



TotalEnergies E&P North Sea UK Ltd

# Culzean Floating Offshore Wind Turbine Pilot Project Environmental Impact Assessment Report - Chapter 14 - Aviation and Radar

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## GLOSSARY

TERM	MEANING
<b>Above Mean Sea Level</b>	The elevation or altitude (in the air) of an object, relative to the average sea level datum.
<b>Culzean Floating Offshore Wind Turbine Pilot Project (the 'Project')</b>	The entire Development including all offshore components and all project phases from pre-construction to decommissioning.
<b>Flight Level</b>	A standard nominal altitude of an aircraft, in hundreds of feet, based upon a standardised air pressure at sea level.
<b>Floating Wind Turbine Generator (WTG)</b>	Device that converts the kinetic energy of wind into electrical energy. Can be functionally divided into four parts: wind turbine, tower and transition piece, floating foundation, and mooring system.
<b>Icing Level</b>	The level at which the air contains droplets of supercooled liquid water which results in icing conditions where aircraft lift characteristics can be adversely affected.
<b>Innovation and Targeted Oil and Gas (INTOG)</b>	The Initial Plan Framework Sectoral Marine Plan for Offshore Wind for INTOG encompasses spatial opportunities and a strategic framework for future offshore wind developments within sustainable and suitable locations that will help deliver the wider United Kingdom (UK) and Scottish Government Net Zero targets.
<b>Marine Licence Application ('the Application')</b>	A Marine Licence is granted under the Marine and Coastal Access Act 2009 for projects between 12-200 Nautical Miles (nm) from shore, or the Marine (Scotland) Act 2010 for projects between Mean High-Water Springs (MHWS) out to 12 nm from shore. The Application includes HRA-supporting documentation (where required), an application letter, Marine Licence application form and this EIAR.
<b>Minimum Safe Altitude (MSA)</b>	The lowest altitude which will provide a minimum clearance of 305 metre (m) (1,000 feet (ft)) above all objects located within a defined sector of airspace.
<b>Offshore Renewable Energy Installation (OREI)</b>	As defined by Marine Guidance Note (MGN) 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (Maritime and Coastguard Agency (MCA), 2021). For the purposes of this report and in keeping with the consistency of the Environmental Impact Assessment, OREI can mean offshore wind turbines and the associated electrical infrastructure such as offshore substations.
<b>Project Area</b>	The extent of the immediate area surrounding the floating Wind Turbine Generator (WTG) and cable route as characterised by the extent of the seabed environmental and habitat surveys. Also referred to as the Survey Area where specifically relating to survey activities.



TERM	MEANING
Project Design Envelope	The maximum range of design parameters of all infrastructure assessed as part of the EIA.
Study Area	Receptor specific area used to characterise the baseline.
Survey Area	The area surveyed during site-specific surveys.
Visual Flight Rules (VFR)	The set of rules that govern aircraft flying clear of cloud and in good visibility.

## ABBREVIATIONS AND ACRONYMS

ACRONYMS/ ABBREVIATIONS	DEFINITION
AARA	Air- to-Air Refuelling Area
AD	Air Defence
ANO	Air Navigation Order 2016
AOC	Aircraft Operator Certificate
ATC	Air Traffic Control
ATS	Air Traffic Services
BOWL	Beatrice Offshore Wind Limited
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
DSLPL	Development Specification and Layout Plan
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ERCoP	Emergency Response Co-operation Plan
ES	Environmental Statement
FIR	Flight Information Region
FL	Flight Level
FSO	Floating Storage and Offloading
ft	feet
HMR	Helicopter Main Route
IFP	Instrument Flight Procedures
km	kilometre
LMP	Lighting and Marking Plan
MAA	Military Aviation Authority
MCA	Maritime and Coastguard Agency
MD-LOT	Marine Directorate – Licensing Operations Team
Met	Meteorological
MGN	Marine Guidance Note
Mil AIP	Military Aeronautical Information Publication
MoD	Ministry of Defence



ACRONYMS/ ABBREVIATIONS	DEFINITION
Moray East	Moray East Offshore Wind Farm
Moray West	Moray West Offshore Wind Farm
NATS	National Air Traffic Services
NERL	NATS (En Route) Public Limited Company
NLB	Northern Lighthouse Board
nm	nautical mile
NOTAM	Notice to Airmen
OREI	Offshore Renewable Energy Installations
PEXA	Practice and Exercise Area
PSR	Primary Surveillance Radar
SAR	Search and Rescue
SG	Scottish Government
TEPNSUK	TotalEnergies Exploration and Production North Sea UK Ltd
UK	United Kingdom
UK IAIP	United Kingdom Integrated Aeronautical Information Package
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
WTG	Wind Turbine Generator

