key provisions	Section where comment addressed
	and that the necessary consultation with relevant bodies and stakeholders has been undertaken at an early stage, mitigation measures may be possible to negate or reduce effects on other offshore infrastructure or operations to a level sufficient to enable the Secretary of State to grant consent.	and further mitigation measures are discussed in section 16.7.

10. In addition to the relevant legislation and NPSs, there are a number of applicable guidance documents to inform the assessment of Aviation, Radar, Military and Communication. These include:

- Civil Aviation Publication (CAP) 168: Licensing of Aerodromes (CAA, 2022) sets out the standards required at UK licensed aerodromes relating to management systems, operational procedures, physical characteristics, assessment and treatment of obstacles and visual aids;
- CAP 764: Policy and Guidelines on Wind Turbines (CAA, 2016) details the CAA policy and guidelines associated with wind turbine impacts on aviation that aviation stakeholders and wind energy developers need to consider when assessing a development's viability;
- CAP 670: Air Traffic Services Safety Requirements (CAA, 2019) sets out the safety regulatory framework and highlights the requirements to be met by providers of civil air traffic services and other services in the UK in order to ensure that those services are safe for use by aircraft;
- CAP 1616: Airspace Change (CAA, 2021) explains the CAA's regulatory process for changes to airspace;
- CAP 437: Standards for Offshore Helicopter Landing Areas (CAA, 2023) provides the criteria applied by the CAA in assessing offshore helicopter landing areas for worldwide use by helicopters registered in the UK, and includes winching area 'best practice' design criteria for wind turbine platforms;
- CAP 032: UK Aeronautical Information Publication (AIP) (CAA, 2023) is the main resource for information on facilities, services and flight procedures at all licensed UK airports, as well as UK airspace rules, regulations and restrictions, en route procedures, charts and other air navigation information;
- UK Military AIP (MOD, 2023) is the main resource for information and flight procedures at all military aerodromes;
- Military low flying in the United Kingdom: the essential facts (MOD, 2017);
- MOD Obstruction Lighting Guidance (Low Flying Operations Flight, 2020) details MOD requirements for the lighting of offshore developments;

- Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021) highlights issues to consider when assessing navigational safety and emergency response, caused by OREI developments;
- MCA document: Offshore Renewable Energy Installations: Requirements, Guidance and Operational Considerations for SAR and Emergency Response (MCA, 2021) forms part of MGN 654 Annex 5; and
- International Civil Aviation Organisation (ICAO) Annex 14: Aerodrome Design and Operations (ICAO, 2022) includes recommendations for marking and lighting of wind turbines.

16.3 Consultation

11. Consultation is a key part of the Development Consent Order (DCO) application process. Consultation regarding the LVIA has been conducted through the following processes:
    - Evidence Plan Process (EPP) including Expert Topic Group (ETG) meetings; [NOTE: If relevant to chapter]
    - EIA scoping process (ODOW, 2022);
    - Bilateral engagement with relevant stakeholders;
    - Section 47 consultation process (all public consultation phases including phase 1 and 1a); and,
    - Section 42 consultation process (Phase 2 Consultation, the Autumn Consultation and the Targeted Winter Consultation).
12. An overview of the Project's consultation process with reference to technical considerations is presented within Volume 1, Chapter 6: Technical Consultation (document reference 6.1.6). Further information on the Project's consultation phases can be found in the Project's Consultation Report (document reference 5.1).
13. Consultation is a key part of the DCO application process. Consultation regarding aviation, radar, military and communication has been conducted through the EIA scoping process (Outer Dowsing Offshore Wind, 2022) and the statutory pre-application consultation process, informed by the Preliminary Environmental Information Report (PEIR) (Outer Dowsing Offshore Wind, 2023). An overview of the consultation undertaken by the Project is presented in the Technical Consultation chapter (document reference 6.1.6) with full details of consultation received and responses provided presented in the Consultation Report (document reference 5.1).
14. A summary of the key issues raised during consultation specific to aviation, radar, military and communication, is outlined in Table 16.2 below, together with how these issues have been considered in the production of this ES.

Table 16.2 Summary of consultation relating to aviation, radar, military and communication

Date	Consultation and key issues raised	Section where comment addressed
Scoping Opinion		
MOD 30/08/22	Wind turbine development has the potential to affect, and be detectable by, radar systems and can have a significant and detrimental impact on the capability and operation of such systems. At paragraph 7.10.33, the report identifies the nearest primary radar-equipped military airfields to the proposed development. It is identified that the development would not be visible to primary surveillance radars used to enable air traffic services.	As WTGs will not be visible to primary radar-equipped military airfields these impacts are scoped out of assessment (see section 16.5.1.2).
MOD 30/08/22	The visibility of the development to Air Defence Radar (ADR) is acknowledged at paragraph 7.10.35 which identifies the position of the application site relative to Remote Radar Head (RRH) Staxton Wold and RRH Trimingham. It should be noted that the development proposed would also be detectable by RRH Neatishead. The impact of the development on those radars should be considered as the design is progressed and any impact will need to be mitigated, it will be for the applicant to provide appropriate technical mitigation(s).	Impacts on Staxton Wold and Neatishead radars scoped into the assessment (section 16.5.1.1) and mitigation are discussed in paragraphs 125 to 137. Since the Scoping phase, RRH Trimingham has been decommissioned and removed and is therefore not considered further.
MOD 30/08/22	Paragraphs 7.10.28 and 7.10.31 acknowledge that the offshore array may fall wholly or partially within the Southern Managed Danger Area (specifically EGD323E) and Air to Air Refuelling Area 8. The lower vertical limits of blocks of danger area airspace are also noted.	Military airspace is addressed in section 16.4.3.3.
MOD 30/08/22	The proximity of Danger Areas associated with Air Weapons Ranges at Donna Nook (EGD307) and Holbeach (EGD207) are also noted, along with their parameters, in paragraph	Military airspace is addressed in section 16.4.3.3.

Date	Consultation and key issues raised	Section where comment addressed
	7.10.29. Similarly, the context provided by The Wash North and South Aerial Tactics Areas (ATAs) along with their vertical limits is set out at paragraph 7.10.32.	
MOD 30/08/22	The applicant should be advised to take account of the current published MOD Practice and Exercise Areas (PEXA) in preparation of their development proposal. The MOD has highly surveyed routes in the locality which may be relevant to the installation of the array & associated infrastructure. With the information provided at this time the area of search for the cable route falls within both the Donna Nook & Holbeach Air Weapons Range. Preparation of any cable route undertaken will need to be compatible with the operation of the Air Weapon Ranges. The MOD would need to be consulted at the next stage of this application when further information in respect of the agreed export cable route is available.	The Export Cable Corridor (Offshore ECC) will now be outside the Air Weapons Ranges and therefore the impact is scoped out of the assessment (see section 16.5.1.2).
MOD 30/08/22	With regard to aviation safety, the requirement to install aviation safety lighting on the turbines proposed is set out in paragraphs 7.10.54 and 7.10.57. In addition to the MOD accredited aviation safety lighting, the MOD will also require that sufficient information is submitted to ensure accurate marking of the development on aeronautical charts.	Charting, marking and lighting is addressed in section 16.5.3.2.
The Planning Inspectorate 09/09/22 ID 3.10.1 Impact on civil and military Primary	The Planning Inspectorate accepts that interference with PSRs from the presence of wind turbines will relate primarily to the operational phase. However, the Applicant should ensure that consultation with relevant operators addresses potential effects from the presence of turbine towers and WTGs in the final phases of construction or testing phase prior to operation. The ES should assess any potential likely	Potential PSR impacts during the construction phase are discussed in section 16.5.1.2. Any required radar mitigations will be in place before construction commences.

Date	Consultation and key issues raised	Section where comment addressed
Surveillance Radar (PSR) systems – Construction	significant effects, where they could occur, and identify the need for mitigation or control measures and how these would be secured.	
The Planning Inspectorate 09/09/22 ID 3.10.2 Impacts from the offshore export cable – Construction, O&M, and Decommissioning	The description of this matter and the justification in the Scoping Report to scope out impacts from the construction of the offshore export cable is brief; however, the Planning Inspectorate also notes from Table 7.10.2 (matters scoped in) that potential impacts on Donna Nook Air Weapons Range activities during installation of the offshore export cable are proposed to be scoped into the impact assessment. The Planning Inspectorate agrees that other impacts from the offshore export cable during construction, O&M and decommissioning can be scoped out of the ES on the basis that the offshore export cable would be below the water surface, making it unlikely to result in significant effects to military and civil aviation during the construction, O&M and decommissioning of the Proposed Development.	The ECC will now be outside the Air Weapons Ranges and therefore the impact is scoped out of the assessment (see section 16.5.1.2).
The Planning Inspectorate 09/09/22 ID 3.10.3 Impact on civil and military Secondary Surveillance Radar (SSR) systems - Operation	The Scoping Report states that there are no SSR systems within 10km of the Proposed Development. The Planning Inspectorate considers that, in accordance with Civil Aviation Authority (CAA) Guidance: CAA Policy and Guidelines on Wind Turbines, potential interference to SSR systems is unlikely to be significant and therefore agrees that this matter can be scoped out. The Applicant is however directed to point 3.10.11 of this Opinion below.	Impacts on SSR systems are scoped out of the assessment in section 16.5.1.2.

Date	Consultation and key issues raised	Section where comment addressed
The Planning Inspectorate 09/09/22 ID 3.10.4 Impact on Humberside Airport PSR and Norwich Airport PSR - Operation	The Scoping Report proposes to scope this matter out of the ES on the basis that the airspace in the vicinity of the wind turbine array is not operationally significant to Humberside Airport and Norwich Airport PSR. Considering both the Humberside Airport PSR and Norwich Airport PSR are located approximately 90km (48nm) from the array area and beyond the Lower Airspace Radar Service (LARS) 30nm service radius, the Planning Inspectorate agrees that potential impacts to the Humberside Airport PSR and Norwich Airport PSR are unlikely and therefore agrees that this matter can be scoped out. The Applicant is however directed to point 3.10.12 of this Opinion below.	Impacts on Humberside Airport and Norwich Airport PSRs are scoped out of the assessment in section 16.5.1.2.
The Planning Inspectorate 09/09/22 ID 3.10.5 Impact on Royal Air Force (RAF) Coningsby PSR, RAF Marham PSR, and RAF Waddington PSR - Operation	The Scoping Report states that the WTGs will not be visible to RAF Coningsby PSR, RAF Marham PSR, and RAF Waddington PSR and are located considerably beyond the LARS radius for these three RAF sites. The Planning Inspectorate notes the response of the Defence Infrastructure Organisation (DIO) at Appendix 2 to this Opinion, which does not identify concerns with regards to impacts on these RAF PSRs. The Planning Inspectorate therefore agrees that potential impacts to the RAF Coningsby PSR, RAF Marham PSR, and RAF Waddington PSR are unlikely and these matters can be scoped out.	Impacts on RAF Coningsby, RAF Marham and RAF Waddington PSRs are scoped out of the assessment in section 16.5.1.2.
The Planning Inspectorate 09/09/22 ID 3.10.6 Creation of an aviation obstacle	The Scoping Report proposes to scope out effects relating to the creation of an aviation obstacle environment during decommissioning as the existing WTGs will be gradually dismantled and the aviation obstacle environment will be removed. However, given there are potential effects similar to those experienced during construction, for example	This impact is scoped in and assessed in section 16.7.3.1.

