FIVE ESTUARIES
OFFSHORE WIND FARM

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PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

VOLUME 2, CHAPTER 13: MILITARY AND CIVIL AVIATION

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DEFINITION OF ACRONYMS

Term	Definition
ACC	Area Control Centre
ADR	Air Defence Radar
agl	above ground level
AIP	Aeronautical Information Publication
amsl	above mean sea level
ANO	The Air Navigation Order (ANO)
AoS	Area of Search
ASACS	Air Surveillance And Control System
ATC	Air Traffic Control
ATS	Air Traffic Service
ATCS	Air Traffic Control Service
BEIS	Department for Business Energy and Industrial Strategy
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CEA	Cumulative Effects Assessment
CNS	Communications, Navigation, Surveillance
CTA	Control Area
DECC	Department for Energy and Climate Control
DGC	Defence Geographic Centre
DIO	Defence Infrastructure Organisation
DOC	Declared Operational Coverage
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment
ERCoP	Emergency Response Co-operation Plan
ESNZ	Energy Security and Net Zero
FIR	Flight Information Region
FIS	Flight Information Service
FL	Flight Level
Ft	feet

Term	Definition
GA	General Aviation
IAIP	Integrated Aeronautical Information Package
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
JTF	Joint Task Force
km	Kilometre
LARS	Lower Airspace Radar Service
LoS	Line of Sight
LSA	London Southend Airport
m	metre
MCA	Maritime Coastguard Agency
MDS	Maximum Design Scenario
MGN	Maritime Guidance Note
MHWS	Mean High Water Springs
Mil	Military
MOD	Ministry of Defence
MRCC	Maritime Rescue Coordination Centre
MSA	Minimum Safe Altitude
NERL	NATS En Route Limited
nm	Nautical Mile
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
NSTA	North Sea Transition Authority
OREI	Offshore Renewable Energy Installations
OWF	Offshore Wind Farm
OWIC	Offshore Wind Industry Council
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PINS	Planning Inspectorate
PSR	Primary Surveillance Radar

Term	Definition
RAF	Royal Air Force
RCS	Radar Cross Section
RDDS	Radar Data Display Screen
RDP	Radar Data Processor
SAR	Search and Rescue
SSR	Secondary Surveillance Radar
TOPA	Technical and Operational Assessment
UKLFS	UK Low Flying System
VE	Five Estuaries Project
VEOWF	Five Estuaries Offshore Wind Farm Limited
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

GLOSSARY OF TERMS

Term	Definition
Controlled Airspace	Airspace in which Air Traffic Control exercises authority. In the UK, Class A, C, D and E airspace is controlled.
Flight Level	A standard nominal altitude of an aircraft, in hundreds of feet, based upon a standardized air pressure at sea-level.
Instrument Flight Rules	The rules governing procedures for flights conducted with the crew making reference to aircraft cockpit instruments for situation awareness and navigation.
Instrument Meteorological Conditions	Weather conditions which would preclude flight by the Visual Flight Rules, i.e., conditions where the aircraft is in or close to cloud or flying in visibility less than a specified minimum.
Uncontrolled Airspace	Airspace in which Air Traffic Control does not exercise any executive authority but may provide basic information services to aircraft in radio contact. In the UK, Class G airspace is uncontrolled.
Visual Flight Rules	The rules governing flight conducted visually i.e., with the crew maintaining separation from obstacles, terrain and other aircraft visually.
Visual Metrological Conditions	A flight category which allows flight to be conducted under Visual Flight Rules defined by in flight visibility and clearance from cloud.

13 MILITARY AND CIVIL AVIATION

13.1 INTRODUCTION

13.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the results of the preliminary Environmental Impact Assessment (EIA) for the potential impacts of the Five Estuaries Offshore Wind Farm Limited (hereafter, VE OWFL) on Military and Civil Aviation. Specifically, this chapter considers the potential impact of the VE Project during its construction, operation and maintenance, and decommissioning phases.

13.1.2 This chapter has been written by Osprey Consulting Services Ltd (Osprey), with the assessment undertaken with specific reference to the relevant legislation and guidance. Details of these and the methodology used for the Environmental Impact Assessment (EIA) and Cumulative Effects Assessment (CEA) are presented in Volume 1, Chapter 3: EIA Methodology.

13.2 STATUTORY AND POLICY CONTEXT

13.2.1 This section identifies the legislation, policy and other documentation that has informed the assessment of effects on aviation. Further information on legislation and policies relevant to the EIA and their status is provided in Volume 1, Chapter 2: Policy and Legislation.

13.2.2 There are a number of aviation publications which contain information and guidance relating to the potential effects of an offshore wind development on aviation stakeholders. The following documents informed the desk-based study of potential impacts of VE. Legislation applicable to the assessment of military and civil aviation is provided as follows:

- Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 393 The Air Navigation Order (ANO) as amended (CAA, 2022a) sets out the provisions of the ANO. It is prepared for those concerned with day-to-day matters relating to air navigation that require an up-to-date reference document of the air navigation regulations and is edited by the Legal Advisers Department of the CAA. CAP 393 also includes the use of aviation obstruction lighting to wind turbines in UK territorial waters.

13.2.3 Applicable guidance is provided in the following key sources of aviation and radar data:

- CAA CAP 168 Licensing of Aerodromes (CAA, 2022) sets out the standards required at UK licensed aerodromes relating to its management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids.
- CAA CAP 764 CAA Policy and Guidelines on Wind Turbines (CAA, 2016): Aids aviation stakeholders in understanding and addressing wind energy related issues thereby ensuring greater consistency in the consideration of the potential effect of proposed wind farm developments.
- CAA CAP 437 Standards for Offshore Helicopter Landing Areas (CAA, 2021): Provides the criteria applied by the CAA in assessing helicopter landing areas for worldwide use by helicopters registered in the UK. It includes design of winching area arrangements located on wind turbine platforms to represent current best practice.

- CAA CAP 670 Air Traffic Services Safety Requirements (CAA, 2019): Sets out the safety regulatory framework and requirements associated with the provision of an Air Traffic Service (ATS).
- CAA CAP 032 UK Integrated Aeronautical Information Package (IAIP) (CAA, 2022b): The main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information.
- Ministry of Defence (MOD) Aeronautical Information Publication (AIP), (MOD, 2022): The main resource for information and flight procedures at all military aerodromes as well as airspace, en-route procedures, charts and other air navigation information.
- Maritime and Coastguard Agency (MCA) Maritime Guidance Note (MGN) 654 Safety of Navigation Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021): Contains information for operators and developers in formulating their emergency response plans and site safety management.
- CAA Visual Flight Rules Chart (CAA, 2022c): Provides topographical air chart information on aerodrome, airspace and areas of air traffic control responsibilities.
- International Civil Aviation Authority (ICAO), Document 8168 Ops/611 Procedures for Air Navigation Services Aircraft Operations (ICAO, 2018): Describes operational procedures recommended for the guidance of flight operations personnel. It illustrates the need for operational personnel including flight crew to adhere strictly to published procedures to achieve and maintain an acceptable level of safety in operations.

13.2.4 Planning policy for offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to aviation and radar, is contained in the Department for Energy and Climate Change[1] (DECC) overarching National Policy Statement (NPS) for Energy (EN-1) (DECC, 2011) and NPS for Renewable Energy Infrastructure EN-3 (DECC, 2011a). NPS EN-1 and EN-3 include guidance on what matters are to be considered in the assessment, these are summarised in Table 13.1. The table also includes information provided in the draft version of EN-3 in which relevant additional NPS requirements not presented within the current NPS (EN-3) have been included. No new requirements applicable to aviation were found within the draft EN-1 document.

[1] DECC merged with the Department for Business, Innovation and Skills to form the Department for Business, Energy and Industrial Strategy (BEIS).

Table 13.1:Legislation and policy context

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
Overarching National Policy Statement (NPS) for Energy (NPS EN-1) (2011).	Paragraph 5.4.10 of EN-1 advises that if the proposed development could have an effect on civil and military aviation (and/or other defence assets) an assessment of potential effects should be set out in the ES.	Consideration of the construction, operation and decommissioning phases of the scheme are set out in Sections 13.14, 13.15 and 13.17 of this report.
Overarching NPS for Energy (NPS EN-1) (2011).	Paragraph 5.4.11 of EN-1 advises that consultation with the MOD, the CAA and NATS and any aerodrome, licensed or otherwise, likely to be affected by the proposed development should be completed.	Table 13.2 provides results of consultation activity.
Overarching NPS for Energy (NPS EN-1) (2011).	Paragraph 5.4.12 of EN-1 advises that any assessment of aviation or other defence interests should include potential impacts of the project upon the operation of Communication, Navigation or Surveillance (CNS) infrastructure, flight patterns (both civil and military), other defence assets and aerodrome operational procedures. It should also assess the cumulative effects of the project with other relevant projects in relation to aviation and defence.	The assessment of civil and military aviation infrastructure is provided in Section 13.14 *et seq*., and cumulative impacts within Section 13.18.
NPS for Renewable Energy (NPS EN-3) (2011).	Paragraph 2.6.107 of EN-3 advises that aviation and navigation lighting should be minimised to avoid attracting birds, taking into account impacts on safety.	Marking and lighting for aviation will be agreed post consent with the appropriate bodies including the MCA, CAA and the MOD with regard of the relevant guidance. The requirement for approved marking and lighting post consent will be as agreed with the regulator.

LEGISLATION/ POLICY	KEY PROVISIONS	SECTION WHERE COMMENT ADDRESSED
Draft NPS for Renewable Energy (NPS EN-3) (2022).	Paragraph 2.22.28 of the draft EN-3 advises that the applicant need to assess impacts on civil and military radar and other aviation and defence interests.	Impacts on civil and military radar and aviation and defence interests are assessed in Section 13.14 *et seq*.
Draft NPS for Renewable Energy (NPS EN-3) (2022).	Paragraph 2.29.5 of the draft EN-3 requires that a review of up-to-date research should be undertaken and all potential mitigation options presented. Aviation and navigation lighting should be minimised and/or on demand (as encouraged in EN-1 Section 5.5) to avoid attracting birds, taking into account impacts on safety.	Marking and lighting for aviation will be agreed post consent with the appropriate bodies including the MCA, CAA and the MOD with regard of the relevant guidance. Marking and lighting of the wind turbines and infrastructure will be in line with current industry standards and regulations.

13.3 CONSULTATION

13.3.1 Consultation regarding aviation has been conducted prior to the publication of this document and throughout the scoping process.

13.3.2 VE OWFL submitted a Scoping Report and request for a Scoping Opinion in September 2021. A Scoping Opinion was received from the Planning Inspectorate in November 2021. The Scoping Report set out the proposed military and civil aviation assessment methodologies, outline of the baseline data collected to date and proposed, and the scope of the assessment. Table 13.2 sets out the comments received in Section 4.7 of the PINS Scoping Opinion specific to military and civil aviation and how these have been addressed in this PEIR.

Table 13.2: Summary of consultation relating to military and civil aviation

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
November 2021 Scoping Opinion	The Planning Inspectorate (PINS) agrees that impacts to military Practice and Exercise Areas (PEXA) can be scoped out of the assessment as significant effects are unlikely to occur.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1
November 2021 Scoping Opinion	PINS agree that impacts to the offshore Export Cable Corridor (ECC) can be scoped out as the ECC would be below the water surface and consequently there will be no impact to aviation interests.	Impacts scoped out of this assessment are detailed in paragraph13.4.1.
November 2021 Scoping Opinion	PINS agree that impacts created by the presence of onshore cabling can be scoped out as onshore cables will be located below ground level and consequently there will be no impact to aviation interests. The MOD (included below in this table) wish to be consulted once the onshore ECC and onshore landfall location is finalised.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.
November 2021 Scoping Opinion	PINS agree that impacts created by the presence of the onshore substation can be scoped out as comparable infrastructure within the Area of Search (AoS) presently exists therefore, no impacts are anticipated to arise on aviation interests.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
November 2021 Scoping Opinion	PINS agree that impacts to Secondary Surveillance Radar (SSR) systems can be scoped out as no aviation SSR systems are located within 10 kilometres (km) of the array areas.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.
November 2021 Scoping Opinion	PINS agree that potential impacts to London Southend Airport, Norwich Airport and London Stansted Airport Primary Surveillance Radars (PSRs) can be scoped out. PINS note that NATS have stated that predicted impacts to NATS PSR and infrastructure are considered acceptable and agrees that this matter can be scoped out from further assessment[2].	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.
November 2021 Scoping Opinion	PINS agree that potential impacts to Royal Air Force (RAF) Marham, Lakenheath, Wattisham and Honington PSRs can be scoped out.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.
November 2021 Scoping Opinion	PINS agree that the impact to Kent International Airport can be scoped out as no decision (at the date of the Scoping Opinion) on the reopening of the airport has been made.	Subsequent to the production of the Scoping Opinion the development of the airport has been granted and therefore Kent International Airport is included in the assessment. Impact to Kent International Airport is provided in paragraph 13.18.16 *et seq*.
November 2021 Scoping Opinion	PINS agree that impact to aviation radar systems during the construction and decommissioning phase over and above that identified at the operation phase can be scoped out.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.