## 14 AVIATION AND RADAR

### 14.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents the Aviation and Radar receptors of relevance to the Culzean Floating Offshore Wind Turbine Pilot Project (the 'Project') and assesses the potential impacts from the construction, operation and maintenance and decommissioning of the Project on these receptors. Where required, mitigation is proposed, and the residual impacts and their significance are assessed. Potential cumulative impacts are also considered while transboundary impacts have been scoped out with the agreement of Scottish Ministers.

Coleman Aviation Ltd have drafted and carried out the impact assessment. Further competency details of the Project Team including lead authors for each chapter are provided in Chapter 1: Introduction.

The potential effects of Wind Turbine Generators (WTGs) on aviation are widely publicised, but the primary concern is one of safety. Despite innumerable subtleties in the actual effects, there are two dominant scenarios that lead to potential impacts:

- Physical obstruction: WTGs can present a physical obstruction to aircraft; and
- Impacts on aviation radar systems and the provision of radar-based Air Traffic Services (ATS): WTGs can create unwanted radar clutter which appears on radar displays and can affect the provision of ATS to pilots. Radar clutter (or false radar returns) can confuse air traffic controllers making it difficult to differentiate between aircraft and those radar returns resulting from the detection of WTGs. Furthermore, the appearance of multiple false targets in close proximity can generate false aircraft tracks and seduce those returns from 'real' aircraft away from the true aircraft position.

It should be noted that adverse effects on radar systems are only possible if the WTG blades are moving, therefore this impact is applicable to the operation and maintenance phase only.

The impact assessment presented herein draws upon information presented within other impact assessments within this Environmental Impact Assessment Report (EIAR), including:

- Chapter 13: Shipping and Navigation

### 14.2 Legislation, policy and guidance

The following legislation, policy and guidance are relevant to the assessment of impacts from the Project on aviation and radar:

- Legislation:
  - Civil Aviation Publication (CAP) 393 – Air Navigation, The Order and the Regulations, (2016a) (Version 6, 12<sup>th</sup> February 2021): Contains the Air Navigation Order (ANO) 2016 and Regulations made under the order; and defines the Rules of the Air regarding civil aviation in the United Kingdom (UK).



- Policy:
  - CAP 437 – Standards for Offshore Helicopter Landing Areas (Version 8.2, 30<sup>th</sup> July 2021): Provides the criteria applied by the Civil Aviation Authority (CAA) in assessing the standards of offshore helicopter landing areas for worldwide use by helicopters registered in the UK (CAA, 2023);
  - CAP 670 – ATS Safety Requirements (CAA, 2019): Sets out the safety regulatory framework and requirements associated with the provision of ATS;
  - CAP 764 – CAA Policy and Guidelines on Wind Turbines (CAA, 2016b): Provides CAA policy and guidance on a range of issues associated with WTGs and their effect on aviation that need to be considered by aviation stakeholders, wind energy developers and Local Planning Authorities when assessing the viability of WTG developments;
  - CAP 774 – The UK Flight Information Services (Version 4, 15<sup>th</sup> December 2021; CAA, 2017): Details the suite of ATS which (excluding aerodrome services) are the only services provided in Class G airspace within the UK Flight Information Region (FIR). This document is equally applicable to civilian and military pilots and air traffic controllers;
  - Military Aviation Authority (MAA) (2021) Regulatory Publication 3000 Series: Air Traffic Management Regulations (last updated 20<sup>th</sup> April 2021): Provides the regulatory framework and instructions to military personnel for provision of military air traffic control;
  - MAA Manual of Military Air Traffic Management (MAA, 2019): Provides regulations for military ATC and emergency procedures and utilisation of military designated airspace;
- Guidance:
  - Ministry of Defence (MoD) Obstruction Lighting Guidance (1<sup>st</sup> January 2020; MoD, 2020): Sets out the MoD's minimum requirements and standards for installation of aviation lighting of onshore and offshore WTG developments;
  - CAA 1:500,000 Visual Flight Rules (VFR) Aviation Chart (CAA, 2022a): Designed to assist in the navigation of aircraft. Enables pilots to determine their position, safe altitude and route to a destination, highlighting navigation aids along the way, alternative landing areas in case of an in-flight emergency, and other useful information such as radio frequencies and airspace boundaries.;
  - CAP 168 – Licensing of Aerodromes (Version 12, 14<sup>th</sup> January 2022): Sets out the standards required at UK licensed aerodromes in terms of operational procedures, physical characteristics, assessment and treatment of obstacles, visual aids, rescue and fire-fighting services and medical services (CAA, 2022b);
  - United Kingdom Integrated Aeronautical Information Package (UK AIP) (CAA, 2022c): Provides comprehensive information on UK civilian aerodromes and aviation procedures within UK airspace;
  - UK Military Aeronautical Information Publication (Mil AIP) (MoD, 2022): Provides comprehensive information on UK military aerodromes and guidance to military aircrew on in-flight navigation procedures;
  - Marine Guidance Note (MGN) 654 – Safety of Navigation: Offshore Renewable Energy Installations (OREIs), Guidance on UK Navigational Practice, Safety and Emergency Response (28<sup>th</sup> April 2021): Highlights issues with assessing the impact on navigational safety and emergency response caused by OREIs in UK internal waters (UK Government, 2021).