Date	Consultation and key issues raised	Section where comment addressed
environment - Decommissioning	related to the involvement of tall crane vessels, the Planning Inspectorate is of the opinion that this matter cannot be scoped out.	
The Planning Inspectorate 09/09/22 ID 3.10.7 Impact on NERL (NATS (En Route) Plc) Radars at Cromer and Claxby, and Ministry of Defence (MOD) Staxton Wold and Trimingham Air Defence (AD) PSR systems - Decommissioning	The Scoping Report seeks to scope this matter out of the ES on the basis that during decommissioning the blades of WTGs will cease rotating and mitigation will be in place until the last WTG ceases to rotate; therefore, the impact on PSRs will gradually reduce until the last WTG ceases operation. The Planning Inspectorate accepts that interference with PSRs from the presence of wind turbines will relate primarily to the operational phase. However, the Applicant should ensure that consultation with relevant operators addresses potential effects from the presence of turbine towers and WTGs in the decommissioning phase. The ES should assess any potential likely significant effects, where they could occur, and identify the need for mitigation or control measures and how these would be secured. The Applicant is also directed to point 3.10.12 of this Opinion below.	Potential PSR impacts during the decommissioning phase are discussed in section 16.5.1.2. Any required radar mitigations will remain in place until the blades of the last WTG stop rotating.
The Planning Inspectorate 09/09/22 ID 3.10.8 Transboundary impacts	The Scoping Report seeks to scope out transboundary impacts on the grounds that the effects on aviation are expected to be localised. Paragraph 7.10.68 states that the nearest Dutch operated airspace is more than 60km east of the Proposed Development. As such the Applicant considers there would be no transboundary effects. The Planning Inspectorate agrees that this matter can be scoped out of further assessment.	Transboundary effects are considered in section 16.10 and scoped out of further assessment.

Date	Consultation and key issues raised	Section where comment addressed
The Planning Inspectorate 09/09/22 ID 3.10.9 Air Weapons Range (AWR)	The Applicant is directed to the response of the DIO at Appendix 2 to this Opinion, which identifies that the AoS for the export cable route also falls within the Holbeach AWR. The Applicant is advised to undertake further consultation with the DIO with regards to the export cable installation and proximity to Military Practice and Exercise Areas (PEXA)/danger areas and take account of the latest MOD PEXA guidance. The ES should consider the potential impact of AWR activities during installation of the offshore export cable, where likely significant effects could occur, and specify any mitigation measures proposed.	The ECC will now be outside the Air Weapons Ranges and therefore the impact is scoped out of the assessment (see section 16.5.1.2).
The Planning Inspectorate 09/09/22 ID 3.10.10 Receptors – MOD Air Defence Radars	As noted in the DIO response at Appendix 2 to this Opinion, the ES should also consider the detectability of the Proposed Development by Remote Radar Head (RRH) Neatishead. The ES should assess the impact of the Proposed Development on this radar and detail any mitigation required.	Impact on Neatishead radar is scoped into the assessment (section 16.5.1.1) and mitigation is discussed in paragraphs 127 to 137.
The Planning Inspectorate 09/09/22 ID 3.10.11 Potential mitigation measures	It is noted that the measures listed include implementing aids to navigation such as lighting. Unless otherwise agreed with relevant stakeholders, the ES should explain how the Proposed Development would be fitted with MOD accredited aviation safety lighting in accordance with the CAA Air Navigation Order 2016.	Lighting requirements are discussed in section 16.5.3.2.
The Planning Inspectorate 09/09/22 ID 3.10.12	The Planning Inspectorate notes the current objection from NATS (En Route) Plc contained at Appendix 2 to this Opinion and requests the Applicant work with NATS (En Route) Plc in effort to reach a satisfactory conclusion to the	Impacts on NATS radars are confirmed in section 16.5.1.1 and are assessed in section 16.7.2.3. Mitigation will be required and will be agreed upon through ongoing consultation with NATS during the Examination phase.

Date	Consultation and key issues raised	Section where comment addressed
NATS (En Route) Safeguarding	operational assessment of impacts to radar safeguarding and NATS technical sites from the Proposed Development, avoiding the potential for any likely significant effects. Where it has not been possible to reach a satisfactory conclusion, the Applicant should ensure that any likely significant effects are assessed in the ES and demonstrate how the position of NATS has been taken into account.	
NATS 12/09/22	Predicted Impact on Claxby RADAR: Using the theory as described in Appendix A and development specific propagation profile it has been determined that the terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is also anticipated.	Impact is confirmed in section 16.5.1.1 and is discussed in section 16.7.2.3.
NATS 12/09/22	Predicted Impact on Cromer RADAR: Using the theory as described in Appendix A and development specific propagation profile it has been determined that the terrain screening available will not adequately attenuate the signal, and therefore this development is likely to cause false primary plots to be generated. A reduction in the RADAR's probability of detection, for real aircraft, is also anticipated.	Impact is confirmed in section 16.5.1.1 and is discussed in section 16.7.2.3
NATS 12/09/22	No impact is anticipated on NATS' navigation aids. No impact is anticipated on NATS' radio communications infrastructure.	Noted.
Phase 2 Consultation (Section 42 consultation on the PEIR)		
MOD 28/07/23	The potential for unexploded ordnance (UXO) to be present within the study area and the necessity for clearance is acknowledged within the Project Description at paragraphs 3.6.73 to 3.6.75. The potential presence of UXO and disposal	UXO surveys are to be undertaken pre-construction are detailed in Volume 1, Chapter 13: Marine and Intertidal Archaeology.

Date	Consultation and key issues raised	Section where comment addressed
	sites should be a consideration during the installation and decommissioning of turbines, cables, and any other infrastructure, or where other intrusive works are necessary.	
MOD 28/07/23	The applicant should be advised to take account of the current published MOD Practice and Exercise Areas (PEXA) in preparation of their development proposal. The MOD has highly surveyed routes in the locality which may be relevant to the installation of the array & associated infrastructure. Preparation of any cable route undertaken will need to be compatible with the operation of the Air Weapon Ranges. The MOD would need to be consulted at the next stage of this application when further information in respect of the agreed export cable route is available.	The ECC will now be outside the Air Weapons Ranges and therefore the impact is scoped out of the assessment (see section 16.5.1.2).
MOD 28/07/23	At paragraph 16.7.15 it is explained that the design of the scheme has been refined and that no part of the export cable would pass through or near the Donna Nook or Holbeach Air Weapons Ranges. This is welcomed by the MOD. The information provided at this time indicates that sections of the Onshore PIER boundary, specifically sections designated WM5, WM6, WM7, WM8, WM9, WM10, WM11, WM12, WM13, WM14, A1, A2, A3, A4, and A5, fall within the safeguarding zone drawn for Air Weapons Ranges at Holbeach and Wainfleet, however the proposed works should not present any safeguarding issues.	Noted.
MOD 28/07/23	A safeguarded microwave link between two masts which provide air traffic services in the area crosses the onshore cable route. This microwave link forms part of the Wide Area Multilateration (WAM) network. The microwave link	Clear line of sight is required between the microwave antennas. Any obstacles within the Fresnel zone will reduce the amount of signal energy at the receiving antenna.

Date	Consultation and key issues raised	Section where comment addressed
	crosses a small section of the onshore cable route just south of The Haven River, south of Fishtoft, as shown on drawing 18 within the Draft Works Plan – Onshore document. The MOD must be consulted on any works within this small section of the onshore cable route to ensure the microwave link is not impeded.	
MOD 28/07/23	The MOD have completed a Radar assessment, and this has confirmed that the development would fall within radar line of sight to the Air Defence radars deployed at RRH Staxton Wold and RRH Neatishead. Specific data and the intention to engage the MOD on potential means to mitigate of the effects of the development on air defence radar is set out in paragraphs 16.7.35 to 16.7.44. At paragraph 16.7.44 it is stated that engagement with the MOD will continue throughout the DCO pre-application phase. MOD would welcome this engagement to address the unacceptable impact the development would have upon the operations and capabilities of Air Defence radars deployed at RRH Staxton Wold and RRH Neatishead.	Impacts on Staxton Wold and Neatishead radars are scoped into the assessment (section 16.5.1.1) and mitigation is discussed in paragraphs 125 to 137. Engagement with the MOD is ongoing through active participation and funding of the industry Offshore Wind Industry Council (OWIC) Aviation Taskforce to put in place suitable mitigation.
MOD 28/07/23	At section 16.5.6 it is noted that the development would have no impact on Air Traffic Control radars deployed at military aerodromes. On the basis of the information available, and noting the indicative nature of the project description, MOD agree with this conclusion. Any variations to the number or height of the turbines proposed may change this position.	Since PEIR, the maximum number of the smallest WTGs has increased from 93 to 100. However, the array area has reduced in size and the blade tip height for the smallest WTGs has decreased. Impacts on RAF Coningsby, RAF Marham and RAF Waddington PSRs are therefore scoped out of assessment in section 16.5.1.2.

Date	Consultation and key issues raised	Section where comment addressed
MOD 28/07/23	The introduction of physical obstructions to low flying aircraft is acknowledged at paragraph 16.5.9. Mitigation during the construction process is to be provided through the use of Notices to Airmen (NOTAMs) and Aeronautical Information Circulars (AICs) as set out in paragraph 16.5.10, in addition paragraphs 16.5.11 and 16.5.12 outline the intention to submit sufficient data to ensure the development is appropriately charted. The MOD will likely request that a requirement is added to any Development Consent Order that might be issued requiring the submission of that data. Example wording is provided below: The undertaker must notify the Defence Infrastructure Organisation Safeguarding, at least 14 days prior to the commencement of the offshore works, in writing of the following information – a. the date of the commencement of construction of the offshore works; b. the date any wind turbine generators are brought into use; c. the maximum height of any construction equipment to be used; d. the maximum heights of any wind turbine generator, meteorological mast, offshore electrical platform and accommodation platform to be constructed; and e. the latitude and longitude of each wind turbine generator, meteorological mast, offshore electrical platform and accommodation platform to be constructed,	Noted. The request from the MOD for a requirement in the DCO is captured in a condition of both the generation assets and transmission assets deemed Marine Licences.

Date	Consultation and key issues raised	Section where comment addressed
	and the Defence Infrastructure Organisation Safeguarding must be notified of any changes to the information supplied under this paragraph and of the completion of the construction of the offshore works.	
MOD 28/07/23	Paragraph 16.5.15 acknowledges that the development will be fitted with 2000cd red visible lights in accordance with the provisions of the Air Navigation Order 2016. The MOD requirement for combination visible and infra-red lighting is acknowledged at paragraph 16.5.18. The draft Development Consent Order (Document ref. 3.1 Rev. V1.0 dated June 2023) contains, at Schedule 1, Part 3, requirement 24 which requires the exhibit of lights in consultation with the DIO Safeguarding team. MOD will likely request that this requirement is supplemented with the following wording: 'Lighting installed specifically to meet Ministry of Defence aviation safety requirements must remain operational for the life of the authorised development unless otherwise agreed in writing with the Ministry of Defence.'	Noted. The supplementary wording requested by the MOD will be included in the DCO.
Orsted Entities Hornsea Project Four Offshore WindFarm 21/07/23	We note the conclusion on the impact of Staxton Wold, Trimingham as not significant. We reserve our position pending further information in this regard.	Noted.
Orsted Entities Race Bank Offshore WindFarm 21/07/23	We would like to understand better from you your proposed radar mitigation solutions to ensure that they do not adversely affect the solutions currently in place for Race Bank (and other WindFarms in the area).	Proposed radar mitigation solutions will consider the possibility of potential adverse effects on existing solutions.