[2] Note: An increase in blade tip height has increased detectability to Southend and Norwich Airport PSR systems. NATS require that they are reconsulted in any change to wind turbine parameters.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
November 2021 Scoping Opinion	The Planning Inspectorate consider that insufficient evidence has been given in the Scoping Report to justify why the use of helicopters during all phases of the project may be scoped out of the assessment.	Impacts to airspace from the increased use of helicopters in all phases of the scheme are detailed in Sections 13.14 and 13.15
November 2021 Scoping Opinion	Due to the location of the array areas lying solely in UK airspace, PINS agree that transboundary impacts can be scoped out.	Impacts scoped out of this assessment are detailed in paragraph 13.4.1.
November 2021 Scoping Opinion	The anticipated final layout of the structures should be consulted on with relevant consultation bodies prior to the submission of the ES.	A radar Line of Sight (LoS) analysis has been undertaken and provided at Section 13.6. The radar LoS analysis may be rerun at final layout, consultation completed so far is included in Table 13.2 (this Table).
November 2021 Scoping Opinion	PINS state that all relevant consultation bodies including the relevant Netherlands aviation authorities should be consulted with responses informing the ES.	Table 13.2 (this Table) provides results of consultation activity undertaken to date.
November 2021 Scoping Opinion	PINS state that any mitigation measures should be clearly explained and based on evidence provided in the ES.	Mitigation principles are included in Section 13.16.
November 2021 Scoping Opinion	The Defence Infrastructure Organisation (DIO) who safeguard MOD assets indicates that radar systems should be considered in the ES and may require technical mitigation to be applied. Additionally, the MOD stated that the Trimingham Air Defence Radar (ADR) should be considered in the preparation of this document; however, it is known that the Trimingham ADR will be decommissioned and replaced by the	Mitigation principles are provided at Section 13.16.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	Neatishead ADR which is to be located approximately 10 miles to the South south-east of the location of the Trimingham ADR. therefore, the Neatishead ADR has also been included within the assessment. DIO expect that impact to PEXA is not anticipated furthermore; in the interests of air safety the MOD would request MOD accredited aviation safety lighting to be fitted in accordance with the ANO. The MOD wish to be consulted on the finalised onshore ECC route and landfall location once finalised.	The MOD will be consulted with further as the project progresses.
November 2021 Scoping Opinion	A NATS completed Technical and Operational Assessment (TOPA) SG32213 Issue 1 (NATS, 2021) was provided within the Scoping Opinion. The TOPA provided the NATS view on the project in respect of the impact upon its operations in respect of the details provided within the report. The TOPA concludes that at the assessed blade tip height of 397 m any impacts are deemed to be acceptable. A potential increase in blade tip height to 420 metres (m) above Mean High water Springs (MHWS)[3] is envisaged therefore, NATS have been re-consulted to establish if an increased predicted impact may occur due to the potential of increased radar detectability created by the taller blade tip height.	Impact to NATS infrastructure is provided in Section 13.15.
25 May 2022 Email from Osprey	The Koninklijke Luchtmacht of the Netherlands Ministerie van Defensie	N/A

[3] For the purpose of radar line of sight analysis this measurement is rounded up to 420 m.

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	informed that they have no objections to the project.	
9 July 2022 Email from Osprey	The Netherlands Civil Aviation Directorate stated that there will be no impact (created by the project) to operations conducted in Netherlands airspace.	N/A
15 August 2022 Email from NATS	NATS informed that they had no safeguarding objection to the scheme at the assessed blade tip height of 397 m. (see note above) NATS confirmed that the original opinion of no impact to their operation still applies at the taller blade tip height.	Impact to NATS infrastructure is provided in Section 13.15.
6 December 2022 Email from NATS	NATS were informed of the increase in blade tip height and responded stating that NATS confirmed that the original opinion of no impact to their operation still applies at the taller blade tip height.	Impact to NATS infrastructure is provided in Section 13.15.
5 January 2023 Email from Osprey to helicopter operators (Bristow Helicopter, NHV Helicopters and CHC Helicopters)	The helicopter operators were provided with details of VE and were requested feedback information on any perceived impact the development may have on their individual operation in the region of VE. To date only Bristow Helicopters have responded (email dated 16 January 2023) stating that no significant impact would be created to their operation.	N/A
12 January 2023 Email from Osprey to Netherlands aviation authorities	The Koninklijke Luchtmacht of the Netherlands Ministerie van Defensie and the Netherlands Civil Aviation Directorate were reconsulted and informed of the increase in blade tip height. It is expected that there will be no change to the 'no impact' opinion provided at the lower blade tip height will apply. The Koninklijke Luchtmacht of the Netherlands Ministerie van Defensie responded by email on the 18 January 2023 stating	N/A

Date and consultation phase/ type	Consultation and key issues raised	Section where comment addressed
	that the increase in blade tip height will not impact their operations. Any adverse comment will be addressed in the EIA aviation chapter.	

13.4 SCOPE AND METHODOLOGY

SCOPE OF THE ASSESSMENT

IMPACTS SCOPED IN FOR ASSESSMENT

13.4.1 The following impacts have been scoped into this assessment

- Construction
  - Impact 1: Creation of an aviation obstacle.
- Operation and maintenance
  - Impact 2: Creation of aviation obstacle.
  - Impact 3: Wind turbines causing interference on civil and military radar systems.
- Decommissioning
  - Impact 4: Creation of an aviation obstacle.
- Cumulative Effects
  - Impact 5: Creation of an aviation obstacle.
  - Impact 6: Wind turbines causing interference on civil and military radar systems.
  - Impact 7: Potential impact to Kent International Airport.

IMPACTS SCOPED OUT OF ASSESSMENT

13.4.2 Table 13.2 provides the response to engagement provided by aviation stakeholders; however, to ensure future options for turbine availability at the time of construction, an increase in blade tip height to 420 m above MHWS (420 m rounded up[4]) is being proposed at this stage, which in turn may increase detectability to aviation radar systems previously assessed as being able to be scoped out. As a precautionary measure, those aviation radar systems that have the potential for increased detectability are included in the assessment.

[4] The radar LoS analysis software utilises above mean sea level (amsl) as a datum for analysis. The difference between MHWS and msl is less than 2 metres and will not impact the theoretical results of the radar LoS analysis.

13.4.3 On the basis of the baseline environment and the project description outlined in Volume 2, Chapter 1: Offshore Project Description and in accordance with the Scoping Opinion (PINS, 2021), a number of impacts have been scoped out (seeTable 13.2), these include:

- Construction, operation and decommissioning
  - Impact 1: Impact of the offshore and onshore ECC including the onshore substation[5].
  - Impact 2: Impact to aviation operations in PEXA.
  - Impact 3: Impact to aviation SSR systems.
  - Impact 4: Impact to London Stansted PSR and the NATS Cromer PSR.
  - Impact 5: Impact to military PSR systems at Marham, Wattisham, Lakenheath and Honington.
  - Impact 6: Transboundary Impacts.

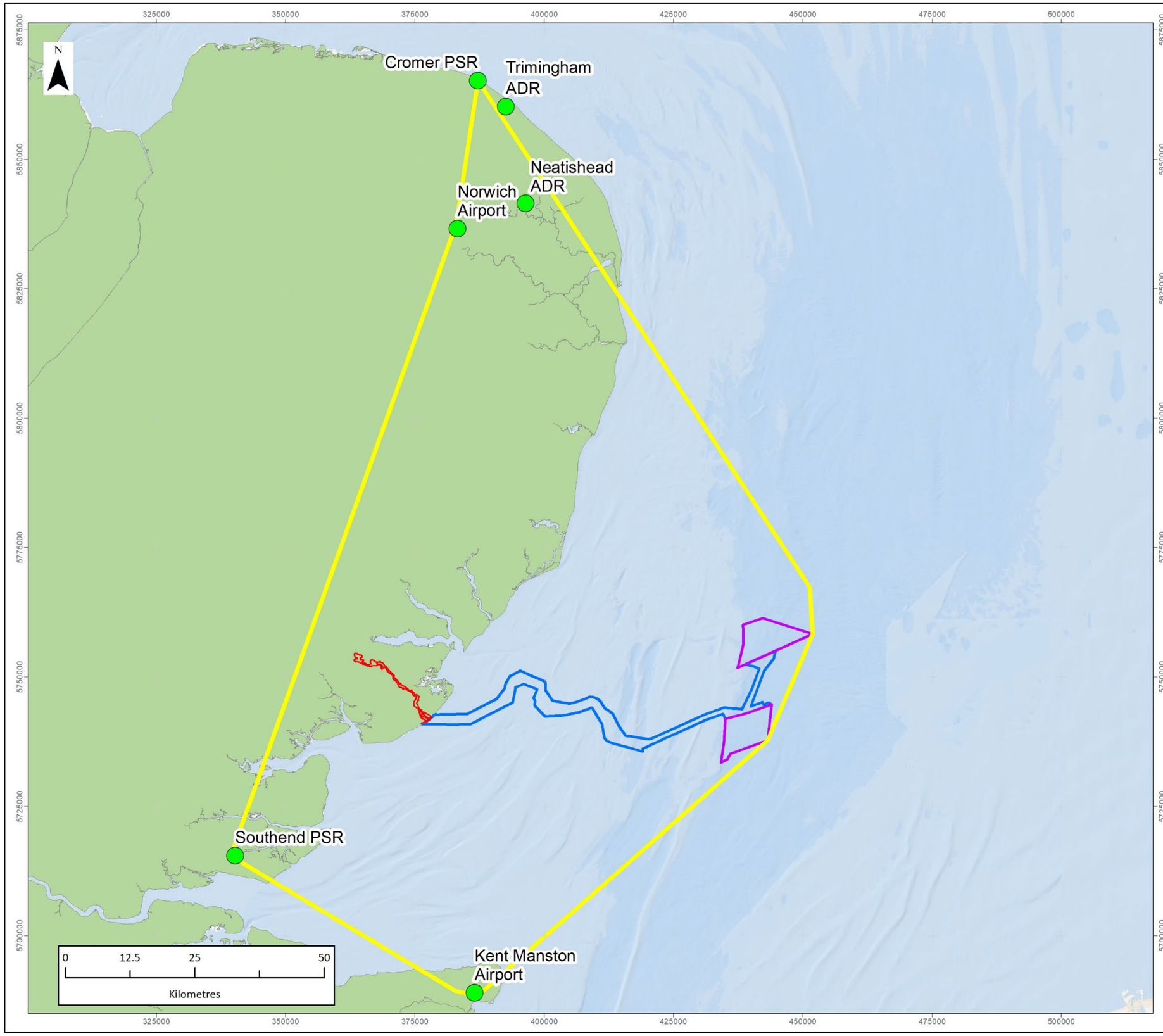
13.5 STUDY AREA

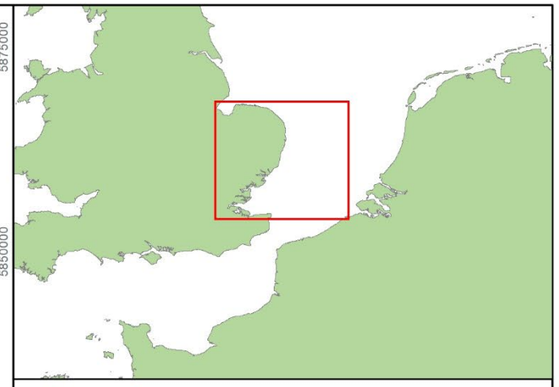
13.5.1 The military and civil aviation study area is shown in Figure 13.1. This military and civil aviation study area includes the VE array area and airspace between the VE array area, and the UK mainland from the Norwich Airport PSR to the north-west, the London Southend Airport (LSA) PSR to the west, Kent International Airport to the south-west. The VE aviation and radar study area for undertaking the assessment of cumulative effects is the same, except for the assessment of radar cumulative effects which includes other offshore wind farms in the southern North Sea that could have potential cumulative effects on identified radar receptors. Specifically, the VE military and civil aviation study area covers:

- Aviation radar systems that potentially detect operational 420 m above MHWS high (blade tip) wind turbines within the array area.
- Offshore helicopter operations that are located within the proximity of the study area.
- Airborne SAR flight operations.
- Military low flying activity over the sea and adjacent to the VE arrays.
- Potential impact created by the regeneration of Kent International Airport.

13.5.2 The VE aviation related study area may be reviewed and amended following consultation responses, or as a result of any amendments to the array and in accordance with any identification of additional constraints.

[5] The MOD wish to be consulted to determine any impact to MOD assets once the landfall location and ECC route is finalised.





LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Onshore Red Line Boundary
- Study Area
- Key Aviation and Radar Sites

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Military and Civil Aviation Study Area

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.1

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:750,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

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13.6 RADAR LINE OF SIGHT

13.6.1 Radar detectable wind turbines can be a significant cause of radar false plots, or unwanted returns known as 'clutter'. Rotating blades can trigger the Doppler threshold (e.g., minimum shift in signal frequency) of the Radar Data Processor (RDP) and therefore might be interpreted as aircraft targets. Additionally, the rotation of the wind turbine blades provides an indication to the radar system that the target acquired is moving and thus defeating Doppler processing techniques. This issue can be further compounded by a large number of wind turbines located together (wind farm) which leads to a cumulative effect with higher densities of radar clutter produced.