### 14.3 Scoping and consultation

Stakeholder consultation has been ongoing throughout the Environmental Impact Assessment (EIA) and has played an important part in ensuring the scope of the baseline characterisation and impact assessment are appropriate with respect to the Project and the requirements of the regulators and their advisors.



The Scoping Report was submitted to Scottish Ministers (Via Marine Directorate – Licensing Operations Team (MD-LOT)), on 14th April 2023, who then circulated the report to relevant consultees. The Scoping Opinion was received on 20th July 2023. Relevant comments from the Scoping Opinion and other consultation specific to aviation and radar are provided in Table 14.1 below, which provides a response outlining how these comments have been addressed within the EIAR.

Table 14.1 Summary of consultation responses specific to aviation and radar

CONSULTEE	COMMENT	RESPONSE
<b>Scoping Opinion</b>		
<b>Scottish Ministers (via MD-LOT)</b>	<p>The Scottish Ministers are content that the use of airspace for defence purposes, as well as the aviation and radar systems that may be affected by the proposed development, have been correctly identified and considered. This is supported by the MoD representation.</p> <p>The Scottish Ministers are content with the impacts scoped in and out of the EIAR, in line with the MoD representation. The Applicant should consider the MoD advice regarding lighting of WTGs.</p>	<p>The Applicant notes the comments of the Scottish Ministers and the MoD. Potential impact on MoD operations is presented within Sections 14.5 and 14.7 of this chapter.</p> <p>The Applicant notes the comments of the Scottish Ministers and the MoD. Potential impact on MoD operations and aviation lighting requirements is presented within Sections 14.5 and 14.7 of this chapter.</p>
<b>Aberdeen International Airport</b>	<p>The proposed development has been examined from an aerodrome safeguarding perspective and does not conflict with safeguarding criteria. We, therefore, have no objection to this proposal.</p>	<p>The Applicant acknowledges Aberdeen International Airport's comments. As a result, potential impact on Aberdeen International Airport is not addressed further in the EIAR.</p>
<b>Edinburgh Airport</b>	<p>The location of the proposed development falls out with the aerodrome safeguarding zone for Edinburgh Airport; therefore, we have no objection/comment.</p>	<p>The Applicant acknowledges Edinburgh Airport's comments. As a result, potential impact on Edinburgh Airport is not addressed further in the EIAR.</p>
<b>MoD</b>	<p>Potential interference with military ATC and AD radars during both construction and operational phases has been scoped out. The MoD accepts these conclusions, given the turbine specification and on the basis of the information currently available it is not anticipated that the proposed development would affect military radar systems.</p> <p>The physical effect of introducing a tall structure on military low flying has been scoped in and the Applicant states in the Scoping Report that</p>	<p>The Applicant acknowledges MoD's comments. As a result, potential impact on MoD ATC and AD radars is not addressed further in the EIAR.</p> <p>The Applicant acknowledges that aviation safety lighting will need to be installed with MoD accredited lights to ensure compatibility</p>

CONSULTEE	COMMENT	RESPONSE
	they are committed to lighting and charting the turbine. In the interests of air safety, the MoD would request that the development be fitted with MoD accredited aviation safety lighting. As a minimum, the MoD would require that the turbine is fitted with 25 candela or infra-red lighting.	with military aviation activity. Further detail on aviation lighting and marking is presented within Section 14.5 and 14.7 of this chapter.
<b>National Air Traffic Services (En Route) Public Limited Company (NERL)</b>	The proposed development has been examined from a technical safeguarding aspect and does not conflict with our safeguarding criteria. Accordingly, NERL has no safeguarding objection to the proposal.	The Applicant acknowledges NERL's comments. As a result, potential impact on NERL operations is not addressed further in the EIAR.