15. As identified in Volume 1, Chapter 3: Project Description and Volume 1, Chapter 4: Site Selection and Alternatives, the Project design envelope has been refined throughout the stages of the Project prior to DCO submission. This process has been reliant on stakeholder consultation feedback.

16.4 Baseline Environment

16.4.1 Study Area

16. In considering the spatial coverage of the aviation, radar, military and communication study area, the overriding factor is the potential for WTGs within the Project array area to have an impact on civil and military radars, taking into account required radar operational ranges. In general, Primary Surveillance Radars (PSRs) installed on civil and military airfields have an operational range of between 40 nautical miles (nm) (74km) and 60nm (111km). All radar equipped airfields within 60nm (111km) of the array area are therefore included in the study area. En route radars operated by NERL and military Air Defence (AD) radars are required to provide coverage at ranges in excess of 60nm (111km) and so all such radars with potential RLoS of WTGs in the array area are also included in the study area.
17. The aviation, radar and military study area for the Project is defined as:
    - The ODOW array area and offshore ECC; and
    - The airspace between the array area and the UK mainland, extending from the MOD AD radar at Staxton Wold to the north, to Norwich Airport to the south.
18. Criteria used to identify receptors within the study area are detailed in the following sections.

16.4.1.1 Civil Aerodromes

19. CAP 764 Policy and Guidelines on Wind Turbines (CAA, 2016) states the distances from various types of aerodromes where consultation should take place. These distances include:
    - Aerodromes with a surveillance radar – 30km;
    - Non-radar equipped licensed aerodromes with a runway of 1,100m or more – 17km;
    - Licensed aerodromes where the WTGs will lie within airspace coincidental with any published Instrument Flight Procedure (IFP);
    - Unlicensed aerodromes with runways of more than 800m – 4km;
    - Unlicensed aerodromes with runways of less than 800m – 3km;
    - Gliding sites – 10km; and
    - Other aviation activity such as parachute sites and microlight sites within 3km.
20. CAP 764 goes on to state that these distances are for guidance purposes only and do not represent ranges beyond which all WTG developments will be approved or within which they will always be objected to. For example, aerodromes may utilise their radars at ranges considerably in excess of 30km.

21. As well as examining the technical impact of WTGs on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168 Licensing of Aerodromes (CAA, 2022) to determine whether a proposed development will breach obstacle clearance criteria.

16.4.1.2 Ministry of Defence

22. It is necessary to consider the aviation, air defence and other activities of the MOD. This includes:
    - MOD airfields, both radar and non-radar equipped;
    - MOD AD radars; and
    - MOD Practice and Exercise Areas (PEXAs) for both aviation and non-aviation activities.

16.4.1.3 NERL Facilities

23. It is necessary to consider the possible effects of WTGs upon NERL radar systems; a network of primary and secondary radar facilities around the UK.

16.4.1.4 Other Aviation Activities

24. Other aviation activities under consideration include:
    - General military low flying training operations; and
    - Military and civilian 'off-route' fixed-wing and helicopter operations, SAR missions and offshore helicopter operations in support of the oil and gas industry.

16.4.1.5 Meteorological Radio Facilities

25. WTGs have the potential to adversely impact meteorological radio facilities such as weather radar. The Met Office must be consulted when wind turbine proposals are within a 20km radius zone of any of their UK weather radar sites. Maps of relevant consultation zones are provided by the Met Office at the following link: https://www.metoffice.gov.uk/services/business-industry/energy/safeguarding.
26. Airports and radars within the study area that are under consideration are shown in Volume 2, Chapter 16, Figure 16.1.

16.4.2 Data Sources

27. The primary source of aviation related data used during desk-based studies in support of the EIA is the UK AIP. The AIP contains details on airspace and en route procedures as well as charts and other air navigation information. Similarly, the UK Military AIP is the main resource for information and flight procedures at all military aerodromes.

16.4.3 Existing Environment

28. An initial desktop study was undertaken to determine those aviation stakeholders that were likely to be affected by the Project including all radar systems within operational range.

29. The main issue identified is associated with potential WTG interference of PSRs. Due to the physical size of the WTGs proposed, there is also potential for the WTGs to become aviation obstacles or obstructions, particularly to helicopters engaged in offshore operations. This is considered within the impact assessment.
30. CAP 764 advises that WTG effects on Secondary Surveillance Radars (SSRs) can be caused due to the physical blanking and diffracting effects of the WTG towers, depending on the size of the WTGs and the windfarm. However, CAP 764 goes on to say that these effects are typically only a consideration when the WTGs are located close to the SSR, i.e. less than 10km. NATS recommend a safeguarded zone of radius 28km around their SSR facilities. The closest SSR (Cromer) is more than 63km from the array area. As all known SSRs are outside the stipulated parameters by a significant margin they will not be affected by the WTGs and are therefore not considered further.
31. Similarly, there will be no measurable effects upon other terrestrial based aviation Communications, Navigation and Surveillance (CNS) systems as the Project is considerably outside applicable safeguarding limits pertaining to such CNS infrastructure. For example, NATS apply a 10km safeguarded zone around en route navigation aids, and the array area is 54km from the nearest coastline. Therefore, terrestrial CNS infrastructure (other than PSR) is not considered further, as no sites will be affected.

16.4.3.1 Radar Modelling and Airspace Analysis

32. Computer modelling using a contemporary software modelling tool (HTZ communications) has been undertaken to predict if RLoS exists between PSRs and WTGs within the array area, and the likelihood of the rotating WTG blades being detected. This exercise identified those PSRs that could detect the WTGs and has been based on WTGs with a maximum tip height of up to 400m above mean sea level (amsl)[1]. The data obtained from the modelling has been analysed and provides a key input into establishing the degree to which aviation and operations in the area of the windfarm site could be affected and what additional mitigation processes could be employed.
33. The RLoS modelling undertaken is based on generic data as the specific and detailed characteristics of the modelled PSRs are considered commercially sensitive. Therefore, contemporary PSR performance characteristics and publicly available PSR data has been used in lieu. Modelling by radar operators with detailed configuration data may reveal marginally different results. However, confidence is high that the PSR performance characteristics used have a high level of compatibility with actual PSR performance.

[1] Radar modelling was based on tip heights amsl as opposed to above Lowest Astronomical Tides (LAT). A maximum tip height of 403m above LAT is under consideration for the Project and the difference between mean sea level and LAT is between -2.42m and -2.22m within the array area. Hence a maximum height of 400m amsl was assessed.

34. Appendix 16.1 details the computer modelling undertaken and uses the outputs of the modelling to identify potential impacts and, where necessary, to determine potential mitigation strategies for inclusion in this document. Where appropriate, final mitigations will be agreed and implemented with aviation and radar stakeholders. Ongoing consultation with stakeholders will continue as part of the design process for the Project. Appendix 16.1 also provides further details of the airspace analysis undertaken. An overview of the existing civil and military airspace environment is shown in Volume 2, Chapter 16, Figure 16.2 and summarised in the following sections.

16.4.3.2 Civil Aviation

35. The airspace above and adjacent to the array area is used by civil and military aircraft and lies within the London Flight Information Region (FIR) for ATC. This airspace is regulated by the UK CAA. The London FIR is adjacent to the Amsterdam FIR, whose boundary is approximately 126km to the east of the array area and is regulated by the Netherlands Inspectie Leefomgeving en Transport (ILT).
36. Airspace is classified as either controlled or uncontrolled and is divided into a number of classes depending on what kind of Air Traffic Service (ATS) is provided and under what conditions. In the UK there are five classes of airspace: A, C, D, E and G. The first four are controlled airspace classes while Class G is uncontrolled. Within controlled airspace aircraft are monitored and instructed by ATC, whereas in uncontrolled airspace aircraft are not subject to ATC instruction but rather operate according to a simple set of regulations. ATC may still provide information, if requested, to ensure flight safety.
37. Aircraft operate under one of two flight rules: Visual Flight Rules (VFR) or Instrument Flight Rules (IFR). VFR flight is conducted with visual reference to the natural horizon while IFR flight requires reference solely to aircraft instrumentation.
38. From sea level to Flight Level (FL) 195, approximately 19,500 feet (ft) or 5,950m amsl, the airspace in the vicinity of the array area is Class G uncontrolled airspace. This airspace is used predominantly by low level flight operations and generally by aircraft flying under VFR. Under VFR flight the pilot is responsible for maintaining a safe distance from terrain, obstacles, and other aircraft.
39. In uncontrolled airspace, aircraft are not obliged to be in receipt of an ATS, although it is open to pilots to seek Air Traffic Services Outside Controlled Airspace (ATSOCAS) from the designated ATS provider. The extent of the ATSOCAS supplied will depend on the CNS capability of the ATS provider, its workload and any regulatory provisions relating to the carriage of CNS equipment by aircraft (for example, transponders). All aircraft above approximately 10,000ft amsl in the London FIR are required to carry and operate transponders in accordance with national regulations.

40. Above FL195 is Class C controlled airspace in the form of a Temporary Reserved Area (TRA). This airspace, TRA 006, has an upper vertical limit of FL245, approximately 24,500ft amsl, and is available for use by both military and civil aircraft, though its main use is to accommodate VFR military flying activity. The North Sea Control Area (CTA), which comprises CTA 1, 25km to the south, and CTAs 2 and 3 to the east of the array area, is Class A controlled airspace from a minimum level of FL175, approximately 17,500ft, up to FL195, and Class C airspace from FL195 up to FL245, approximately 24,500ft amsl. CTA 2 (GODOS) and CTA 3 (MOLIX) are 96km and 67km respectively from the array area and the provision of ATS within them is delegated to Amsterdam Area Control.
41. To gain access to controlled airspace, a pilot must comply with various mandatory requirements. This includes establishing two-way radio communications with the designated ATC authority for the specified airspace and obtaining permission to enter it. The pilot must then comply with instructions received. In this way, the controllers know of all the air traffic in the defined airspace. The controllers can then take appropriate measures to ensure that standard separation minima are maintained between all known aircraft by using various techniques that may or may not include the use of PSR.
42. Flight procedures in the vicinity of the Project are conducted in accordance with national UK CAA and MOD Standards and Recommended Practices (SARPs) as promulgated in the UK AIP.
43. Given that all aircraft operating above circa 10,000ft amsl are required to be equipped with and operate transponders, the significance of primary radar for the provision of an ATS is more acute in the lower airspace outside of controlled airspace and is especially relevant to helicopter operators.
44. Immediately west and south of the array area is the Greater Wash Transponder Mandatory Zone (TMZ). Within a TMZ the carriage and operation of aircraft transponder equipment is mandatory. This enables such aircraft to be detected and tracked by SSR systems. The Greater Wash TMZ is in the vicinity of a large offshore windfarm complex comprising Race Bank, Triton Knoll, Dudgeon and Sheringham Shoal offshore windfarms and is used to mitigate the impact the associated WTGs have on NERL PSRs. The establishment of a TMZ over the array area is one of the potential mitigation measures to be considered during the Project design process.
45. The only radar-equipped airports within 60nm (111km) of the array area are Humberside Airport, approximately 90km (48nm) to the west, and Norwich Airport, approximately 90km (48nm) south of the array area. Controllers at both airports may provide a Lower Airspace Radar Service (LARS) to aircraft operating outside controlled airspace up to FL100 (approximately 10,000ft amsl) within the limits of radio and radar cover. The maximum range for this service provision is typically within 30nm (56km) of the participating Air Traffic Service Unit (ATSU). The array area is not below airspace coincidental with any published IFPs for either Humberside or Norwich Airport.
46. The nearest major European airport is Schiphol Airport, which lies approximately 250km southeast of the array area and is outside any area of effect.