13.6.2 Generally, the greater the size of the wind turbine infrastructure the larger its Radar Cross Section (RCS) will be to the radar, thus resulting in an increased chance of it creating clutter. This clutter will be processed by the radar and provided to an air traffic controller on the Radar Data Display Screens (RDDS). False plots, clutter and reduced radar sensitivity may reduce effective use of the system to an unacceptable level and compromise the provision of a safe radar service to participating aircraft and detection of aircraft targets. The generalised effects wind turbines have on radar systems are as follows:

- Twinkling appearance/blade flash effect can distract the air traffic controller from their primary task.
- Masking of real aircraft targets caused by increased clutter being displayed on the RDDS.
- Increase in unwanted targets or false aircraft tracks.
- Receiver saturation.
- Target desensitisation causing loss of valid aircraft targets that are of a small RCS.
- Shadowing behind the wind turbines caused by physical obstruction (blocking of radar transmitted signal).
- Degradation of target processing capability and processing overload.
- Degradation of tracking capabilities including track seduction.

13.6.3 Without specific wind turbine mitigation processing capabilities, radar cannot distinguish between returns from wind turbines (false returns, or clutter) and those from aircraft. Air traffic controllers are required to assume that actual aircraft targets could be lost over the location of a wind farm; furthermore, identification of aircraft under control could be lost or interrupted. It is mainly for the above reasons that aviation radar system operators may object to wind farm developments that are within radar LoS to radar systems.

13.6.4 Osprey utilised the Advanced Topographic Development and Images (ATDI) system software (Version 22.4.7 x64) tool to model the terrain elevation profile between the identified PSR and ADR systems and the array areas. Otherwise known as a point-to-point radar LoS analysis, the result is a graphical representation of the intervening terrain and the direct signal LoS (taking into account earth curvature and radar signal properties). This is a limited and theoretical desk-based radar modelling study which is frequently used for offshore wind assessments in order to establish the potential for individual wind farm developments to create an effect to aviation radar. However, there are unpredictable levels of atmospheric signal diffraction and attenuation within a given radar environment that can influence the probability of a wind turbine being detected. The analysis is designed to give an indication of the theoretical likelihood of a wind turbine being detected by the assessed radar system. The qualitative definitions utilised in the radar LoS assessment are defined in Table 13.3.

Table 13.3: Qualitative definition of radar LoS

Result	Definition
Yes	The wind turbine is highly likely to be detected by the radar: direct LoS exists between the radar and the wind turbine.
Likely	The wind turbine is likely to be detected by the radar at least intermittently.
Unlikely	The wind turbine is unlikely to be detected by the radar but cannot rule out occasional detection.
No	The wind turbine is unlikely to be detected by the radar as significant intervening terrain exists.

13.6.5 Radar detectability of wind turbines does not automatically provide justification for an objection from radar stakeholders. Other factors will determine the nature and severity of the operational impact on the receptor e.g.:

- The consideration of airspace structure and classification in the wind turbine vicinity.
- The operational significance of the airspace to the operator.
- The range of the development from the radar source.
- Applicable aircraft traffic patterns and procedures.
- The type of radar service provided by the radar stakeholder to air traffic using the airspace.
- The operational coverage of the radar system utilised by the air traffic controller/air defence controller to complete the specific task.

13.6.6 A radar LoS analysis was undertaken to obtain information on potential aviation and radar receptors. The documents listed in Section 13.2 and the consultation responses provided in Table 13.2 informed the analysis on which aviation PSR systems to assess radar detectability.

13.6.7 The aim of the LoS analysis is to determine which radar systems have the potential to detect operational wind turbines at the maximum blade tip height placed within the offshore array development areas. At the time of radar analysis, a wind turbine site layout wasn't available; however, the layout of wind turbines does not have a material effect on establishing if theoretical radar LoS is possible. Therefore, to enable the analysis, points of reference in the form of a regular grid pattern were established across the VE array areas with turbines on all array vertices at the worst-case blade tip height of 420 m above MHWS which is considered to be the Maximum Design Scenario (MDS) for aviation. Please note this shows more turbine positions than is proposed for the MDS of a maximum of 79 WTG, but demonstrates the areas within the array which could be subject to theoretical radar detectability.

NATS PSR

13.6.8 The Cromer PSR is located at a distance of 62.3 nautical miles (NM) from the closest boundary position of the north array. Figure 13.2 below provides the results of the radar LoS analysis from the Cromer PSR to the north and south array areas at the assessed blade tip height of 420 m above MHWS.

13.6.9 The NATS Cromer PSR is predicted to theoretically detect the VE wind turbines by varying degrees of detectability. The north array which is closest to the PSR position will theoretically be highly likely to detect the operational wind turbines (red pins) with detectability decreasing across the north and south arrays as the distance from the PSR location increases. NATS have previously stated (within the Scoping Opinion) that impact created by detectability of the project wind turbines can be managed without mitigation; however, as parameters of the wind turbines have changed, NATS have been reconsulted in order to establish if the initial opinion provided by them remains unchanged this was confirmed by email as included in Table 13.2 and therefore NATS infrastructure is not considered further.

MOD AIR DEFENCE RADAR (ADR)

13.6.10 The RAF is responsible for the UK's Air Surveillance and Control System (ASACS) which is formed in part by the ADR network. Due to the east coast location the Trimingham and Neatishead ADR systems on the North Norfolk coast are close enough to the north and south array that the maximum height wind turbines will be theoretically detectable by these ADR. Detection of the operational wind turbines will create an unacceptable effect to ASACs capability which is responsible for the protection of UK airspace.

13.6.11 The Neatishead PSR is located 49.8 NM from the closest boundary position of the north array. Figure 13.3 below provides the results of the radar LoS analysis from the Neatishead ADR to the north and south array areas at the assessed blade tip height of 420 m above MHWS.

13.6.12 The Trimingham ADR is located 60.4 NM from the closest boundary position of the north array. Figure 13.4 below provides the results of the radar LoS analysis from the Trimingham ADR to the north and south array areas at the assessed blade tip height of 420 m above MHWS.

13.6.13 The Neatishead and Trimingham ADR systems are predicted to theoretically detect the development wind turbines by varying degrees of detectability. The north array which is closest to the ADR positions will theoretically be highly likely to detect the operational wind turbines (red pins) with detectability decreasing across the north and south arrays as the distance from the ADRs location increases. Due to the results of the radar LoS analysis and the response provided by the MOD, the Neatishead and Trimingham ADRs are included within the assessment.

LONDON SOUTHEND AIRPORT PSR

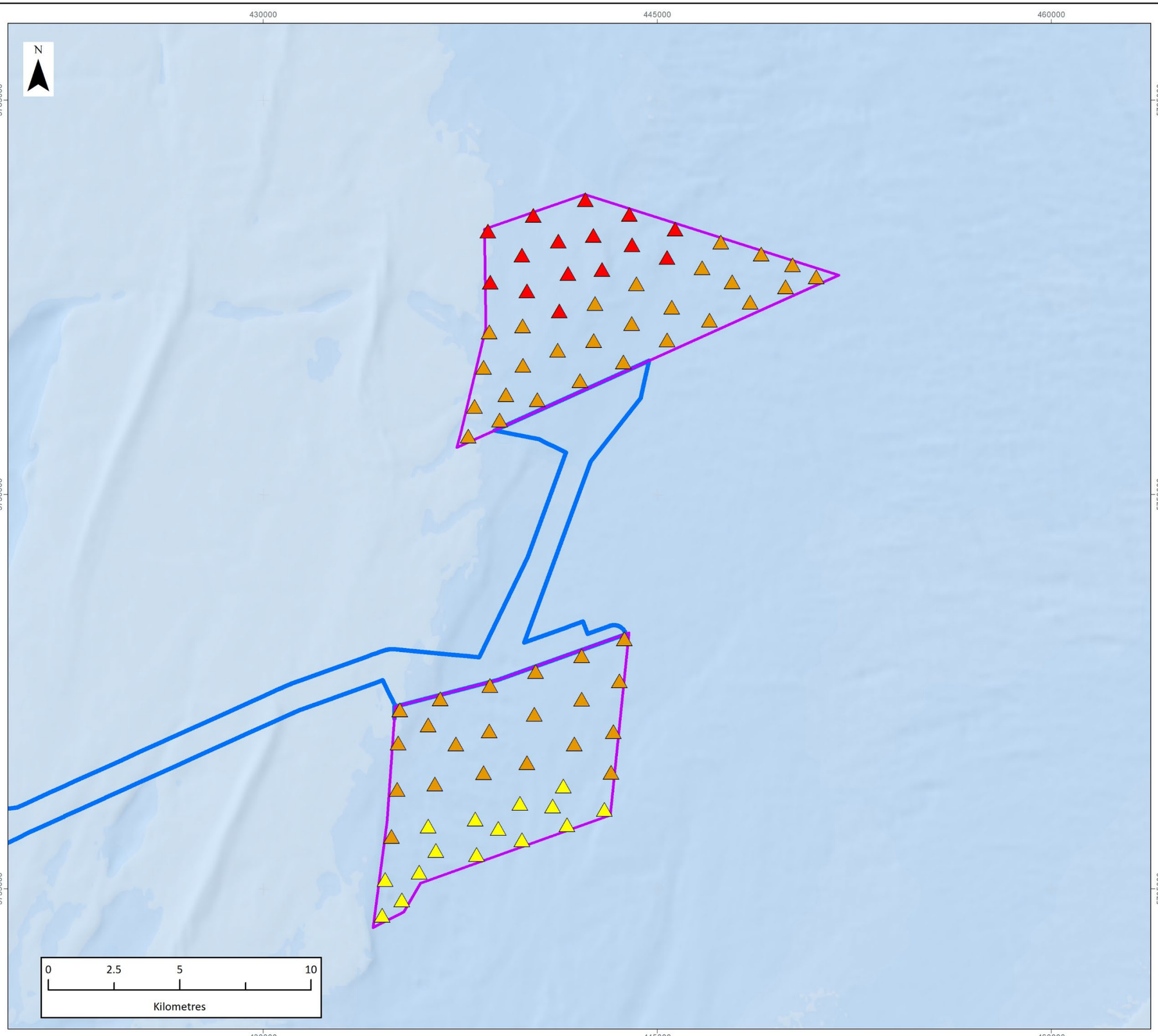
13.6.14 Radar LoS analysis was completed to the LSA PSR which is located on a bearing of 257°/54 NM from the closest edge of south array area and 235°/55.7 NM from the north array area. Figure 13.5 below provides the results of the radar LoS analysis from the Southend Airport PSR to the north and south array areas at the assessed blade tip height of 420 m above MHWS.

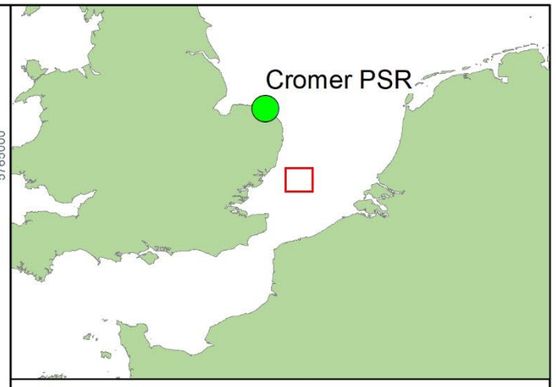
13.6.15 The Southend Airport PSR is predicted to theoretically detect the development wind turbines by varying degrees of detectability. The south array which is closest to the PSR position will theoretically be highly likely to detect the operational wind turbines (red pins) with detectability decreasing across the north array as the distance from the PSR location increases. It is however, considered unlikely that LSA ATC (Approach Radar Service Documented Operational Coverage (DOC) of 40 NM) will be controlling aircraft in the airspace above the array areas however, until the airport has confirmed that no effect to the airport PSR will be created, the Southend Airport PSR is considered within the assessment.

NORWICH AIRPORT PSR

13.6.16 The Norwich Airport PSR is located 51 NM from the closest boundary position of the north array. Figure 13.6 below provides the results of the radar LoS analysis from the Norwich Airport PSR to the north and south array areas at the assessed blade tip height of 420 m above MHWS.

13.6.17 The Norwich Airport PSR is predicted to theoretically detect the development wind turbines by varying degrees of detectability. The north array which is closest to the PSR position will theoretically be likely to detect the operational wind turbines (orange pins). The south array is unlikely to detect the operational wind turbines however analysis cannot rule out occasional detection. It is considered unlikely that Norwich ATC will be controlling aircraft in the airspace above the array areas however, until the airport has confirmed that no effect to the airport PSR will be created, the Norwich Airport PSR is considered within the assessment.