In line with the Scoping Opinion, aspects relevant to Aviation and Radar but scoped out of further assessment in this EIAR include:

- Civil airport patterns and procedures during all Project phases;
- Military aerodrome patterns and procedures during all Project phases;
- Civil ATC radar during all Project phases;
- Military ATC radar during all Project phases;
- Military AD radar during all Project phases;
- Helicopter Main Routes (HMRs) during all Project phases;
- Other project offshore installations during all Project phases;
- Local airspace restrictions during all Project phases; and
- Met Office radar during all Project phases.

## 14.4 Study Area

The aviation and radar Study Area is defined as a 9 nautical mile (nm) (17 kilometre (km)) buffer around the Project which will enable the impact on aviation in the immediate vicinity of the site to be determined; in particular in respect of low-visibility helicopter operations into offshore installations (oil and gas platforms).

A secondary aviation and radar Study Area is defined by the range of the affected aviation receptors; in particular, Air Traffic Control (ATC) and Air Defence (AD) Primary Surveillance Radars (PSRs). The aviation Study Area covers radars in the north of Scotland that could potentially detect WTGs within the Project; with the extent of the aviation and radar Study Area defined by the furthest potential aviation receptor. The operating range of aviation radars can be up to 200 nm (370 km); however, it is only the likely radar coverage over the Project that needs to be considered, as the question of whether WTGs are visible to radar is the determining factor relating to aircraft safety. This has assisted in identifying whether any relevant PSRs, and stakeholders, may be affected. The aviation and radar Study Area can be seen in Figure 14.1 together with the locations of the relevant aviation receptors.