47. NERL provides en route civil air traffic services within the London FIR. NERL operates a network of radar facilities which provide en route information for both civil and military aircraft. The closest NERL radars to the array area are based at Cromer, 64km to the south, and Claxby, 89km to the west. These radars are utilised by Anglia Radar, a NATS ATSU based at Aberdeen Airport, in the provision of various Flight Information Services to enhance flight safety and expedite SAR operations over the southern North Sea. The services are available to both helicopters operating in support of the offshore oil and gas and renewables industries and other civil and military aircraft transiting the airspace, from sea level to FL65 (approximately 6,500ft amsl).

16.4.3.3 Military Aviation

48. The northern half of the array area lies beneath the Southern Managed Danger Area (MDA), one of four MDA complexes in UK airspace that provide segregated airspace for military flying training. Specifically, the array area is beneath Danger Area (DA) EGD323E which, when activated, has vertical limits from FL50 (approximately 5,000ft amsl) up to FL660 (approximately 66,000ft amsl). The base of the DA airspace is sufficiently clear of array area infrastructure that there is no potential for physical penetration of the airspace. Additionally, the airspace between the array area and the DA base allows for non-military overflights to comply with Minimum Heights regulations without infringement.
49. DAs associated with Air Weapons Range activities off the Lincolnshire coast at Donna Nook (EGD307) and Holbeach (EGD207) lie approximately 44km to the west and 79km to the southwest respectively of the array area. When active, Donna Nook has vertical limits from the surface up to 20,000ft amsl (occasionally notified to 23,000ft amsl) while Holbeach has vertical limits from the surface up to 23,000ft amsl.
50. The cable Landfall will be between the Donna Nook and Holbeach DAs. At its closest point, the ECC boundary will be more than 14km from the Donna Nook airspace and more than 34km from the Holbeach airspace.
51. There are no known further PEXAs, including PEXAs for non-aviation activities, in the vicinity of the array area.
52. The southern half of the array area lies beneath an Air-to-Air Refuelling Area (AARA) designated Area 8, with vertical limits of FL70 (approximately 7,000ft amsl) to FL170 (approximately 17,000ft amsl). Within AARA airspace fuel is transferred from tanker aircraft to receiver aircraft under a radar control service provided by military controllers embedded within the London Area Control Centre at Swanwick, Hampshire.
53. Less than 5km south of the array area are The Wash North and South Aerial Tactics Areas (ATAs). ATAs are defined within the AIP as “an airspace of defined dimensions designated for air combat training, within which high energy manoeuvres are regularly practised by aircraft formations”. Both ATAs have a lower limit of FL50 or approximately 5,000ft amsl.
54. The nearest PSR equipped military airfields to the array area are Royal Air Force (RAF) Coningsby and RAF Waddington, 92km (50nm) and 109km (59nm) respectively to the west, and RAF Marham, 100km (54nm) to the south. Controllers at these stations offer a LARS service to a range of 30nm.

55. The MOD safeguard a network of long range high powered AD radars used to provide the UK with airspace surveillance and security and to fulfil national and international obligations. The nearest MOD AD radars to the array area are based at Remote Radar Head (RRH) Staxton Wold, 119km to the northwest, and at RRH Neatishead, 87km to the south. The Neatishead radar was formerly located at RRH Trimingham and was relocated to its current site in 2023.

16.4.3.4 Helicopter Main Routing Indicators

56. Helicopter Main Routing Indicators (HMRIs) are routes typically and routinely flown by helicopters operating to and from offshore destinations and are promulgated for the purpose of highlighting concentrations of helicopter traffic to other airspace users. HMRI promulgation does not predicate the flow of helicopter traffic. Whilst HMRIs have no airspace status and assume the background airspace classification within which they lie (in the case of the southern North Sea, Class G), they are used by the Air Navigation Service Provider (ANSP) and helicopter operators for flight planning and management purposes. In summary, HMRIs are recognised routes to assist in regularising routings and effectively managing traffic safely and do not comprise controlled airspace.
57. HMRIs have no promulgated lateral dimensions although CAP 764 states that there should be no obstacles within 2nm (3.7km) either side of the route centreline. The 2nm (3.7km) distance is based upon operational experience, the accuracy of navigation systems, and practicality. Such a distance provides time and space for helicopter pilots to descend safely to an operating altitude below the icing level.
58. HMRIs over the southern North Sea are shown in Volume 2, Chapter 16, Figure 16.3. They generally extend vertically from 1,500ft amsl to FL60 (approximately 6,000ft amsl), although icing conditions or other flight safety considerations may require helicopters to operate below 1,500ft amsl. Both HMRI 4 and HMRI 6 pass overhead the array area. All other HMRIs are more than 2nm (3.7km) from the array area.
59. Planned obstacles within 2nm (3.7km) of an HMRI should be consulted upon with the helicopter operators and the ANSP which in this case is Anglia Radar. Anglia Radar is a NATS Air Traffic Service Unit. No concerns have been raised by NATS regarding impacts on HMRI 4 or HMRI 6.
60. The proposed maximum WTG tip height of 400m amsl is equivalent to 1,400ft amsl rounded up to the nearest 100ft, and will present significantly taller obstacles than existing WTGs in the vicinity. Helicopters operating under IFR must maintain at least 1,000ft vertical clearance above the highest obstacles within 5nm, and will therefore need to transit the array area at a minimum altitude of 2,400ft amsl. Under VFR, helicopters must maintain a minimum of 500ft separation from obstacles.
61. The ability of a helicopter to fly higher over WTGs depends on the icing level, and on days of low cloud base helicopters could be required to fly lower and extend their routings around WTG obstacles.

16.4.3.5 Offshore Helidecks

62. To help achieve a safe operating environment, a 9nm (16.7km) consultation zone for planned obstacles exists around offshore helicopter destinations. Within 9nm (16.7km), obstacles such as WTGs can potentially impact upon the feasibility of helicopters to safely fly low visibility or missed approach procedures at the associated helideck site. There are 13 offshore helidecks within 9nm (16.7km) of the array area, as depicted in Volume 2, Chapter 16, Figure 16.3 and listed in Table 16.3. Of these, the Malory and Galahad platforms are within the array area. The Pickerill A and B platforms are also shown within the array area but are in the process of being decommissioned, the topsides having already been removed leaving jacket structures with no helidecks. In addition, Galahad has been declared carbon-free and is expected to be decommissioned within circa three years, and decommissioning programmes have been approved for Amethyst B1D and Ensign Platform.

Table 16.3 Oil and gas platform ranges from array area

Platform	Operator	Range from array area (nm)
Amethyst B1D	Perenco	5.11
Barque PB	Shell	0.75
Barque PL	Shell	3.55
Clipper PH	Shell	7.99
Ensign Platform	Spirit Energy	8.77
Excalibur EA	Perenco	2.13
Galahad	Perenco	Within array area
Lancelot A	Perenco	5.60
Malory	Perenco	Within array area
Waveney	Perenco	8.22
West Sole A (6 Leg)	Perenco	5.41
West Sole B	Perenco	6.58
West Sole C	Perenco	8.88

63. As stated in CAP 764, this zone does not prohibit development, but is a trigger for consultation with offshore helicopter operators, the operators of existing installations and exploration and development locations to determine a solution that maintains safe offshore helicopter operations alongside proposed developments. The CAA advises wind energy lease holders, oil and gas developers, and petroleum licence holders to discuss their development plans with each other to minimise the risks of unanticipated conflict.

64. Helicopter Traffic Zones (HTZs) are established around individual and groups of offshore platforms to notify of helicopters engaged in platform approaches, departures and inter-platform transits. HTZ airspace extends vertically from sea level to 2,000ft amsl and laterally to 1.5nm (2.8km) from the platform helidecks.

16.4.3.6 Search and Rescue

65. SAR operations are a highly specialised undertaking involving not only aviation assets, but also small boats, ships and shore-based personnel. SAR operations are generally carried out in extremely challenging conditions and at all times of the day and night. There are ten helicopter SAR bases, incorporating 22 aircraft, around the UK with Bristow Helicopters providing helicopters and aircrew.
66. The nearest SAR base is at Humberside Airport, approximately 90km west of the array area. Its helicopters can provide rescue services up to approximately 460km away from base.
67. The random nature of people, watercraft or aircraft in distress makes it very difficult to determine the routes taken by SAR aircraft. Fixed wing SAR aircraft would tend to stay at higher altitudes in a command-and-control role during major incidents, whilst helicopters would be used in a low-level role, sometimes in support of small rescue boats.

16.4.3.7 Area Minimum Altitudes

68. A chart of Area Minimum Altitudes (AMAs) across the London and Scottish FIRs is published in the AIP. An AMA provides a minimum obstacle clearance of 1,000ft within a specified area formed by lines of latitude and longitude in half degree steps. This allows pilots of aircraft flying under IFR the reassurance of properly designated obstacle and terrain clearance protection in poor weather conditions.
69. The array area infringes an AMA area of 1,700ft amsl. WTGs with a maximum tip height exceeding 213m (700ft) amsl would require the 1,700ft AMA to be increased to maintain the necessary 1,000ft obstacle clearance protection.

16.4.3.8 Meteorological Radio Facilities

70. The closest Met Office weather radar to the array area is located at Ingham in Lincolnshire, 106km to the west. WTGs within the array area would be significantly beyond the 20km safeguarded zone around the Ingham facility.

16.4.4 Future Baseline

71. Although the aviation industry is under long-term pressure to reduce its contribution to climate change, this is not considered to have significant implications for the aviation and radar baseline parameters discussed above. However, an increasing amount of offshore oil and gas infrastructure in the North Sea is being decommissioned which will potentially reduce the volume of helicopter traffic to and from offshore platforms.

16.5 Basis of Assessment

16.5.1 Scope of the Assessment

72. WTGs have the potential to affect civil and military aviation (fixed-wing and helicopters), either through their physical presence limiting access and affecting safe passage, or through their impacts on PSR systems which can affect the safe provision of an ATS.

73. PSR impacts are caused by the characteristics of rotating WTG blades being similar to aircraft, leading to spurious clutter on ATC radar displays.
74. The creation of a new obstacle environment increases the risk of collision for military low flying aircraft, helicopters in support of the oil and gas industry, and SAR operations.
75. Helicopter traffic as a result of planned activities in support of the Project may raise the overall level of air traffic in the area and increase the likelihood of aircraft-to-aircraft collision.