LEGEND

- Array Areas
- Offshore Export Cable Corridor

LoS Analysis (420m):

- NO
- UNLIKELY
- LIKELY
- YES

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Cromer PSR
Results of LoS analysis at 420 m

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.2

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

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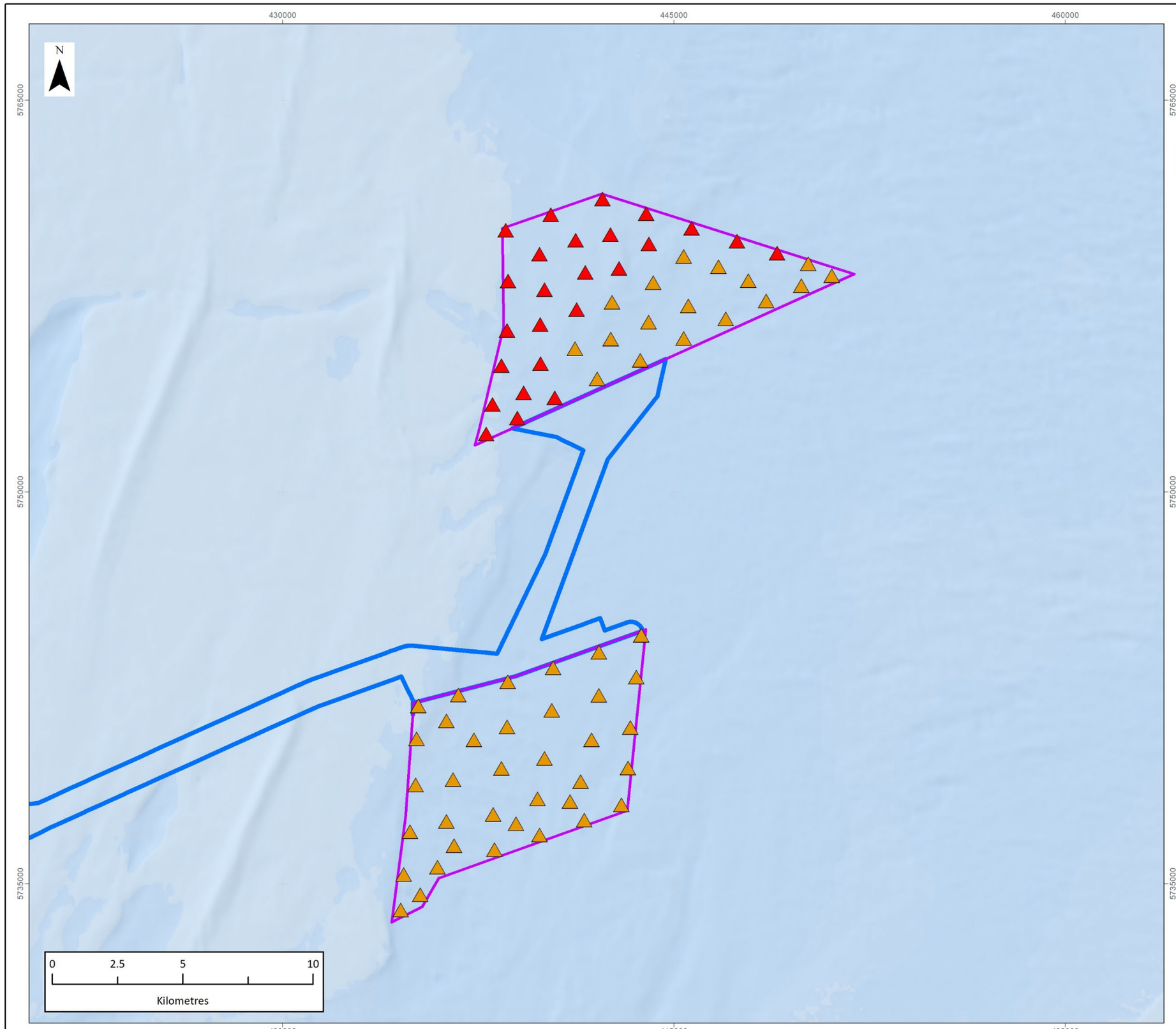

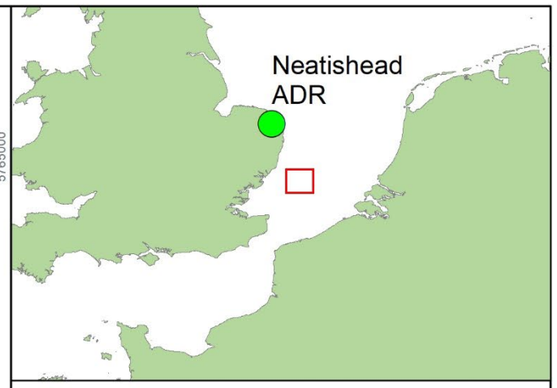

LEGEND

- Array Areas
- Offshore Export Cable Corridor

LoS Analysis (420m):

- NO
- UNLIKELY
- LIKELY
- YES

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Neatishead ADR
Results of LoS analysis at 420 m

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.3

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

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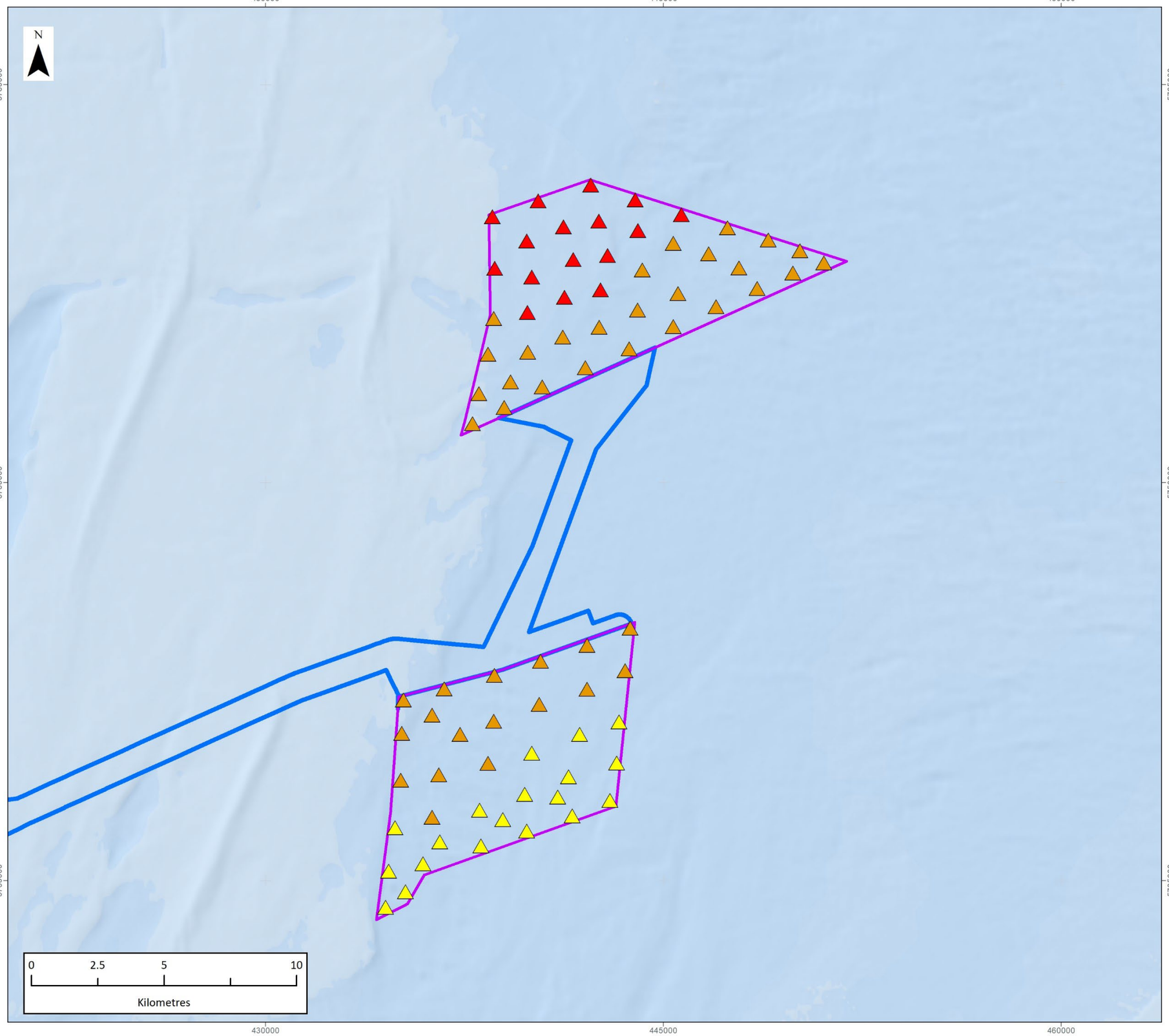

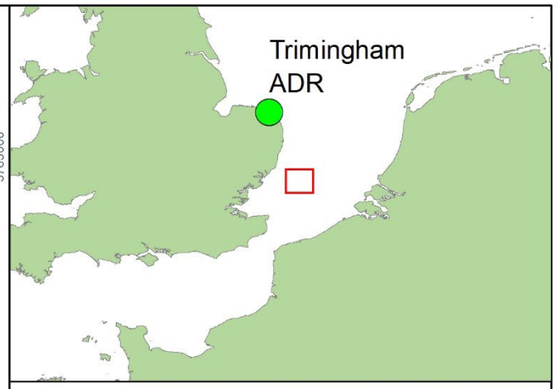

LEGEND

- Array Areas
- Offshore Export Cable Corridor

LoS Analysis (420m):

- NO
- UNLIKELY
- LIKELY
- YES

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Trimingham ADR
Results of LoS analysis at 420 m

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.4

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

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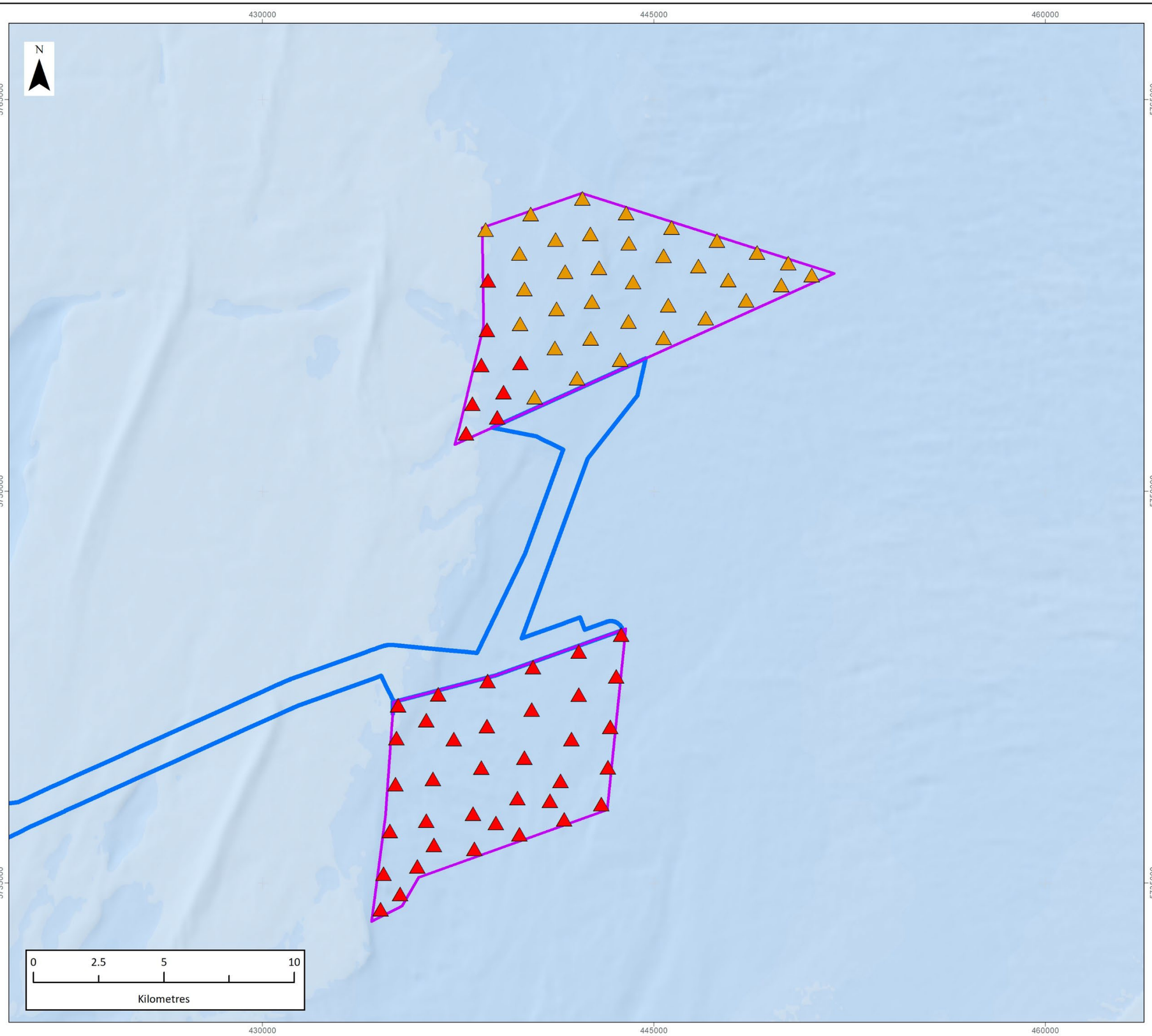

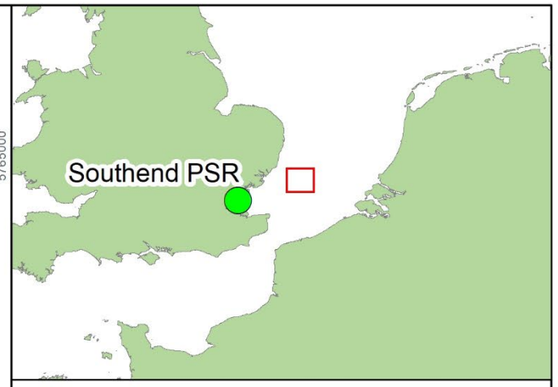

LEGEND

- Array Areas
- Offshore Export Cable Corridor

LoS Analysis (420m):

- NO
- UNLIKELY
- LIKELY
- YES

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Southend Airport PSR
Results of LoS analysis at 420 m