16.5.1.1 Impacts Scoped in for Assessment

76. The following impacts have been scoped into this assessment:

- Construction:
  - Impact 1: Creation of an aviation obstacle environment. Construction of the windfarm will involve tall crane vessels and the installation of infrastructure above sea level which could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstacles; and
  - Impact 2: Increased air traffic in the area related to windfarm activities. Helicopter traffic associated with the construction phase could impact on existing traffic in the area, increasing the risk of aircraft collision.
- Operation and maintenance:
  - Impact 1: Creation of an aviation obstacle environment. The presence of completed WTGs could pose a physical obstruction to low flying aircraft, increasing the risk of collision or requiring aircraft to fly extended routes to avoid obstacles;
  - Impact 2: Increased air traffic in the area related to windfarm activities. Helicopter traffic associated with maintenance activities could impact on existing traffic in the area, increasing the risk of aircraft collision; and
  - Impact 3: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR systems. To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. PSRs that can see the rotating blades of WTGs can mistake them for aircraft and so present them on ATC radar displays as clutter. Controllers may not be able to distinguish aircraft from the clutter.
    - Cromer PSR: Modelling indicates that all WTGs within the array area, irrespective of blade tip height, will be in RLoS of Cromer PSR and highly likely to be detected;
    - Claxby PSR: Modelling indicates that all WTGs within the array area, irrespective of blade tip height, will be in RLoS of Claxby PSR and highly likely to be detected;
    - Staxton Wold PSR: Modelling indicates that WTGs with a maximum blade tip height of 400m amsl will be in RLoS of Staxton Wold PSR and highly likely to be detected within approximately 60% of the array area. WTGs with a blade tip height of 276m amsl will be in RLoS and highly likely to be detected within approximately 10% of the array area; and

- Neatishead PSR: Modelling indicates that WTGs with a maximum blade tip height of 400m amsl will be in RLoS of Neatishead PSR and highly likely to be detected within approximately 9% of the array area. WTGs with a blade tip height of 276m amsl will not be in RLoS of Neatishead PSR. It is unlikely that 276m tip height WTGs will be detected by Neatishead PSR within the array area.

- Decommissioning:
  - Impact 1: Creation of an aviation obstacle environment. During the decommissioning phase the existing WTGs will be gradually dismantled. This will involve tall crane vessels, similar to the construction phase; and
  - Impact 2: Increased air traffic in the area related to windfarm activities. Helicopter traffic associated with the decommissioning phase could impact on existing traffic in the area, increasing the risk of aircraft collision.

16.5.1.2 Impacts Scoped out of Assessment

77. In line with the Scoping Opinion (The Planning Inspectorate, 2022), Section 42 consultation feedback, and based on the receiving environment, expected parameters of the Project (Volume 1, Chapter 3: Project Description), and expected scale of impact/potential for a pathway for effect on the environment, the following impacts have been scoped out of the assessment:

- Construction:
  - Impact 1: Impact on civil and military PSR systems. To discriminate wanted aircraft targets from unwanted clutter, PSRs ignore static objects and only display moving targets. The rotating blades of WTGs impart a Doppler frequency shift to the reflected radar pulse, which the radar receiver 'sees' as a moving target; these targets are then presented on the radar display as primary radar returns, indistinguishable from those returns originating from aircraft. This is not a steady effect but has dependency on the axis of rotation of the turbine in relation to the radar. Such unwanted radar returns are known as 'clutter'. Until WTG blades in RLoS are allowed to rotate at operational speeds, they will not generate PSR clutter. Similarly, tall construction vessels and cranes that are in RLoS will not be moving fast enough to generate PSR clutter;
  - Impact 2: Impacts from the offshore export cable. The offshore export cable will be below sea level and will have no impact on aviation activities. Surface vessels will not generate any PSR clutter; and
  - Impact 3: Potential impact on Donna Nook and Holbeach Air Weapons Ranges activities during installation of the offshore export cable. The ECC boundary will be more than 14km and 34km respectively from the Donna Nook and Holbeach DAs which are associated with Air Weapons Range activities, thus providing sufficient safe buffers for vessels and personnel engaged in the cable installation.

- Operation and maintenance:
  - Impact 1: Impacts from the offshore export cable. The offshore cable will be below sea level and will have no impact on aviation activities;

- Impact 2: Impact on civil and military SSR systems. NATS do not consider the impact of WTGs on SSR to be material or relevant for turbines that are beyond approximately 28km from their SSR facilities. Furthermore, CAP 764 states that WTG effects on SSR "…are typically only a consideration when the turbines are located very close to the SSR i.e. less than 10 km." The nearest SSR facility, at Cromer, is 63km from the array area;
- Impact 3: Impact on Humberside Airport PSR. RLoS modelling indicates that the WTGs will not be visible to Humberside PSR. The WTGs are considerably beyond the Humberside LARS service radius and the airspace in the vicinity of the array area is not considered to be operationally significant to the airport;
- Impact 4: Impact on Norwich Airport PSR. RLoS modelling indicates that the WTGs will not be visible to Norwich PSR. The WTGs are considerably beyond the Norwich LARS service radius and the airspace in the vicinity of the array area is not considered to be operationally significant to the airport;
- Impact 5: Impact on RAF Coningsby PSR. RLoS modelling indicates that the WTGs will not be visible to Coningsby PSR and the WTGs are considerably beyond the Coningsby LARS service radius;
- Impact 6: Impact on RAF Marham PSR. RLoS modelling indicates that the WTGs will not be visible to Marham PSR and the WTGs are considerably beyond the Marham LARS service radius;
- Impact 7: Impact on RAF Waddington PSR. RLoS modelling indicates that the WTGs will not be visible to Waddington PSR and the WTGs are considerably beyond the Waddington LARS service radius; and
- Impact 8: Impact on RRH Trimingham. The AD PSR has been decommissioned and relocated to the site at RRH Neatishead.
- Impact 9: Impact on Ingham weather radar. At a minimum range of 106km, WTGs within the array area will be significantly beyond the 20km safeguarded zone established around Ingham weather radar, and therefore unlikely to have a significant impact.

- Decommissioning:
  - Impact 1: Impacts from the offshore export cable. The offshore cable will be below sea level and will have no impact on aviation activities; and
  - Impact 2: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR systems. During the decommissioning phase the blades of WTGs will cease rotating, therefore the impact on PSRs will gradually reduce until the last WTG ceases operation. Any mitigations will remain in place until the blades of the last WTG stop rotating. There will be no other specific impacts on PSRs during decommissioning.

16.5.2 Realistic Worst Case Scenario

78. The following section identifies the Maximum Design Scenario (MDS) in environmental terms, defined by the Project design envelope.

Table 16.4 Maximum design scenario for aviation, radar, military and communication for the Project alone

Potential effect	Maximum design scenario assessed	Justification
Construction		
Impact 1: Creation of an aviation obstacle environment.	Maximum of 100 WTGs, or Up to 50 WTGs with a maximum blade tip height of 403m above LAT. The final scenario is likely to be between 50 and 100 WTGs with tip heights between 276m and 400m amsl (403m above LAT). The assessment of impacts is robust for any combination of WTG parameters within these ranges. Maximum of four offshore substations, two offshore reactive compensation platforms, two artificial nesting structures and one offshore accommodation platform. High crane installation vessels.	Maximum number of WTGs, or Maximum number of the tallest WTGs. (Either of the above scenarios could be worst case and both have been assessed for all impacts). Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the array area. Impact starting from a point of zero infrastructure present to full presence over the construction period.
Impact 2: Increased air traffic in the area related to windfarm construction activities.	Maximum number of 384 helicopter return trips during construction phase, including offshore export cables installation.	Helicopter trips as a result of being engaged in works on the Project causing increased likelihood of aircraft to aircraft collision.
Operation and Maintenance		
Impact 1: Creation of an aviation obstacle environment.	Maximum of 100 WTGs, or Up to 50 WTGs with a maximum blade tip height of 403m above LAT. The final scenario is likely to be between 50 and 100 WTGs with tip heights between 276m and 400m amsl (403m above LAT). The assessment of impacts is robust for any	Maximum number of WTGs, or Maximum number of the tallest WTGs. (Either of the above scenarios could be worst case and both have been assessed for all impacts). Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the array area.

Potential effect	Maximum design scenario assessed	Justification
	combination of WTG parameters within these ranges. Maximum of four offshore substations, two offshore reactive compensation platforms, two artificial nesting structures and one offshore accommodation platform.	
Impact 2: Increased air traffic in the area related to windfarm activities.	Maximum number of 2,480 yearly helicopter return trips required for offshore operation and maintenance activities.	Helicopter trips as a result of being engaged in works on the Project causing increased likelihood of aircraft to aircraft collision.
Impact 3: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR systems.	Maximum of 100 WTGs, or Up to 50 WTGs with a maximum blade tip height of 403m above LAT. The final scenario is likely to be between 50 and 100 WTGs with tip heights between 276m and 400m amsl (403m above LAT). The assessment of impacts is robust for any combination of WTG parameters within these ranges.	Maximum number of WTGs, or Maximum number of the tallest WTGs. (Either of the above scenarios could be worst case and both have been assessed for all impacts). ATC may be unable to provide an effective surveillance service due to interference on radar displays. UK AD detection capability and therefore national security could be compromised.
Decommissioning		
Impact 1: Removal of aviation obstacle environment.	Maximum of 100 WTGs, or Up to 50 WTGs with a maximum blade tip height of 403m above LAT. The final scenario is likely to be between 50 and 100 WTGs with tip heights between 276m and 400m amsl (403m above LAT). The assessment of impacts is robust for any combination of WTG parameters within these ranges.	Maximum number of WTGs, or Maximum number of the tallest WTGs. (Either of the above scenarios could be worst case and both have been assessed for all impacts). Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the array area.

Potential effect	Maximum design scenario assessed	Justification
	Maximum of four offshore substations, two offshore reactive compensation platforms, two artificial nesting structures and one offshore accommodation platform. High crane dismantling vessels.	Impact starting from a point of full infrastructure present to zero presence over the decommissioning period.
Impact 2: Increased air traffic in the area related to windfarm decommissioning activities.	Maximum number of 384 helicopter return trips during decommissioning phase including offshore export cables installation.	Helicopter trips as a result of being engaged in works on the Project causing increased likelihood of aircraft to aircraft collision.

16.5.3 Embedded Mitigation

79. Mitigation measures that were identified and adopted as part of the evolution of the Project design (embedded into the Project design) and that are relevant to aviation, radar, military and communication are listed in Table 16.5. General mitigation measures, which would apply to all parts of the Project, are set out first. Thereafter, mitigation measures that would apply specifically to aviation, radar, military and communication issues associated with marking and lighting, and information, notifications and charting, are described separately.

16.5.3.1 Information, Notifications and Charting

80. The Project will create an obstacle environment which can be wholly mitigated by compliance with appropriate international and national requirements for the promulgation of the obstacle locations on charts and in aeronautical documentation, together with the permanent marking and lighting of obstacles.
81. Measures will be adopted at the commencement of works on the Project to ensure that aviation stakeholders are made aware of the creation of a further aviation obstacle environment in the southern North Sea. These measures will include issuing Notices to Airmen (NOTAMs) warning of the establishment of obstacles within the array area and publicity in such aviation publications as the General Aviation Safety Council (GASCo) Flight Safety magazine. Obstacle considerations may include temporary cranes and WTG components being towed from shore to the array area.
82. In accordance with ANO Article 225A, at least eight weeks before construction commences details of the type, position, proposed elevation amsl and height above ground level, and type and colour of any obstacle lighting of each of the completed permanent structures that are 100m or more above ground level will be notified in writing to the CAA together with the scheduled dates of works commencement and completion. The CAA will forward the relevant information to NATS Aeronautical Information Services (AIS) and the MOD Defence Geographic Centre (DGC) for inclusion in the AIP and on relevant civil and military aeronautical charts, as notifiable permanent obstructions. This permanent information will replace the short-term NOTAMs that will continue to be issued to cover the Project until construction has been completed.

16.5.3.2 Marking and Lighting

83. The international marking and lighting requirement, as set out in ICAO Annex 14 (ICAO, 2022), specifies that:

- *"a wind turbine shall be marked and/or lighted if it is determined to be an obstacle."*; and

"the rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study."

84. UK regulations adopt ICAO Annex 14's requirements as to lighting of WTGs but do not require that WTGs follow the ICAO recommendation as to paint colour, although CAP 764 does set out the ICAO recommendation by way of guidance. In terms of marking the WTGs, in keeping with recent practice for offshore windfarms, it is anticipated that Trinity House will require all structures to be painted yellow from the level of Highest Astronomical Tide (HAT) to a height directed by Trinity House (at least 15m), and above the yellow section all WTGs will be painted submarine grey.
85. The Project will be lit in accordance with the ANO. ANO Article 222 defines an 'en route obstacle' as any building, structure or erection, the height of which is 150m or more above ground level and requires these to be lit. Article 223 modifies the Article 222 requirement with respect to offshore WTGs, requiring these to be lit where they exceed 60m above HAT with a medium intensity (2000 candela (cd)) steady red light mounted on the top of each nacelle and requires for limited downward spillage of light. Article 223 allows for the CAA to permit that not all WTGs are so lit. CAP 764 states that the CAA will permit that only WTGs on the periphery of any windfarm need to be equipped with aviation warning lighting and such lighting, where achievable, shall be spaced at longitudinal intervals not exceeding 900m. There is no current routine requirement for offshore obstacles to be fitted with intermediate vertically spaced aviation lighting.
86. CAA guidance has been subject to coordination with maritime agencies to avoid confusion with maritime lighting. To that end, the CAA has indicated that the use of a flashing red Morse Code letter 'W' is likely to be approved to resolve potential issues for the maritime community.
87. A Lighting Management Plan (LMP) must be agreed and implemented in consultation with the CAA.
88. The MCA requires that WTG blade tips are marked in red, together with markings down the blade, to provide a SAR helicopter pilot with a hover reference point as set out in MGN 654 Annex 5 (MCA, 2021). The MCA also requires a lighting scheme comprising 200cd red/infra red lights on the nacelles of non-Article 223 WTGs, to be operated on demand during SAR operations and a WTG shutdown protocol to be applied during rescue situations. An Emergency Response and Cooperation Plan (ERCoP) will be developed and implemented for all phases of the Project, based upon the MCA's standard template. Appropriate lighting will be utilised to facilitate heli-hoisting if undertaken within the array area, as outlined in CAP 437: Standards for Offshore Helicopter Landing Areas (CAA, 2023).
89. To satisfy MOD requirements, the WTGs will also be required to be fitted with infra-red lighting in combination with the ANO Article 223 lights. MOD lighting guidance indicates that provided combination infra-red/2000cd visible red lights are used to light the WTGs required to be lit under ANO Article 223, this satisfies the MOD operational requirement.

16.5.3.3 Regulatory Requirements

90. The Project will occupy uncontrolled (Class G) airspace, therefore the responsibility for avoiding other traffic and obstacles rests with captains of civilian and military aircraft. Thus, logically a pilot will avoid the charted areas, and individually lit WTGs and any other obstacles, laterally or vertically, by the legislated standard minimum separation distance. This is outlined in CAA Official Record Series 4 No. 1496: (UK) Standardised European Rules of the Air – Exceptions to the Minimum Height Requirements (CAA, 2021), which sets out that to avoid persons, vessels, vehicles and structures, pilots must give clearance of a minimum distance of 500ft. This applies equally to the avoidance of WTGs and any other structure.
91. Military operations are subject to separate rules sponsored by the MOD. Pilots of military aircraft will be required to ensure that a Minimum Separation Distance of 250ft from any person, vessel, vehicle, or structure exists whilst operating in the vicinity of the array area. The charting and lighting of the Project should also be taken into account by MOD low flying units and SAR operators.
92. It is assumed that aviation stakeholders will adhere to all relevant CAA and MOD safety guidance in the conduct of their specific operations to ensure safe operations for all users of the airspace above the Project.

Table 16.5 Embedded mitigation relating to aviation, radar, military and communication

Project phase	Mitigation measures embedded into the project design
General	
Regulatory Requirements	Aviation stakeholders will adhere to all relevant CAA and MOD safety guidance to ensure safe operations for all users of the airspace above the Project.
Construction	
Information, notifications and charting	Aviation stakeholders will be made aware of the Project via NOTAMs and obstacle details will be passed to the CAA at least eight weeks before construction commences. CAA will forward the information to MOD DGC and NATS AIS for inclusion in the AIP and on relevant civil and military aeronautical charts.
Marking and lighting	Marking and lighting of obstacles will be in accordance with Article 223, MCA (MGN 654) and MOD requirements.
Operation and Maintenance	
Marking and lighting	Marking and lighting of obstacles will be in accordance with Article 223, MCA (MGN 654) and MOD requirements.
Decommissioning	
Information, notifications and charting	Aviation stakeholders will be made aware of the Project decommissioning via NOTAMs and obstacle details will be passed to the CAA at least eight weeks before decommissioning commences. CAA will forward the information to MOD DGC and NATS AIS for inclusion in the AIP and on relevant civil and military aeronautical charts.

16.6 Assessment Methodology

93. In assessing the significance of the effects from the Project it was necessary to identify whether or not there will be an impact on aviation operations. The aviation industry is highly regulated and subject to numerous mandatory standards, checks and safety requirements (for example CAP 670), many international in nature and requiring the issue of operating licences. In all cases, the sensitivity or magnitude of the impact on operations can only be identified by the appropriate aviation organisation conforming to a Risk Classification Scheme used to quantify and qualify the severity and likelihood of a hazard occurring. A Risk Classification Scheme is a fundamental element of an aviation organisation's Safety Management System (SMS)[2], which must be acceptable to, and approved by, the UK CAA or the Military Aviation Authority (MAA), as appropriate. As such, for the purposes of this assessment, no detailed grading has been made of the magnitude of the impact or sensitivity of the receptor on the basis that any potential reduction in aviation safety cannot be tolerated. Instead, the following definitions of basic significance have been used as defined in Table 16.6. This represents a deviation from the standard methodology presented within Volume 1, Chapter 5: Environmental Impact Assessment Methodology.

Table 16.6 Significance of potential effects definitions

Significance	Definition
Major Significant	Receptor unable to continue safe operations or safe provision of air navigation services (radar) or effective air defence surveillance in the presence of the WTGs. Technical or operational mitigation of the impact is required.
Moderate Significant	Receptor able to continue safe operations but with some restrictions or non-standard mitigation measures in place.
Not Significant	The Project will have little effect on the aviation receptor, or the level of effect will be acceptable to the aviation receptor.
No Change	The Project will have no effect on the aviation receptor and will be acceptable to the aviation receptor.

16.6.1 Assumptions and Limitations

94. No overarching assumptions or limitations have been identified that apply to the assessment for aviation, radar, military and communication. Where routine assumptions have been made in the course of undertaking the assessment, these are noted in section 16.7.

16.7 Impact Assessment

16.7.1 Construction

95. This section presents the assessment of impacts arising from the construction phase of the Project.

[2] An SMS is defined by the CAA as a systematic and proactive approach for managing safety risks.

16.7.1.1 Impact 1: Creation of an Aviation Obstacle Environment

Construction of the windfarm will involve the installation of infrastructure above sea level which could pose a physical obstruction to aircraft utilising the airspace in the vicinity of the array area. From a starting point of no infrastructure within the array area, the infrastructure outlined in

96. Table 16.4 will gradually be installed over the period of the construction phase.

97. Specifically, permanent or temporary obstacles can increase risk to:

- General military low flying training and operations;
- Helicopter traffic transiting to and from offshore oil and gas platform helidecks;
- Helicopters utilising HMRIs 4 and 6; and
- Other offshore fixed-wing and helicopter operations, including those undertaking SAR missions over the southern North Sea.

98. The array area is within an AMA area of 1,700ft amsl. WTGs with a maximum tip height exceeding 213m (700ft) amsl will require the 1,700ft AMA to be increased to maintain the necessary 1,000ft obstacle clearance protection.

Table 16.5Significance of Effect

99. Embedded mitigation in the form of compliance with international and national SARPs with respect to notification, charting, marking, and lighting is summarised in Table 16.5. This will make pilots aware of the addition of infrastructure to the array area, and it is assumed that pilots will comply with aviation regulatory requirements.

100. An ERCoP will be developed and implemented for all phases of the Project.

101. Consultation with relevant platform operators and offshore helicopter operators is ongoing, and will be considered within the layout design process. Appropriate separation between activities will minimise effects on operations.

102. A Helicopter Access Report (document reference 6.3.18.1) details the potential impacts on oil and gas helicopter operations. The assessment indicates a minor logistical impact on helicopter access to the Excalibur Lancelot and West Sole Alpha platforms, and recommends an obstacle free radius of 1nm around the Malory platform and an obstacle free arc of 1nm from the array area to the Barque PB platform. Full SAR helicopter access to installations within and adjacent to the array area will still be available as they are not subject to Commercial Air Transport meteorological limits. Embedded mitigation together with the obstacle free areas recommended in the Helicopter Access Report means the effect significance will likely be **Not Significant**.

16.7.1.2 Impact 2: Increased Air Traffic in the Area Related to Windfarm Construction Activities

103. The use of helicopters to support construction activities for the Project could impact on existing air traffic in the vicinity. It is possible that helicopters could be used for transferring people or equipment to the array area on a daily basis during the construction period.

104. The possible increase in air traffic associated with construction support activities brings with it a potential increased risk of aircraft collision in the airspace around the Project.

Significance of Effect

105. The increase in air traffic will be managed by the existing ATS infrastructure, provided in accordance with national procedures, and pilots will be expected to operate in accordance with regulatory requirements.

106. Due to the predicted low number of movements caused by the construction of the Project and assuming compliance with regulatory requirements and national procedures, the effect on aircraft operators in the vicinity of the Project is considered to be **Not Significant**.

16.7.2 Operations and Maintenance

107. This section presents the assessment of impacts arising from the O&M phase of the Project.

16.7.2.1 Impact 1: Creation of an Aviation Obstacle Environment

During the O&M phase of the Project the infrastructure outlined in

108. Table 16.4 will be present within the array area. This could pose a physical obstruction to aircraft utilising the airspace in the vicinity of the Project.

109. Specifically, permanent obstacles can increase risk to:

- General military low flying training and operations;
- Helicopter traffic transiting to and from offshore oil and gas platform helidecks;
- Helicopters utilising HMRIs 4 and 6; and
- Other offshore fixed-wing and helicopter operations, including those undertaking SAR missions over the southern North Sea.

110. Table 16.5Significance of Effect

111. Embedded mitigation in the form of compliance with international and national SARPs with respect to notification, charting, marking, and lighting is summarised in Table 16.5. This will make pilots aware of the addition of infrastructure to the array area, and it is assumed that pilots will comply with aviation regulatory requirements.

112. An ERCoP will be developed and implemented for all phases of the Project.

113. Consultation with relevant platform operators and offshore helicopter operators is ongoing, and will be considered within the layout design process. Appropriate separation between activities will minimise effects to operations.

114. A Helicopter Access Report (document reference 6.3.18.1) details the potential impacts on oil and gas helicopter operations. The assessment indicates a minor logistical impact on helicopter access to the Excalibur, Lancelot and West Sole Alpha platforms, and recommends an obstacle free radius of 1nm around the Malory platform and an obstacle free arc of 1nm from the array area to the Barque PB platform. Full SAR helicopter access to installations within and adjacent to the array area will still be available as they are not subject to Commercial Air Transport meteorological limits. Embedded mitigation together with the obstacle free areas recommended in the Helicopter Access Report means the residual effect significance will likely be **Not Significant**.