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.5

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

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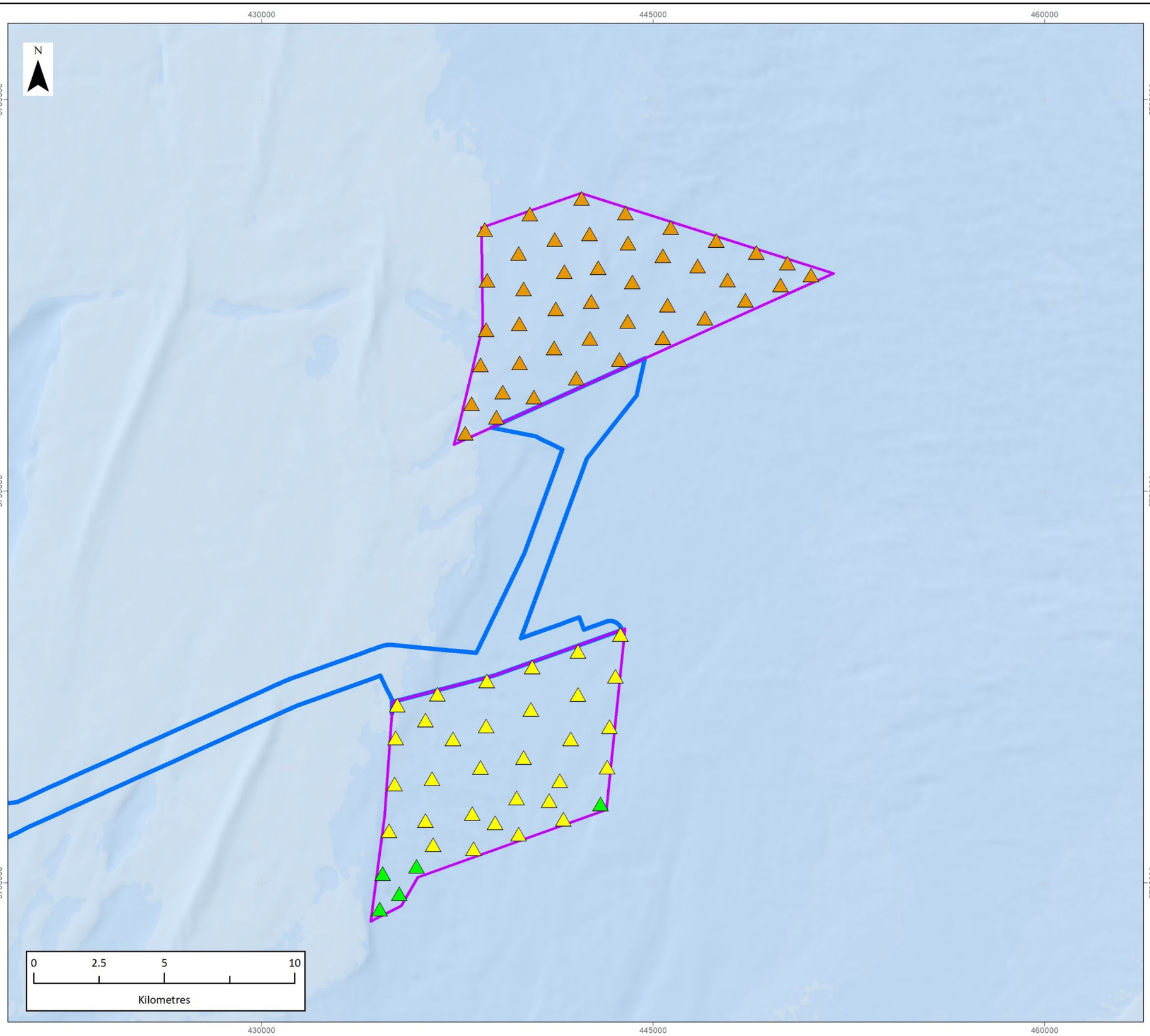

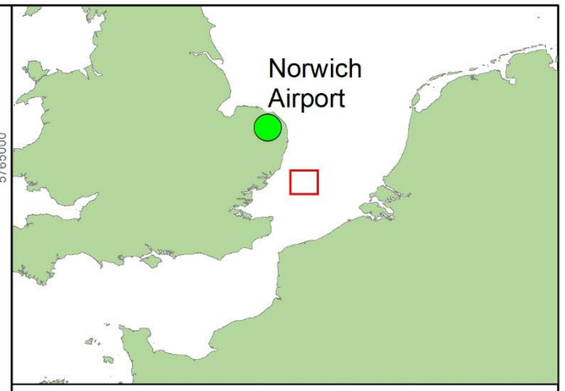

LEGEND

- Array Areas
- Offshore Export Cable Corridor

LoS Analysis (420m):

- NO
- UNLIKELY
- LIKELY
- YES

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Norwich Airport PSR
Results of LoS analysis at 420 m

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.6

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:150,000	A3	WGS84	UTM31N

FIVE ESTUARIES OFFSHORE WIND FARM

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13.7 DATA SOURCES

13.7.1 The data used in this chapter are the most up to date publicly available information which can be obtained. Sources that have been used to inform the assessment are listed in Table 13.4.

Table 13.4: Data and information sources

Data set	Year of publication
CAA Visual Flight Rules Charts.	2022
MOD Military Aeronautical Information Publication (Mil AIP).	2022
CAA CAP 032: UK IAIP.	2022
CAA CAP 764.	2016

13.8 ASSESSMENT CRITERIA AND ASSIGNMENT OF SIGNIFICANCE

13.8.1 Determining the significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. The criteria for defining magnitude of the impacts in this chapter are outlined in Table 13.5. Sensitivity/ importance of the environment/receptors is defined in Table 13.6.

13.8.2 In basic terms, the potential significance of an impact is a function of the sensitivity of the receptor and the magnitude of the effect. The determination of significance is guided by the use of an impact significance matrix of potential effects as described in Table 13.7.

Table 13.5: Impact magnitude definitions

Magnitude	Description/ reason
High	Total loss of ability to carry on activities and/ or impact is of extended physical extent and/ or long-term duration (i.e., total life of project) and/ or frequency of repetition is continuous and/ or effect is not reversible for the project.
Medium	Loss or alteration to significant portions of key components of current activity and/ or physical extent of impact is moderate and/ or medium-term duration (i.e., operational period) and/ or frequency of repetition is medium to continuous and/ or effect is not reversible for the project phase.
Low	Minor shift away from baseline, leading to a reduction in level of activity that may be undertaken and/ or physical extent of impact is low and/ or short to medium term duration (i.e., construction period) and/ or frequency of repetition is low to continuous and/ or effect is not reversible for the project phase.

Magnitude	Description/ reason
Negligible	Very slight change from baseline condition and/ or physical extent of impact is negligible and/ or short- term duration (i.e., less than two years) and/ or frequency of repetition is negligible to continuous and/ or effect is reversible.

Table 13.6: Sensitivity/importance of the environment/receptor

Receptor sensitivity/ importance	Definition
High	Receptor provides a service which is of high value to the local, regional or national economy, and/ or the receptor is generally vulnerable to impacts that may arise from the project, and/ or recoverability is slow and/ or costly.
Medium	Receptor provides a service which is of moderate value to the local, regional or national economy, and/ or the receptor is somewhat vulnerable to impacts that may arise from the project, and/ or has moderate to high levels of recoverability.
Low	Receptor provides a service which is of low value to the local, regional or national economy, and/ or the receptor is not generally vulnerable to impacts that may arise from the project, and/ or has high recoverability.
Negligible	Receptor provides a service which is of negligible value to the local, regional or national economy, and/ or the receptor is not vulnerable to impacts that may arise from the project, and/ or has high recoverability.

Table 13.7: Matrix to determine effect significance

Magnitude		Sensitivity: High	Sensitivity: Medium	Sensitivity: Low	Sensitivity: Negligible
Negative	High	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
Neutral	Negligible	Minor	Minor	Negligible	Negligible
Beneficial	Low	Moderate	Minor	Minor	Negligible
	Medium	Major	Moderate	Minor	Negligible
	High	Major	Major	Moderate	Minor

Note: shaded cells are defined as significant with regards to the EIA Regulations 2017[6].

13.9 UNCERTAINTY AND TECHNICAL DIFFICULTIES ENCOUNTERED

13.9.1 No technical limitations or difficulties were encountered in compiling the information required for the completion of the military and civil aviation baseline study and confidence in the establishment of the baseline is high. However, the radar LoS analysis is a limited and theoretical desk-based study; in reality there are unpredictable levels of signal refraction, diffraction and attenuation within a given radar environment that can influence the probability of an operational wind turbine being detected.

13.10 EXISTING ENVIRONMENT

13.10.1 The operational range of a radar system is dependent on the type of radar used and its operational requirement. CAP 764 (CAA, 2016) provides a guide of 30 km for assessment of radar impact; however, any impact is dependent on radar detectability of operational wind turbines, the radars operational range and the use of airspace in which VE sits. This assessment has been informed by the results of baseline studies, radar LoS analysis and consultation, with reference to the existing evidence base regarding the effects of offshore wind farm development.

[6] The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017

13.10.2 Aviation receptors were identified in accordance with CAP 764 (CAA, 2016) and radar LoS analysis as described in Section 13.6. This assessment considers all radar systems within operational range of VE and are predicted (through the results of analysis) to detect operational wind turbines at a maximum blade tip height of 420 m above MHWS, as well as military areas of operation. For each identified receptor, the physical obstruction and/ or radar effect, and subsequently the operational impacts were considered along with any other potential impacts. The operational impact considers the orientation of approach and departure flight paths, physical safeguarding of flight, airspace characteristics and flight procedures as published in the UK IAIP (CAA, 2022b) and the Mil AIP (MOD, 2022).

THE ARRAY

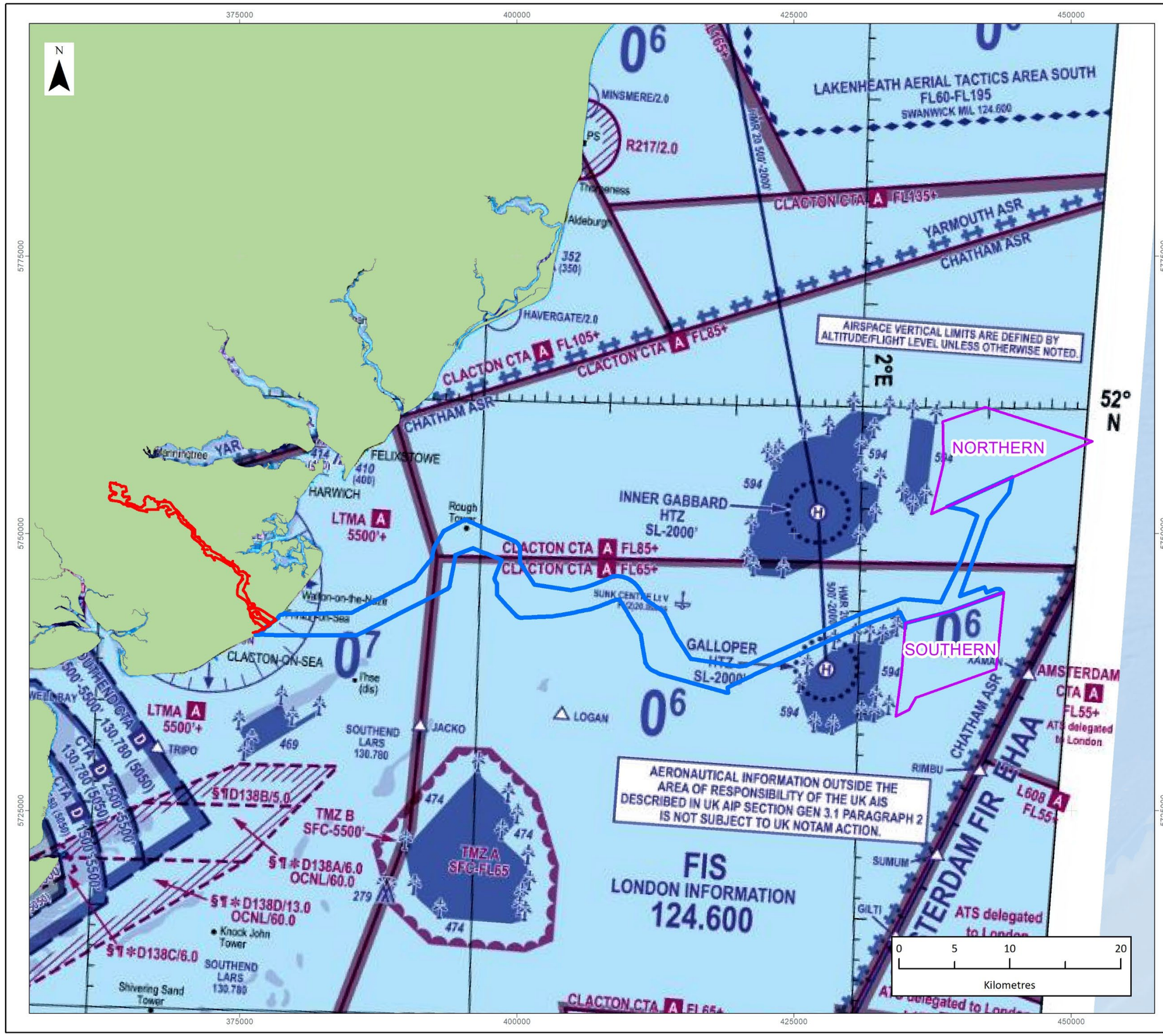
13.10.3 A characterisation of the aviation baseline for the area of the arrays was detailed within the EIA Scoping Report (VE OWFL, September 2021). A review of the key findings from that study has been incorporated into the description of the existing environment.