16.7.2.2 Impact 2: Increased Air Traffic in the Area Related to Windfarm Activities

115. The O&M phase of the Project will likely see an increase in helicopter traffic above the current baseline level engaged in support operations in the area.

116. The possible increase in air traffic associated with support activities brings with it a potential increased risk of aircraft collision in the airspace around the Project.

Significance of Effect

117. The safety of aircraft operating in uncontrolled airspace ultimately resides with the aircrew who will be expected to operate in accordance with regulatory requirements and who may request the provision of an ATS that will be provided in accordance with national procedures.

118. Due to the predicted low number of movements during the O&M phase of the Project and assuming compliance with regulatory requirements and national procedures, the effect on aircraft operators in the vicinity of the Project is considered to be **Not Significant**.

16.7.2.3 Impact 3: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR Systems

119. The array area will be within the operational range of radar systems serving both civil and military agencies. Radar modelling detailed in Appendix 16.1 shows that at least some WTGs with blade tip heights of between 276m and 400m amsl within the array area will be theoretically detectable by the NERL PSRs at Cromer and Claxby, and by the MOD AD PSRs at RRH Staxton Wold and RRH Neatishead. The final number of WTGs detected by these PSRs will depend on the maximum tip heights of individual WTGs and the final array layout selected.

120. When operational (in other words, with blades fitted and rotating), WTGs have the potential to generate 'clutter' (or false targets) upon radar displays because current generation PSRs are unable to differentiate between the moving blades of WTGs and aircraft. As a consequence, radar operators can be unable to distinguish between primary radar returns generated by WTGs and those generated by aircraft. As a general rule controllers are required to provide 5nm (9.3km) lateral separation between traffic receiving an ATS and 'unknown' primary radar returns in Class G airspace. This may therefore produce an adverse impact on the provision of a safe and effective ATS by those ANSPs such as Anglia Radar that utilise the Cromer and Claxby PSRs, and could compromise the ability of the MOD to undertake its Air Defence role utilising the Staxton Wold or Neatishead AD PSRs.

Mitigation will be required if both modelling of the windfarm design, based upon

parameters outlined in

121. Table 16.4, indicates that WTGs will be above the PSR system threshold levels that allow the WTG blades to be presented on PSR displays, and the airspace is operationally significant to the PSR operator. Mitigation should only be required for so long as PSRs do not have the inherent capability to distinguish WTG returns from aircraft returns: increasingly, "next generation" PSRs are looking to provide this functionality.

122. The interim (until PSRs are developed with inherent capability to distinguish WTGs from aircraft) additional mitigation that may be required for affected PSRs is discussed below:

Cromer and Claxby PSRs

123. Mitigation in respect of Cromer and Claxby PSRs may involve:

- Blanking (not displaying radar data) over the array area (either at the radar head or in the radar display system) so as to remove the PSR data containing the WTG returns from the radar data presented to controllers; or
- In addition to blanking, introducing a TMZ over the array area which requires all aircraft that wish to transit the TMZ airspace to be equipped with SSR transponders to enable controllers to track aircraft through what will otherwise be a "black hole" in primary surveillance cover.

124. Consultation with NATS will continue throughout examination to agree the most suitable form of mitigation for Cromer and Claxby PSRs.

Staxton Wold and Neatishead PSRs

125. Staxton Wold PSR has recently been upgraded to an Indra Lanza Long-Range Tactical Radar 25 (LTR-25) system. Detailed technical information for this system is not publicly available. In respect of the TPS-77 PSR at Neatishead, the most common WTG mitigation technique applied for previous windfarm developments was the application of a Non-Auto Initiation Zone (NAIZ) in the TPS-77's lowest beam over the footprint of any detectable WTGs. A NAIZ is a pre-defined geographical area where spurious radar returns from WTGs will not initiate a track that could be interpreted as an aircraft. However, on 24 August 2018 the MOD issued a statement indicating that the TPS-77 NAIZ mitigation had not performed to expectations at flight trials over two offshore windfarms and as a result immediately paused the receipt and assessment of any technical mitigation reports or submissions relating to TPS-77 radars and multi-turbine windfarms.

126. An update to this statement was issued in June 2019 in which the MOD stated, "The MOD will continue to work with industry to resolve the current issues and will, on a case by case basis, consider certain developments where impact on operational capability is deemed to be acceptable. TPS-77-based mitigation reports will now be considered where suitable mitigation can be adequately modelled. The MOD will continue to receive and assess TPS-77 based mitigation reports for single turbine developments following the results of a previous trial relating to these developments. The MOD will also consider alternative ADR mitigation proposals should developers wish to submit them."

127. In August 2019 an Air Defence and Offshore Wind (AD&OW) Windfarm Mitigation Task Force was formed as a collaborative initiative between the MOD, what was then the Department for Business, Energy and Industrial Strategy (table) and is now the Department for Energy Security and Net Zero (DESNZ), OWIC and The Crown Estate. The aim of the Task Force is to enable the co-existence of UK Air Defence and offshore wind by identifying potential mitigations and supporting processes, allowing offshore wind to contribute towards meeting the UK Government's Net Zero target without degrading the nation's AD surveillance capability.

128. The Project has been actively engaged in this industry initiative since early 2022 and is fully committed to supporting future activities to seek an industry-wide solution.

129. The AD&OW Strategy and Implementation Plan (S&IP) sets the direction for this collaboration by identifying, assessing and deploying solutions that will enable the co-existence of AD&OW operations such that neither is unduly nor excessively compromised. The S&IP may lead to significant changes to current AD PSR characteristics and capabilities that in turn affect the potential impact that the Project may have.

130. In support of the S&IP, in March 2020 the MOD Defence and Security Accelerator (DASA) and DESNZ launched an Innovation Challenge to reduce and remove the impact of windfarms on the UK's AD surveillance systems by seeking technological proposals in four areas:

- Alternatives to radar;
- Technologies applied to the WTG or installation;
- Technologies applied to the radar, its transmission or return; and
- Technological mitigations not covered by the above.

131. Phase 1 identified mitigations such as new radar signal processing methods or radar absorbing treatments applied to WTGs, and recommended a hybrid approach involving changes to both radar and WTG design to solve the problem in the long term.

132. Phase 2 of the competition was launched in April 2021 seeking proposals to address four main subject areas:

- Reduction of clutter or the impact of clutter;
- Ensuring efficient detection and tracking time;
- Technologies to mitigate against larger turbine blades and wider turbine spacing development; and
- Alternate methods of surveillance.

133. Of 20 submitted proposals, contracts for seven proposals were awarded in September 2021 and completed by March 2023.

134. DASA and DESNZ launched Stream 1 of Windfarm Mitigation for UK Air Defence: Phase 3 in February 2023, building upon Phases 1 and 2 to advance innovative technologies in radar signal processing, WTG materials and alternative tracking approaches.

135. In August 2023 funding was awarded for two projects: a project developing passive air defence sensors to address clutter from WTG blades, and another project developing stealth materials for next-generation WTG blades. At the same time, Phase 3 Stream 2 was launched to find solutions for the modelling and testing of different mitigation technologies.

136. The ultimate aim of the S&IP is to have mitigations in place to support offshore wind developments by Q2 2025, and therefore it is expected that such mitigation will be available before the Project construction phase.

137. Notwithstanding the S&IP, the Staxton Wold LTR-25 PSR is described by the manufacturer, Indra, as being "exceptionally effective in mitigating the effects of electronic warfare and windfarms", so there is likely to be scope for configuring Staxton Wold PSR to mitigate the effects of WTGs within the array area.

138. Given that WTGs with the maximum blade tip height will only be in RLoS of Neatishead PSR within approximately 9% of the array area, NAIZ mitigation is likely to be an available option for Neatishead PSR.

139. Engagement with the MOD will continue throughout the application phase to agree a suitable mitigation for the impact of the Project on Staxton Wold and Neatishead PSRs.

Significance of Effect

140. CAP 764 outlines other mitigation options which could be applied either singly or in combination to optimise the effectiveness of any mutually agreed solutions. Due to the promising developments currently being advanced by industry in this area of technology, consultation on technical measures will continue as a development might emerge that proves to be more suitable for adoption and implementation while the Project advances and matures.

141. Without additional mitigation, the significance of effects on receptors receiving changes to their operational environment has been assessed to be **Major Significant**. However, it is anticipated that the potential risk posed to aviation and MOD operations can be wholly and successfully mitigated through various technical solutions applied to current generation PSRs. Following the application of additional mitigation, the residual significance of effect on radars is assessed to be **Not Significant**.

142. It is anticipated that, during the operational life of the Project, the MOD and NERL will procure "next generation" PSRs which should not require the application of mitigation measures to allow them to provide an appropriate surveillance picture in the presence of WTGs.

16.7.3 Decommissioning

143. Offshore decommissioning will most likely involve the removal of all structures above the seabed level, together with all subsea cables. For the decommissioning phase, the implementation of standard aviation safety management processes will be applicable and a risk assessment based on the appropriate aviation requirements pertinent at the time will be required.

16.7.3.1 Impact 1: Removal of Aviation Obstacle Environment

During the decommissioning phase, the above sea level infrastructure outlined in

144. Table 16.4 will be gradually removed. This will reduce the physical obstruction to aircraft utilising the airspace in the vicinity of the Project.

145. Specifically, permanent or temporary obstacles can increase risk to:

- General military low flying training and operations;
- Helicopter traffic transiting to and from offshore oil and gas platform helidecks;
- Helicopters utilising HMRIs 4 and 6; and
- Other offshore fixed-wing and helicopter operations, including those undertaking SAR missions over the southern North Sea.

146. Embedded mitigation in the form of compliance with international and national SARPs with respect to notification, charting, marking, and lighting, as summarised in Table 16.5, will be retained until decommissioning has been completed.

147. An ERCoP will be developed and implemented for all phases of the Project.

148. Any additional mitigation plans required to safeguard offshore oil and gas helicopter operations will remain in place during the decommissioning phase.

149. The effect on the aviation sector during the decommissioning phase will be reduced to pre-development conditions.

Significance of Effect

150. The significance of effect has been assessed to be **No Change** for decommissioning.

16.7.3.2 Impact 2: Increased Air Traffic in the Area Related to Windfarm Decommissioning Activities

151. The use of helicopters during the decommissioning phase of the Project could impact on existing traffic in the area. It is possible that helicopters could be used for transferring people or equipment to the array area on a daily basis during the decommissioning of offshore infrastructure.

152. The possible increase in air traffic associated with decommissioning support activities brings with it a potential increased risk of aircraft collision in the airspace around the Project.

Significance of Effect

153. The safety of aircraft operating in uncontrolled airspace ultimately resides with the aircrew who will be expected to operate in accordance with regulatory requirements and who may request the provision of an ATS that will be provided in accordance with national procedures.

154. Due to the predicted low number of movements during the decommissioning phase of the Project and assuming compliance with regulatory requirements and national procedures, the effect on aircraft operators in the vicinity of the Project is considered to be **Not Significant**.

16.8 Cumulative Impact Assessment

155. This cumulative impact assessment for aviation, radar, military and communication has been undertaken in accordance with the methodology provided in Volume 3, Appendix5.1: Offshore Cumulative Impact Assessment.