13.10.4 The airspace above and around VE is used by both civil and military aircraft, which are tracked by radar systems including those operated by NATS and the MOD. The VE northern array area will be located in an area of Class G uncontrolled airspace, which is established above the array area from the surface up to a ceiling of Flight Level[7] (FL) 85 (approximately 8,500 feet (ft). The Class G airspace ceiling lowers to FL65 above the southern array area. Above this Class G airspace, Class A Controlled Airspace (CAS) (airways) forms the Clacton Control Area (CTA) which is established from various levels up to FL195 (19,500ft), further CAS is established above FL195. Figure 13.7 below provides an illustration of the airspace structure above the array areas together with the dividing line between the London and Amsterdam Flight Information Regions[8] (FIR). VE lies completely within UK airspace[9].

[7] A Fight Level (FL) is a surface of constant atmospheric pressure related to a specific pressure datum, 1013.2hPa and is separated from other such surfaces by specific pressure intervals. Altitude above the sea-level is measured in 100 feet (ft) units according to the standard atmosphere. In lay terms the FL corresponds approximately to the nearest 100 ft of altitude at which the airspace begins.

[8] A Flight Information Region (FIR) is a specified region of airspace in which a flight information service and an alerting service are provided. The International Civil Aviation Organisation (ICAO) delegates which country is responsible for the operational control of a given FIR.

[9] The boundary between London FIR (under the regulation of the UK CAA) and Amsterdam FIR (under the regulation of the Netherlands Inspectie Leefomgeving en Transport (ILT)) is located to the east of the array areas which both lie within the lateral confines of the London FIR.



LEGEND

- Array Areas
- Offshore Export Cable Corridor
- Onshore Red Line Boundary

Data Source:
Basemap: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

PROJECT TITLE:

FIVE ESTUARIES OFFSHORE WINDFARM

DRAWING TITLE:

Airspace Structure

VER	DATE	REMARKS	Drawn	Checked
1	10/03/2023	For Issue	SWM	WH

DRAWING NUMBER:

13.7

SCALE:	PLOT SIZE:	DATUM:	PROJECTION:
1:350,000	A3	WGS84	UTM31N

FIVE ESTUARIES
OFFSHORE WIND FARM

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AIRSPACE DESIGNATIONS

13.10.5 The airspace within, above and surrounding the array areas is used by aircraft which observe the airspace rules dependent on the classification of airspace within which they are operating as follows:

- Class G uncontrolled airspace: any aircraft can operate in an area of uncontrolled airspace without any mandatory requirement to be in communication with Air Traffic Control (ATC). Pilots of aircraft operating under Visual Flight Rules[10] (VFR) in Class G airspace are ultimately responsible for seeing and avoiding other aircraft, terrain and obstructions.
- Class A CAS: all aircraft operating in this airspace must be in receipt of an ATS.

13.10.6 The RAF is responsible for the UK's Air Surveillance and Control System which is formed in part by the ADR network. The Trimingham ADR system on the North Norfolk coast is close enough to the north and south array that the turbines will be theoretically by this ADR; similarly, the Neatishead ADR will theoretically highly likely detect the majority of the north array, with likely (occasional) detection of the south-east corner of the north array and south array which will create an unacceptable effect to ASACs capability which is responsible for the protection of UK airspace.

13.10.7 Above and surrounding the VE array areas within Class G uncontrolled airspace, a radar based ATS may be provided on request (subject to suitable radar and radio coverage) by the following agencies:

- NATS, has a licence obligation to provide radar data to other remote aviation stakeholders (such as the MOD and airport authorities) to a high quality and performance standard for the benefit of UK aviation as a whole. Any effect that VE might have on NATS En-route Limited (NERL) (which is a subsidiary of NATS) radar systems must be considered both in terms of effect on the civilian en-route services and in the context of its remote users such as the MOD and airports.
- The MOD, military air traffic controllers located at the Swanwick Area Control Centre (ACC) utilise NATS PSR for the provision of ATS to aircraft flying outside of and crossing CAS above FL 100 within radar and radio coverage. Military air defence controllers may also control aircraft in support of air defence operations utilising NATS PSR and MOD ADR systems.

13.10.8 Within CAS, NERL are the main ATS provider utilising several long-range PSR systems positioned to provide maximum coverage of UK airspace.

AIR TRAFFIC SERVICE IN UNCONTROLLED (CLASS G) AIRSPACE

13.10.9 A non-radar based Flight Information Service (FIS) is provided within Class G uncontrolled airspace within the area of the offshore array areas for those General Aviation (GA), military and commercial aircraft which wish to use it. The service is provided by airfields, NATS and the MOD for basic and alerting purposes as well as providing on request, routine and airfield meteorological information to pilots. The development of VE will not impact the provision of this service.

[10] Visual Flight Rules - A set of regulations under which a pilot operates an aircraft in weather conditions clear enough to allow the pilot to see where the aircraft is going; the pilot must be able to operate the aircraft with visual reference to the ground, and by visually avoiding obstructions and other flying machines.

13.10.10 A Lower Airspace Radar Service (LARS) is available by Norwich and Southend Airport radar controllers to all aircraft requesting it and operating outside of CAS (up to FL 100) within the limits of the airfield radio and radar cover. The provision of LARS is at the discretion of the airport controllers concerned because they may be fully engaged in their primary tasks therefore, occasionally, the service may not be available. The array areas are outside of the LARS service provision range of these two radar systems (Norwich 30 NM radius, Southend 25 NM radius) (UK IAIP, 2022). Both airports may operate their radar systems outside of the range of LARS provision (subject to appropriate radar coverage being provided) for the control of aircraft inbound and outbound from their respective airfields or for tactical awareness of the air traffic situation. Subject to stakeholder confirmation, Norwich and Southend Airport air traffic controllers may also provide a radar based ATS overhead the array areas.

RADAR LINE OF SIGHT CONCLUSIONS

13.10.11 Due to the potential of radar detectability of the operation of 420 m above MHWS blade tip height wind turbines and stakeholder feedback, the following PSR and ADR systems are considered within the assessment:

- MOD Neatishead ADR.
- MOD Trimingham ADR.
- Southend Airport PSR.
- Norwich Airport PSR.

OTHER AVIATION RECEPTORS CONSIDERED IN THE BASELINE ASSESSMENT

MILITARY LOW FLYING OPERATIONS

13.10.12 The UK Low Flying system (UKLFS) used for military low flying activity covers the airspace over the entire UK land mass and surrounding sea (excluding restricted, PEXA and built-up areas) generally out to 2 NM from the coastline, from the surface to 2,000 ft above ground level (agl) or amsl, however military low flying activities can take place further from the coastline out to sea. VE has the potential to impact low flying operations due to the construction of multiple obstacles above sea level.

AIRBORNE SEARCH AND RESCUE OPERATIONS

13.10.13 The Search and Rescue (SAR) force provides 24-hour aeronautical SAR cover in the UK which is provided from ten strategically located bases across the country. The bases are positioned close to SAR hotspots so that aircraft can provide support as quickly and efficiently as possible. Bristow Helicopters were awarded the contract to provide SAR helicopter services for the UK in 2013 and operate SAR operations from Lydd Airport (the closest SAR aircraft base to VE).

OFFSHORE HELICOPTERS OPERATING IN SUPPORT OF VE

13.10.14 The use of helicopters in the construction, operation and maintenance phases of the development will increase the numbers of users operating in the airspace between the airfield of departure and arrival and the transit to and from VE. The airspace in which the helicopters will be operating is uncontrolled in which aircraft operate on see and be seen basis with flight likely to be conducted under Visual Meteorological Conditions[11] (VMC). If conducting the flight under Instrument Flight Rules (IFR) aircraft are likely to be receiving an Air Traffic Control Service (ATCS) and utilising onboard radar systems for the separation from other aircraft operating in the airspace. It is expected that the continued safe operation of uncontrolled airspace between the shore and VE will not be affected by the addition of helicopter flights in support of VE. As defined in the Scoping Opinion (PINS, November 2021) the use of helicopters in support of VE is considered in the assessment due to the creation of an obstruction.

KENT INTERNATIONAL AIRPORT

13.10.15 The Kent International Airport, now closed, is located approximately 38 NM southwest of the south array area. The UK Government has granted approval for the airport to be developed to become London's seventh airport. The future aviation related infrastructure (communication, navigation and surveillance) or future Instrument Flight Procedures[12] (IFP), which will assist the operation of the airport cannot be publicly obtained however, it is possible that the two projects may interact due to the proximity of VE to the airport. Until the operation and associated infrastructure required for the airport to operate safely has been published, it is difficult to assess the impact individually, and accurately; therefore, Kent International has been assessed with the cumulative effect assessment.

[11] Visual Meteorological Conditions (VMC): A flight category which allows flight to be conducted under visual flight rules defined by in flight visibility and clearance from cloud.
[12] Instrument Flight Procedures (IFP): An IFP is a published procedure used by aircraft flying in accordance with the instrument flight rules which is designed to achieve and maintain an acceptable level of safety in operations and includes an instrument approach procedure, a standard instrument departure, a planned departure route and a standard instrument arrival. IFPs are safeguarded by the airport authority.

13.11 EVOLUTION OF THE BASELINE

13.11.1 It is difficult to define what the likely evolution of the aviation interests in the southern North Sea will be either with, or in the absence of VE. There are no aviation related interactions between the project and the hydrocarbon industry as no offshore hydrocarbon platforms are located within the vicinity of the array areas.

13.11.2 To bolster the UK's energy security, the UK government has confirmed its support for a new oil and gas licensing round, expected to be launched by the North Sea Transition Authority (NSTA) in early October. These licenses will enable developers to search for commercially viable oil and gas sources within the areas of their licenses which may lead to an increased aviation activity as new offshore areas are developed.

13.12 KEY PARAMETERS FOR ASSESSMENT

13.12.1 The assessment of potential impacts on military and civil aviation is based on the MDS and is specific to the potential impacts identified in this chapter. The key parameters for the MDS include the maximum number of wind turbines across the largest area and the maximum blade tip height of 420 m above MHWS.

13.12.2 The MDS for impacts on military and civil aviation including radar assumes that the entirety of the VE array area will be populated with wind turbines (29 in the case of the largest wind turbines) at the maximum blade tip height of 420 m above MHWS. This is because the largest area of the highest wind turbines will create the largest impact from a physical obstruction and radar interference perspective, leading to a potential greater effect on aviation services. Any aspects of the infrastructure that are lower in height than the wind turbines and less than the extent of the VE array areas will not create an incremental effect on aviation interests. provides the MDS for impacts to military and civil aviation.

Table 13.8:Maximum design scenario for the project alone

Potential effect	Maximum adverse scenario assessed	Justification
Construction		
Impact 1: Creation of an aviation obstacle.	Array MDS for VE at a maximum blade tip height of 420 m above MHWS.	Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the VE array area.
Operation		
Impact 2: Creation of an aviation obstacle. Impact 3: Wind turbines causing interference on civil and military radar systems.	Array MDS for VE at a maximum blade tip height of 420 m above MHWS. Impact throughout the Operation phase of 40 years. Impact duration present during operational period.	Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the VE array area. ATC and air defence controllers may be unable to provide an effective surveillance service due to interference on radar displays. Impact duration present during operational period.
Decommissioning		
Impact 4: Creation of an aviation obstacle.	Array MDS for VE at a maximum blade tip height of 420 m above MHWS.	Maximum physical obstruction to aviation operations due to size and number of above sea level infrastructure within the VE array area.
Cumulative		
Impact 5: Creation of an aviation obstacle.	MDS for VE plus the cumulative full development of other offshore projects	This includes the presence of other developments which will have the potential to

Potential effect	Maximum adverse scenario assessed	Justification
	within 40 km[13] of VE. Table 13.11 provides those operational and planned projects considered within the military and civil aviation cumulative effect assessment.	create a cumulative aviation obstacle and affect available airspace for other low level flying users in the same region.
Impact 6: Wind turbines causing interference on civil and military radar systems.	MDS for VE plus the cumulative full development of other offshore projects within 100 km[14] of the VE array areas.	MDS aviation and radar cumulative effect is calculated within a representative 100 km buffer of the VE array areas.
Impact 7: Potential impact to Kent International Airport.	MDS for VE plus the cumulative full development of other offshore projects within 100 km to account for obstruction and radar effect.	MDS aviation and radar and obstruction cumulative effect is calculated within a representative 100 km buffer of the VE array areas.

[13] For the purposes of this PEIR, this additive impact has been assessed within 40 km from the VE array areas, which is considered to be the maximum range where the creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore may occur although some impacts are likely to be localised to the VE array areas.
[14] For the purposes of this PEIR, this additive impact has been assessed within 100 km from the VE array areas, which is considered to be the maximum range where aviation radar cumulative effect may occur although some impacts are likely to be localised to the VE array areas.

13.13 EMBEDDED MITIGATION

13.13.1 The embedded mitigation contained in Table 13.9 are mitigation measures or commitments that have been identified and adopted as part of the evolution of the topic, these include project design measures, compliance with elements of good practice and use of standard protocols. Where the assessment determined significant effects accounting for embedded mitigation, further measures may be required, which are presented as additional mitigation. These have typically been put forward where:

- An effect is significant in EIA terms, even with embedded mitigation, but additional mitigation measures are available to reduce the level of effect; or
- Mitigation has been proposed but has not yet been agreed with regulators, stakeholders, etc. or it is unproven.

13.13.2 Section 13.16 describes in further detail the potential options with regards to additional mitigation.

Table 13.9: Embedded mitigation relating to civil and military aviation

Project phase	Mitigation measures embedded into the project design
General	
Compliance with MGN 654	An Emergency Response Co-operation Plan (ERCoP) secured by a requirement of the DCO will be in place for the construction, operation and decommissioning phases of VE. The ERCoP is completed initially in discussion between the developer and the MCA, SAR and Navigation Safety Branches. Detailed completion of the plan will then be in cooperation with the Maritime Rescue Coordination Centre (MRCC), responsible for maritime emergency response. The ERCoP must then be submitted to and approved by the MCA. The ERCoP would detail specific marking and lighting of the wind turbines. The SAR helicopter bases would be supplied with an accurate chart of the VE wind turbine locations, helicopter access positions and spacing between wind turbines. Furthermore, the arrangements of liaison between the wind farm developer and HM Coastguard in the event of an emergency response would be detailed together with an explanation of procedures and processes carried out.
Construction	
Notification to aviation stakeholders.	The Defence Geographic Centre (DGC) will be informed of the locations, heights and lighting status of the wind turbines, including estimated and actual dates of construction and the maximum height of any construction equipment to be used, prior to the start of construction, to allow inclusion on Aviation Charts. A Notice to Aviators (NOTAM) will be provided ahead of construction activity.
Operation	
Fitment of aviation obstruction lighting.	VE OWFL is committed to marking and lighting the project in accordance with relevant industry guidance and as advised by relevant stakeholders including the MCA, CAA and Trinity House. Marking and lighting of the wind turbines and infrastructure will be in line with current industry standards and regulations.
Decommissioning	
Notification to aviation stakeholders.	As per construction.

13.14 ENVIRONMENTAL ASSESSMENT: CONSTRUCTION PHASE

IMPACT 1: CREATION OF AN AVIATION OBSTACLE

13.14.1 The impacts of the offshore construction of VE have been assessed on military and civil aviation. The impacts arising from the construction of VE are listed in Table 13.12 along with the MDS against which each construction phase impact has been assessed. The subsequent assessment stage of the EIA is based on the 'mitigated' design.

MAGNITUDE OF IMPACT

13.14.2 Aviation receptors that are likely to operate in the vicinity of the VE array areas (helicopter operators, the MOD and ATC service providers) will continue to be engaged regarding the offshore study area and the potential for the creation of an obstruction to low flying aircraft operating in the vicinity of construction infrastructure.

13.14.3 The construction of VE will create a physical obstruction to flight operations in the vicinity of the array areas. Construction infrastructure such as vessels, offshore substation platforms and erected wind turbines can be difficult to see from the air, particularly in poor meteorological conditions, leading to potential increased obstacle collision risk. Furthermore, during the construction phase, the presence and movement of construction infrastructure may present a potential obstacle collision risk to low flying aircraft operations. The MOD commented that in the interest of air safety, VE should be fitted with MOD accredited aviation safety lighting in accordance with the ANO (CAA, 2022b). The specification of the lighting to be used would be confirmed alongside requirements for the CAA, MCA, MOD and Trinity House in consideration of effects to civil and military low flying aircraft.

13.14.4 A range of embedded mitigation measures, in the form of appropriate notification to aviation stakeholders, lighting and marking to minimise effects to aviation flight operations would apply to the development of VE. These measures would comply with current guidelines and be agreed with the appropriate stakeholders. Embedded mitigation measures are outlined in Table 13.9.

13.14.5 Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. In VMC, pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and will be aware through notification of construction activities. Furthermore, when flying in Instrumental Meteorological Conditions[15] (IMC) in the vicinity of the construction area, pilots qualified to do so, will be flying above the Minimum Safe Altitude[16] (MSA) and will utilise (if available) on-board radar which detects obstructions and will be under the control of ATC with an appropriate level of radar service. The impact is predicted to be of short-term duration and intermittent and the magnitude of effect is therefore considered to be **low.**

[15] Instrument Meteorological Conditions (IMC): Weather conditions which would preclude flight by the visual flight rules, i.e., conditions where the aircraft is in, or close to cloud or flying in visibility less than a specified minimum.
[16] Minimum Safe Altitude (MSA): Under aviation flight rules, the altitude below which it is unsafe to fly in IMC owing to presence of terrain or obstacles within a specified area.

SENSITIVITY OF THE RECEPTOR

13.14.6 Those helicopter operators supporting VE, SAR helicopters, the MOD and ATC service providers will continue to be consulted regarding the potential for VE to create an obstruction to aviation activities in the vicinity of construction infrastructure. Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter on their route of flight. The development will be included within applicable military and civil aviation publications and charts; pilots will be aware of the presence of the development through notification procedures as provided within Table 13.9. Embedded mitigation and notification of construction, operation and decommissioning of the wind farm and the lighting and promulgation on aviation charts will reduce any physical obstruction effect to aviation activities in the region of the development. The ability of aviation stakeholders to continue using the portion of the southern North Sea in which VE will be operated is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

SIGNIFICANCE OF THE EFFECT

13.14.7 The magnitude of effect is deemed to be low; the sensitivity of the receptors is considered to be medium. Therefore, the impact on low flying fixed wing and rotary aircraft operating in the vicinity of the construction areas (including those flying in support of VE) is considered to be of **minor adverse** significance, which is not significant in EIA terms.

13.15 ENVIRONMENTAL ASSESSMENT: OPERATIONAL PHASE

IMPACT 2: CREATION OF AN AVIATION OBSTACLE

MAGNITIUDE OF IMPACT

13.15.1 The operation of the VE wind turbines will create a physical obstruction to flight operations in the vicinity of the offshore array areas. During the operational phase of VE, wind turbines could pose a physical obstruction to the flight of aircraft operating in the vicinity of the VE array areas, specifically to offshore helicopters and low flying aircraft. Helicopter operators operating offshore, SAR operators, the MOD and ATC service providers will continue to be engaged with regarding the potential for the VE array areas to create an obstruction to aviation activities in the vicinity of the wind turbines.

13.15.2 A range of embedded mitigation measures, in the form of appropriate notification to aviation stakeholders, lighting and marking to minimise effects to aviation flight operations would apply to the development of the projects, as included in Table 13.9.

13.15.3 As described in paragraph 13.14.6, pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions may necessitate route adjustments. In VMC, pilots would be expected to see and avoid obstructions. In low visibility and when operating in IMC, pilots qualified to do so, will be flying above the MSA, use onboard radar to detect obstructions and be under the control of ATC with an appropriate level of air traffic service. It is predicted that the impact will affect the receptor directly, however, the magnitude is considered to be **low**.

SENSITIVITY OF THE RECEPTOR

13.15.4 A range of embedded mitigation measures, in the form of appropriate notification to aviation stakeholders of the extent of the operational area, the maximum height of obstructions, the operational period and timings of any maintenance activity, together with the lighting and marking of infrastructure (in accordance with ANO (CAA. 2022b)) will minimise effects to aviation flight operations. The ability of aviation receptors to continue to operate safely remains as the obstacles are marked, lit and notified. Dependent on specific weather conditions, aircraft may be required to alter tracks or climb to avoid the area, the sensitivity of the receptors is therefore considered to be **medium**.

SIGNIFICANCE OF EFFECT

13.15.5 The magnitude of effect is deemed to be low; the sensitivity of the receptors is considered to be medium. Therefore, the impact on fixed wing and rotary aircraft during the operational phase (including those flying in support of VE) is considered to be of **minor adverse** significance, which is not significant in EIA terms.

IMPACT 3: WIND TURBINES CAUSTING INTERFERENCE ON CIVIL AND MILITARY RADAR SYSTEMS.

MAGNITUDE OF IMPACT

13.15.6 The operational wind turbines of the VE array areas would be theoretically detectable by the Norwich Airport and Southend Airport PSRs and the MOD Trimingham and Neatishead ADR systems by varying degrees. Wind turbines detectable by an aviation radar surveillance system might degrade the system by creating false targets, reduce system sensitivity, create radar shadowing behind the wind turbines and saturate the radar receiver leading to clutter potentially concealing real aircraft targets.

13.15.7 Radar LoS analysis which assessed a blade tip height of 420 m above MHWS, concluded that all of the operational wind turbines of VE placed within the north array area will be highly likely to be theoretically detectable by the Norwich Airport PSR. Parts of the north array are theoretically also highly likely to be detectable by the remaining aviation radar systems. For these four radar systems, detectability of the north array wind turbines reduces with distancing (from the radar source) however, intermittent detection of the operational wind turbines cannot be completely ruled out.

13.15.8 Radar LoS results also vary across the south array. The Southend Airport PSR will theoretically detect the operational wind turbines at a blade tip height of 420 m above MHWS. The Norwich Airport PSR will not detect the operational wind turbines placed in the south array area although occasional detection cannot be completely ruled out.

13.15.9 Parts of the south array are theoretically also highly likely to be detectable by the remaining three aviation radar systems (Neatishead and Trimingham) detectability of the south array reduces with distancing (from the radar source) however, intermittent detection of the operational wind turbines cannot be completely ruled out.

13.15.10 The impact to radar systems is predicted to be of regional spatial extent and of permanent duration. It is predicted that the impact will affect the receptor directly, which is vulnerable to this effect, but has moderate levels of recoverability; the magnitude is considered to be **medium**.

SENSITIVITY OF THE RECEPTOR

13.15.11 All aviation radar stakeholders aim to ensure 'clutter free' radar to continue to deliver a safe and effective ATS. The radar stakeholders are considered to be of high vulnerability, low recoverability and high value. The sensitivity of these receptor is therefore, considered to be **high**.

SIGNIFICANCE OF THE EFFECT

13.15.12 Overall, the sensitivity of all of the receptors assessed is considered to be high and the magnitude of the impact is deemed to be medium. The effect for all of the receptors considered will therefore be **major** which is significant in terms of the EIA Regulations.

13.16 ADDITIONAL MITIGATION

NEATISHEAD AND TRIMINGHAM ADR

13.16.1 During August 2018 and following radar trials on existing operational windfarms, the MOD widely released information regarding ADR mitigation in which it stated that the receipt and assessment of any technical mitigation reports/submissions reports, relating to the TPS-77 ADRs and multi-turbine wind farms will be paused with immediate effect. An update to this statement was provided during 2019 in which the MOD stated that it continues to work collaboratively with Government and wind farm developers to *"fully understand and mitigate all risks to our current and future military air surveillance capabilities".*

13.16.2 The MOD confirmed that they will *"…continue to work with industry to resolve the current issues and will, on a case-by-case basis, consider certain developments where impacts on operational capability is deemed to be acceptable".* The UK Defence and Security Accelerator has launched a competition seeking proposals that can provide future offshore wind farm mitigation for UK ADR.

13.16.3 The MOD, the department of Energy Security and Net Zero (ESNZ), the Crown Estate and the Offshore Wind Industry Council (OWIC) have formed a Joint Task Force (JTF) whose aim is to enable co-existence of air defence and offshore wind. In September 2021, the task force published a strategy document entitled Air Defence and Offshore Wind, Working Together Towards Net Zero (JTF, 2021) which sets out the process of the development of future technical radar mitigation schemes to mitigate ADR from the impact created by the radar detectability of operational wind turbines. Potential technical radar mitigation solutions have been identified and these systems have demonstrated that they could potentially support wind farm development, the JTF are working towards the procurement of an ADR technical mitigation solution which once deployed will provide an enduring solution.

13.16.4 VE OWFL will continue to engage with the MOD prior to and during the application process and will continue this engagement and seek to identify agreed mitigation for the ADR systems. The assumption that suitable mitigation will be agreed with the MOD reduces the impact (magnitude of effect) created by the projects to **minor** which is not significant in EIA terms.

LONDON SOUTHEND AND NORWICH AIRPORT PSR

13.16.5 It is not expected that Norwich Airport or London Southend Airport air traffic controllers will be providing a radar service to aircraft in the vicinity of the VE array areas. Due to the results of the radar LoS analysis, which predicts a degree of detectability; consultation with the airport safeguarding teams will commence with an aim to reach a mutually agreeable mitigation solution (if required) to remove any impact created by the projects. With mitigation in place the any impact will be reduced to **minor** which is not significant in EIA terms.

13.17 ENVIRONMENTAL ASSESSMENT: DECOMISSIONING PHASE

IMPACT 4: CREATION OF AN AVIATION OBSTACLE

MAGNITUDE OF IMPACT

13.17.1 During the decommissioning phase, the presence and movement of decommissioning infrastructure may present a potential collision risk to aircraft in the vicinity specifically to low flying aircraft. A range of mitigation measures (notification, lighting and marking and inclusion of VE on aviation charts) to minimise environmental effects would apply to the decommissioning of the proposed project. These will comply with current guidelines and be agreed with the appropriate stakeholders and are outlined in Table 13.9. Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter; however, during flight, weather conditions or operational requirements may necessitate route adjustments. Pilots are ultimately responsible for seeing and avoiding obstructions such as wind turbines and decommissioning infrastructure and will be aware through previous notification procedures of the operational VE. It is expected that any mitigation implemented will remain in place until the last wind turbine has been removed. The impact is predicted to be of regional spatial extent and of short-term duration and intermittent. It is predicted that the impact will affect the receptor directly, the magnitude is therefore, considered to be **low**.