156. The projects and plans selected as relevant to the assessment of impacts to aviation, radar, military and communication are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect-receptor pathway, data confidence and the temporal and spatial scales involved. For the purposes of assessing the impact of the Project on aviation, radar, military and communication in the region, the cumulative effect assessment technical note submitted through the EIA Evidence Plan and forming Volume 3, Appendix 5.1 of this ES screened in a number of projects and plans as presented in Table 16.7. Projects out to a distance of 100km have been included. 100km is the maximum range at which radar cumulative effects are considered to occur. The potential cumulative effect of radar impacts on ATC operations diminishes as the separation between windfarm sites increases. A separation distance of 100km is considered to be a pragmatic range beyond which cumulative effects will be negligible.

Table 16.7 Projects considered within the aviation, radar, military and communication cumulative assessment

Development type	Project	Status	Data confidence assessment/phase	Tier
Offshore windfarm	Triton Knoll (9km)	Active/In operation	High	Tier 1
Offshore windfarm	Dudgeon Extension (14km)	Under examination	High	Tier 1
Offshore windfarm	Dudgeon (20km)	Active/In operation	High	Tier 1
Offshore windfarm	Hornsea Project Two (20km)	Active/In Operation	High	Tier 1
Offshore windfarm	Hornsea Project One (23km)	Active/In operation	High	Tier 1
Offshore windfarm	Race Bank (24km)	Active/In operation	High	Tier 1
Offshore windfarm	Sheringham Shoal Extension (26km)	Under examination	High	Tier 1
Offshore windfarm	Sheringham Shoal (34km)	Active/In operation	High	Tier 1
Offshore windfarm	Hornsea Project Four (39km)	Consented	High	Tier 1
Offshore windfarm	Lincs (46km)	Active/In operation	High	Tier 1
Offshore windfarm	Humber Gateway (47km)	Active/In operation	High	Tier 1
Offshore windfarm	Inner Dowsing (51km)	Active/In operation	High	Tier 1
Offshore windfarm	Lynn (54km)	Active/In operation	High	Tier 1

Development type	Project	Status	Data confidence assessment/phase	Tier
Offshore windfarm	Hornsea Project Three (60km)	Consented	High	Tier 1
Offshore windfarm	Westermost Rough (60km)	Active/In operation	High	Tier 1
Offshore windfarm	Dogger Bank South (East) (83km)	Pre-planning application	High	Tier 2
Offshore windfarm	Norfolk Vanguard West (84km)	Consented	High	Tier 1
Offshore windfarm	Norfolk Boreas (95km)	Consented	High	Tier 1
Offshore windfarm	Dogger Bank South (West) (97km)	Pre-planning application	High	Tier 2
Offshore windfarm	Scroby Sands (98km)	Active/In operation	High	Tier 1

157. The cumulative MDS for the Project is outlined in Table 16.8. Only potential impacts where the effect is assessed in section 16.7 as Not Significant or above are included in the cumulative MDS. Those assessed as No Change are not taken forward as there is no potential for them to contribute to a cumulative impact.

Table 16.8 Cumulative MDS

Impact	Scenario	Justification
Construction		
Impact 1: Creation of an aviation obstacle environment.	Temporal overlap of the Project construction phase with other offshore project construction phases and existing offshore windfarms.	WTGs and high crane installation vessels associated with other developments create aviation obstacles, restricting the available airspace.
Impact 2: Increased air traffic in the area related to windfarm construction activities.	Air traffic activities associated with the Project and other offshore developments.	Air traffic activities associated with other developments have the potential to cumulatively increase the risk of aircraft collision.
Operation and Maintenance		
Impact 1: Creation of an aviation obstacle environment.	Multiple new offshore windfarms and existing offshore windfarms.	WTGs associated with other developments create aviation obstacles, restricting the available airspace.
Impact 2: Increased air traffic in the area related to windfarm activities.	Air traffic activities associated with the Project and other offshore developments.	Air traffic activities associated with other developments have the potential to cumulatively increase the risk of aircraft collision.

Impact	Scenario	Justification
Impact 3: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR systems.	Unmitigated impacts on PSRs from multiple offshore developments.	Other windfarm projects could impact radars over a larger area.
Decommissioning		
Impact 1: Increased air traffic in the area related to windfarm decommissioning activities.	Air traffic activities associated with the Project and other offshore developments.	Air traffic activities associated with other developments have the potential to cumulatively increase the risk of aircraft collision.

16.8.1 Assessment of Cumulative Impacts

158. Having established the residual impacts from the Project with the potential for a cumulative impact along with other relevant projects, the following sections provide an assessment of the level of effect that may arise.

16.8.1.1 Creation of an Aviation Obstacle Environment

159. Construction of the Project will involve the installation of infrastructure above sea level which could pose a physical obstruction to military low flying and offshore fixed wing and helicopter operations, including helicopters transiting to and from offshore oil and gas platform helidecks and helicopters engaged in SAR missions. There is potential for cumulative effects when also considering the infrastructure associated with other offshore projects.

160. Specifically, any additional mitigation plans agreed with offshore platform operators and offshore helicopter operators before construction of the Project commences should take into account other operational and future developments within 9nm (16.7km) of the relevant platforms.

161. The potential cumulative effect of maritime and aviation obstacle lighting creating confusing lighting configurations to both sectors has been addressed and CAA guidance has been subject to coordination with maritime agencies. There should be no cumulative effects on aviation operations as compliant markings and lighting will be provided.

162. Through the use of embedded mitigation measures such as effective lighting, additional agreed mitigation plans, reliance on pilots who are required to avoid any obstacle by legislated minimum distances, and consideration of charted obstacles, the significance of the cumulative effect from the creation of an obstacle environment is considered to be **Not Significant**.

16.8.1.2 Increased Air Traffic in the Area Related to Windfarm Activities

163. During the construction, operation and maintenance and decommissioning phases of the Project there is likely to be an increase in helicopter air traffic over the current baseline levels due to the use of helicopters in the provision of support in the airspace around the Project.

164. The predicted number of daily helicopter movements is considered to be low, however the cumulative effect of this activity and similar activities associated with the other projects included in the assessment will create a greater potential risk of mid-air collision between aircraft engaged in such operations and/or aircraft in transit across the study area.

165. The increase in air traffic will be managed by the existing ATS infrastructure, provided in accordance with national procedures, and pilots will be expected to operate in accordance with civil and military regulatory requirements. The significance of the cumulative effect is therefore considered to be **Not Significant** in EIA terms.

16.8.1.3 Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR Systems

166. There is potential for a cumulative effect where radars detect the rotating blades of WTGs from multiple offshore wind developments that are in their operational phase. This could result in a significant increase in clutter being generated on radar displays over a larger area.

167. With no mitigation in place the potential significance of the cumulative effect is considered to be **Major Significant**.

168. However, future offshore windfarms must have all necessary radar mitigations in place before becoming operational, and any potential radar impacts from the Project will be similarly mitigated. With such mitigation implemented the potential for cumulative effects on civil and military radars is assessed to be **Not Significant**.

16.9 Inter-Relationships

169. There are potential inter-relationships between this chapter and other topics that have been considered within the ES. The identified inter-relationships with this chapter are Volume 1, Chapter 15: Shipping and Navigation and Volume 1, Chapter 17: Seascape, Landscape and Visual Assessment. Aviation lighting fitted to offshore WTGs could cause confusion to the maritime community as the specification for the lighting to be displayed below the horizontal plane of the light filament itself could cause mariners some confusion. This confusion could result in WTGs with conflicting warning lighting representing a collision risk to maritime surface vessels.

170. Work has been undertaken to develop an aviation warning light standard where, from the nature of the lighting, it will be apparent to mariners that the aviation lighting is clearly distinguishable from maritime lighting. Where it is evident that the default aviation warning lighting standard may generate issues for the maritime community, a developer can make the case, that is likely to receive CAA approval, for the use of a flashing red Morse Code letter ‘W’ instead. See CAP 764 paragraph 3.16. A Lighting and Marking Plan (LMP) will be developed that will serve as mitigation for both aviation and shipping.

16.9.1 Interactions

171. An assessment of whether the impacts identified and assessed in this chapter have the potential to interact with each other.

172. Inter-related effects consider impacts from the construction, operation or decommissioning of the Project on the same receptor (or group).

173. 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.

174. A description of the process to identify and assess these effects is presented in Part 6, Volume 1 Chapter 5: EIA Methodology.

175. The impacts identified and assessed in this chapter have the potential to interact with each other. For example, the effects of the creation of an obstacle environment and increased air traffic due to windfarm activities interacting on helicopter/SAR traffic or military low flying. The worst-case effects assessed within the aviation, radar, military and communication chapter take these potential interactions into account, therefore there are no additional interactions to consider.

16.10 Transboundary Effects

176. The potential impacts of WTGs on aviation are localised and the array area is completely within UK airspace. The nearest Dutch operated airspace is more than 60km east of the Project and the array area is significantly beyond the expected radar coverage from the nearest major European Airport. Transboundary effects are thus scoped out of further assessment, as agreed in the Scoping Opinion (The Planning Inspectorate, 2022).

16.11 Conclusions

177. Table 16.9 presents a summary of the impact assessment undertaken with respect to the Project in relation to aviation, radar, military and communication.

178. The desk-based assessment has considered effects with respect to impacts on radar and UK airspace predicted due to the physical presence of the Project and associated air traffic during the construction, operation and maintenance, and decommissioning phases. Potential impacts are physical obstruction to aircraft, increased air traffic in the area related to windfarm activities, and interference on radars caused by rotating WTG blades.

179. Potentially affected aviation stakeholders include civil and military radar facilities, and offshore fixed-wing and helicopter flights such as military low flying, SAR operations, and helicopter support for the oil and gas industry.

180. A range of mitigation measures will be embedded in the Project design to reduce potential aviation effects. These include the development of an ERCoP to mitigate the effect on SAR operations, notification to aviation stakeholders of the location and height of all structures during construction of the windfarm, and an aviation obstacle lighting scheme agreed with the relevant authorities.

181. Consultation is ongoing with aviation stakeholders to agree additional appropriate mitigations to safeguard offshore oil and gas helicopter operations.

182. Technical mitigation solutions are available for radar interference and such solutions will be discussed and agreed with NATS and the MOD.

183. No other significant effects on civil and military aviation and radar have been identified.

Table 16.9 Summary of Potential Impacts on Aviation, Radar, Military and Communication

Description of effect	Effect	Additional mitigation measures	Residual impact
Construction			
Impact 1: Creation of an aviation obstacle environment.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant
Impact 2: Increased air traffic in the area related to windfarm construction activities.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant
Operation and Maintenance			
Impact 1: Creation of an aviation obstacle environment.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant
Impact 2: Increased air traffic in the area related to windfarm activities.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant
Impact 3: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR systems.	Major Significant	Technical mitigation solutions applied to impacted PSRs to be agreed with NATS and the MOD.	Not Significant
Decommissioning			
Impact 1: Removal of aviation obstacle environment.	No Change	Not Applicable – no additional mitigation identified.	No Change
Impact 2: Increased air traffic in the area related to windfarm decommissioning activities.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant
Cumulative			
Impact 1: Creation of an aviation obstacle environment.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant
Impact 2: Increased air traffic in the area related to windfarm activities.	Not Significant	Not Applicable – no additional mitigation identified.	Not Significant

Description of effect	Effect	Additional mitigation measures	Residual impact
Impact 3: Impact on NERL Cromer and Claxby, and MOD Staxton Wold and Neatishead AD PSR systems.	Major Significant	Technical mitigation solutions applied to impacted PSRs to be agreed with NATS and the MOD.	Not Significant

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