SENSITIVITY OF THE RECEPTOR

13.17.2 Helicopter operators including SAR, the MOD and ATC service providers will continue to be consulted regarding the potential for VE to create an obstruction to aviation activities in the vicinity of the operational wind turbines. The ability of aviation stakeholders to continue using the portion of the southern North Sea airspace in which VE will operate and decommissioned is deemed to be of low vulnerability, high recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

SIGNIFICANCE OF EFFECT

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

13.18 ENVIRONMENTAL ASSESSMENT: CUMULATIVE EFFECTS

13.18.1 This cumulative effect assessment for military and civil aviation has been undertaken in accordance with the methodology provided in Volume 1, Annex 3.1: Cumulative Effects Assessment Methodology.

13.18.2 The projects and plans selected as relevant to the assessment of impacts to military and civil aviation 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 based on effect-receptor pathway, data confidence and the temporal and spatial scales involved. For the purposes of assessing the impact of the VE on military and civil aviation in the region, the cumulative effect assessment technical note submitted through the EIA Evidence Plan and forming Technical Annex 1.3.1 of this PEIR screened in a number of projects and plans.

13.18.3 An explanation of the 'Tiers' are provided in Volume 1, Annex 3.1: Cumulative Effects Assessment Methodology, and outlined here in Table 13.10. The specific projects scoped into the CEA for aviation and radar, as well as the tiers into which they have been allocated are presented in Table 13.11.

13.18.4 The cumulative MDS is described in Table 13.12

Table 13.10: Description of Tiers of other developments considered for cumulative effect assessment.

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

Table 13.11: Projects considered within the military and civil aviation cumulative effect assessment.

Development type	Project	Status	Data confidence assessment/ phase	Tier
Offshore Wind Farm	Galloper	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Greater Gabbard	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Gunfleet Sands I	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Gunfleet Sands II	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Gunfleet Sands Demo	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	London Array	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	East Anglia ONE	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Thanet	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Kentish Flats	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Kentish Flats Extension	Constructed	High – Consented by applicant.	Tier 1
Offshore Wind Farm	Scroby Sands	Constructed	High – Consented by applicant.	Tier 1

Development type	Project	Status	Data confidence assessment/ phase	Tier
Offshore Wind farm	East Anglia ONE North	Consented	High – consented by applicant	Tier 1
Offshore Wind Farm	East Anglia TWO	Consented	High – Consented by applicant	Tier 1
Offshore Wind Farm	North Falls	Scoping Report submitted	High	Tier 2

Table 13.12: Cumulative MDS

Impact	Scenario	Justification
Creation of an aviation obstacle	MDS for VE plus the cumulative full development of the following projects within 40 km of the VE array areas > Galloper > Greater Gabbard > London Array > East Anglia ONE > East Anglia One North > East Anglia Two > North Falls	This includes the presence of other developments which will have the potential to create a cumulative aviation obstacle and affect the available airspace for other users in the same region.
Wind turbines causing interference on civil and military radar systems	MDS for VE plus the cumulative full development of the following projects within 100 km of the VE array areas > Galloper > Greater Gabbard > Gunfleet Sands I > Gunfleet Sands II > Gunfleet Sands Demo > London Array > East Anglia ONE > East Anglia One North > East Anglia Two > North Falls > Thanet > Kentish Flats > Kentish Flats Extension > Scroby Sands	Maximum radar cumulative effect is calculated within a representative 100 km buffer of the VE array areas.
Potential impact to Kent International Airport	MDS for VE plus the cumulative full development of the following projects within 100 km of the VE array areas	As radar may be part of the infrastructure included in the development of the airport, a maximum radar cumulative effect is calculated within a

Impact	Scenario	Justification
	> Galloper > Greater Gabbard > Gunfleet Sands I > Gunfleet Sands II > Gunfleet Sands Demo > London Array > East Anglia ONE > Thanet > Kentish Flats > Kentish Flats Extension > Scroby Sands	representative 100 km buffer of the VE array areas.

IMPACT 5: CREATION OF AN AVIATION OBSTACLE

MAGNITUDE OF IMPACT

13.18.5 There is potential for cumulative aviation obstacle effect as a result of VE through all development phases and other projects. For the purposes of this PEIR, this additive impact has been assessed within 40 km from the VE array, which is considered to be the maximum range where the creation of an aviation obstacle to fixed wing and rotary aircraft operating offshore may occur although some impacts are likely to be localised to the VE array area.

13.18.6 The cumulative increase in helicopter operations from the project alone together with those existing flights (which are likely to be minimal) to the adjacent renewable energy projects is likely to be negligible, although flights may be concentrated in a regional obstruction area and may impact other users of the airspace including military low flying aircraft and airborne SAR flights.

13.18.7 The impact is predicted to be of regional spatial extent, long-term duration, continuous and not reversible for the operational lifetime of VE. However, pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter on their route of flight. The development and other cumulative offshore developments considered within the CEA will be included within applicable military and civil aviation publications and charts; pilots will be aware of the presence of the developments through notification procedures. Embedded mitigation and notification of construction, operation and decommissioning of the wind farm and the lighting and promulgation on aviation charts of all wind farms considered to provide a cumulative obstruction to aviation will reduce any physical obstruction effect to aviation activities in the region of the development. It is considered that low flying operations in the airspace presently available between the obstructions created by the operational offshore wind farms would not be affected by the operation of the development. Safe low flying operations continue in the presence of the operational wind farms in the region. It is predicted that the impact will affect the aviation receptors operating in the airspace directly but without a change to present operating parameters and therefore the magnitude is considered to be low .

SENSITIVITY OF THE RECEPTOR

13.18.8 The impact to aviation receptors operating offshore is deemed to be of low vulnerability, high recoverability and high value. Aviation operations in the UK are highly regulated. The VE array areas are located in airspace where the provision of an ATS is available. The same rules of the air which maintain a safe operating environment in the current baseline will apply in the portion of the southern North Sea surrounding the arrays during all phases of development and the provision of the ATS will not be affected. The sensitivity of the receptors is therefore, considered to be **medium**.

SIGNIFICANCE OF EFFECT

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

IMPACT 6: WIND TURBINES CAUSTING INTERFERENCE ON CIVIL AND MIILITARY RADAR SYSTEMS

MAGNITUDE OF IMPACT

13.18.10 There is potential for cumulative radar effect as a result of VE through the operation and maintenance phases and other projects. For the purposes of this PEIR, this additive impact to aviation radar has been assessed within 100 km from VE, which is considered to be the maximum range where radar cumulative effects may occur although some impacts are likely to be localised to the VE array area due to the unmitigated effect created by the detection of operational wind turbines.

SENSITIVITY OF THE RECEPTOR

13.18.11 Airport authorities and the MOD aim to ensure 'clutter free' radar to continue to deliver a safe and effective ATS in the safety critical environment. The radar stakeholders are considered to be of high vulnerability, low recoverability and high value. The sensitivity of these receptor is therefore, considered to be **high**.

SIGNIFICANCE OF EFFECT

13.18.12 The Norwich and Southend Airports PSR systems and the MOD Trimingham and Neatishead ADR systems indicates that the operational VE wind turbines with a tip height of 420 m above MHWS, would be considered to be theoretically detectable (by varying degrees) to the radar systems.

13.18.13 Other offshore wind farms that are considered likely to be detected by the radar systems are listed in Table 13.11. Unmitigated the potential cumulative effect will be to add to the radar clutter and possibly an increase in the individual signal processing demands of the predicted effected PSRs and ADRs. The impact is predicted to be of regional spatial extent, long-term duration, intermittent and not reversible for the lifetime of VE. It is predicted that the impact will affect the receptor directly. The magnitude is considered to be medium.

13.18.14 The sensitivity of the receptors considered is high and the worst-case magnitude of potential cumulative effects is deemed to be, without mitigation, medium.

13.18.15 The impact for all of the receptors considered would therefore, in the absence of mitigation, have major cumulative impacts on radar receptors. However, as mitigation will have been required for those radar systems which are affected by operational and planned projects, no radar cumulative effect will be apparent and therefore with mitigation in place the residual effect will be **minor** which is not significant in terms of the EIA Regulations for all scenarios due to the requirement for a technical solution to mitigate future radar effect.

IMPACT 7: POTENTIAL IMPACT TO KENT INTERNATIONAL AIRPORT

MAGNITUDE OF IMPACT

13.18.16 Kent International Airport is located 38 NM (70.3 km) from the closest point of the south array boundary. The airport is presently closed however, redevelopment of the airport has been approved by the Planning Inspectorate.

13.18.17 The future aviation related infrastructure has yet to be publicly published however, based on the previous operations of the site it is expected that the airport will provide a full range of ATC service provision including the use of surveillance radar. There is potential for the VE operational wind turbines to be detected by a Kent International Airport ATC PSR system located at the airport, equally, there is potential for the proposed development to affect the IFP associated with future airport flight operations. It is expected that if an impact is apparent the operator of the airport would consider the magnitude of impact to be **medium**.

SENSITIVITY OF THE RECEPTOR

13.18.18 The new airport authority will aim to ensure the safe operation of their airport and will consider all required technical safeguarding aspects of their infrastructure including IFP in order to deliver a safe and effective ATS in the safety critical environment. If the airport was operational now, the airport authority will be considered to be of high vulnerability, low recoverability and high value however, until detailed information on the airports mode of operation is known, it is difficult to establish a sensitivity. Based on the requirement to safeguard aviation activities it is considered that the sensitivity of this receptor would be **high.**

SIGNIFICANCE OF EFFECT

13.18.19 The sensitivity of the receptor is considered to be high, and the worst-case magnitude of potential cumulative effects is deemed to be, without mitigation, medium. In the absence of consideration of the baseline, the cumulative effect would be **major** which is significant in EIA terms.

13.18.20 It is expected that Kent International Airport infrastructure including any new CNS equipment and the establishment of IFPs would be capable of being operated safely within the existing environment. It is similarly expected that in establishing a safe airport operating environment at the reopened airport, the operation of VE and other planned and operational wind farm which may impact the safe operation of the airport would be similarly considered. The same principles for the safe operation of ATC radar and the interaction of other projects likely to impact that radar (as detailed in paragraph 13.18.4) would equally apply. With mitigation in place the residual effect will be **minor** which is not significant in terms of the EIA Regulations for all scenarios.

13.19 INTER-RELATIONSHIPS

13.19.1 The greatest potential for spatial and temporal interactions is likely to occur due to interaction or creation of an aviation obstacle. The individual standalone impacts were assigned a residual significance of minor. ATS provision and the rules of air, including the 'see and be seen principle', will mean reduced potential for inter and intra-related effects for helicopter operators and the MOD alike, operating at low level in the airspace surrounding the arrays. It is therefore anticipated the significance of these combined effects on airspace users will not be of any greater significance than the effects when assessed in isolation (i.e., minor significance).

13.19.2 There are no inter-related effects that are of greater significance than those assessed in isolation.

13.20 TRANSBOUNDARY EFFECTS

13.20.1 Due to the location of the array areas lying solely in UK airspace, PINS agree that transboundary impacts can be scoped out of the assessment. The Netherlands ATC authorities have also confirmed that no impact will be created to operations conducted in the Netherlands however, reengagement has been completed at the increased blade tip height. The Netherlands Ministerie van Defensie have confirmed that there will no impact predicted at the higher blade tip height, a similar response is expected from the Netherlands civil aviation agencies.

13.21 SUMMARY OF EFFECTS

13.21.1 Table 13.13 presents a summary of the significant effects assessed within this PEIR, any mitigation required, and the residual effects are provided.

Table 13.13: Summary of effects for military and civil aviation

Description of Impact	Effect	Additional mitigation measures	Residual impact
Construction			
Effect 1 (minor)	Creation of an aviation obstacle	None proposed beyond existing embedded mitigation and commitments	No significant residual effects
Operation			
Effect 2 (minor)	Creation of an aviation obstacle	None proposed beyond existing embedded mitigation and commitments	No significant residual effects
Effect 3 (major)	Wind turbines causing interference on civil and military radar systems	Civil radar receptors will continue to be engaged to establish if a perceived impact	Minor (not significant)

Description of Impact	Effect	Additional mitigation measures	Residual impact
		is expected through radar detection of operational wind turbines. The present position of the MOD regarding mitigation is discussed in paragraph 13.16.1 *et seq*. With agreed mitigation in place impact to all radar systems will be negligible.	
Decommissioning			
Effect 4 (minor)	Creation of an aviation obstacle	None proposed beyond existing embedded mitigation and commitments	No significant residual effects
Cumulative effects			
Effect 5 (minor)	Creation of an aviation obstacle	None proposed beyond existing embedded mitigation and commitments	No significant residual effects
Effect 6 (medium)	Wind turbines causing interference on civil and military radar systems	Civil radar receptors will continue to be engaged to establish if a perceived impact is expected through radar detection of operational wind turbines. The present position of the MOD regarding mitigation is discussed in paragraph 13.16.1 *et seq*. With agreed mitigation in place impact to all radar	Minor (not significant)

Description of Impact	Effect	Additional mitigation measures	Residual impact
		systems will be negligible.	
Effect 7	Potential impact to Kent International Airport	Noe proposed until and if required. It is expected that Kent International Airport infrastructure including any new CNS equipment and the establishment of IFPs would be capable of being operated safely within the existing environment.	Minor (not significant)

13.22 NEXT STEPS

13.22.1 Further consultation is required to refine the potential magnitude of impacts on aviation and radar facilities. This consultation shall continue during preparation of the Environmental Statement such that the most up to date information can be used within the assessments.

13.23 REFERENCES

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