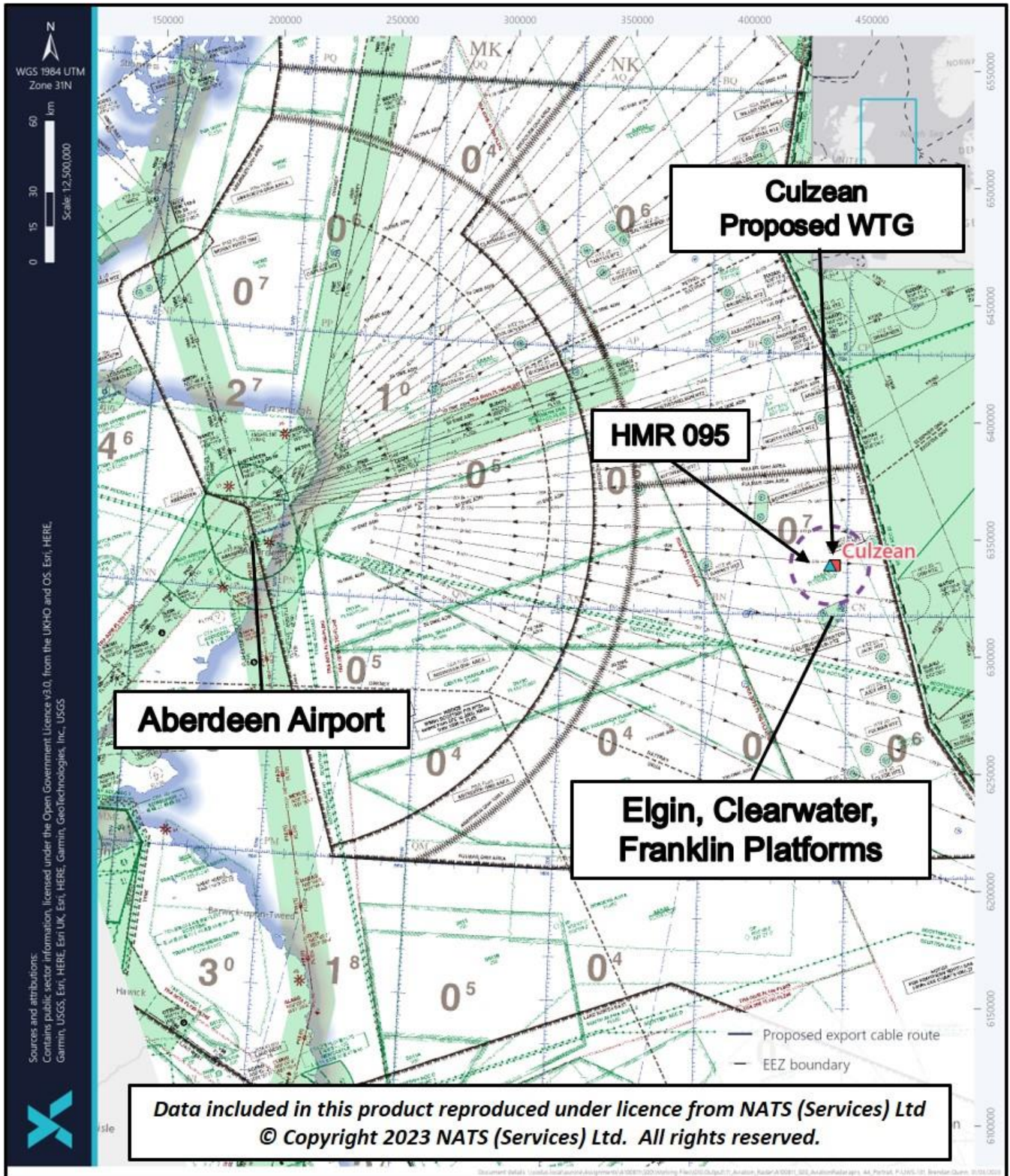


Figure 14.1 Aviation Study Area and Locations of Aviation Receptors



## 14.5 Baseline Environment

### 14.5.1 Data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform the baseline characterisation for aviation and radar are outlined in Table 14.2.

Table 14.2 Summary of key datasets and reports

TITLE	SOURCE	YEAR	AUTHOR
CAA 1:500,000 VFR Aviation Chart	CAA	2022	CAA
UK IAIP	CAA	2022	CAA
UK Mil AIP	MoD	2022	MoD
National Air Traffic Services (NATS) Self-Assessment Maps	NATS	2023	NATS
Scottish Government (SG) Sectoral Marine Plan for Offshore Wind Energy	SG	2020	SG
Beatrice Offshore Wind Farm Ltd (BOWL) Environmental Statement (ES)	BOWL	2012	BOWL
Moray East Offshore Wind Farm (Moray East) ES	Moray East	2012	Moray East
Moray West Offshore Wind Farm (Moray West) EIA	Moray West	2018	Moray West
Dounreay Tri ES	Dounreay Tri	2016	Dounreay Tri

### 14.5.2 Project site-specific surveys

No site-specific surveys have been undertaken to inform the EIA for aviation and radar. The baseline characterisation developed through existing data sources, coupled with ongoing consultation with relevant stakeholders, is considered sufficient to inform the aviation and radar impact assessment.



### 14.5.3 Existing baseline

A desk-based review of literature and available data sources (see Table 14.2), augmented by consultation has been undertaken to describe the current baseline environment for aviation and radar. The key aviation receptors potentially impacted by offshore wind farm developments are:

- Civil airport Instrument Flight Procedures (IFPs);
- Military aerodrome IFPs;
- Civil ATC radar;
- Military ATC radar;
- Military AD radar;
- Low flying Areas (including Search and Rescue (SAR));
- HMRs;
- Offshore helicopter installations (oil and gas platforms);
- Local Airspace Restrictions (Prohibited/Restricted/Danger Areas and Military Practice and Exercise Areas (PEXAs); and
- Meteorological (Met) Office radar.

The aviation environment within the vicinity of the Project can be described as follows:

#### 14.5.3.1 Airspace

The Project Area is located approximately 120 nm (222 km) off the northeast coast of Scotland. In aviation terms, the Project Area is situated in a relatively uncomplicated piece of airspace but with an active HMR routeing west to east approximately 2 nm (3.7 km) north of the proposed WTG's location.

#### 14.5.3.2 Civil Airports

The nearest major civil airport to the Project Area is Aberdeen Airport, located approximately 133 nm (246 km) to the west. The published obstacle safeguarding area for airports of this nature is 30 nm (56 km), therefore the proposed WTG will not impact on any airport IFPs.

#### 14.5.3.3 Civil ATC Radars

The nearest civil ATC radars to the Project Area are the NATS Allanshill and Perwinnes radars both of which are located more than 120 nm (222 km) from the Project. There is no possibility that the proposed WTG will be in radar line of sight (RLOS) of either radar. Consequently, no civil ATC radar systems are expected to be affected by the Project.

#### 14.5.3.4 Military ATC and AD Radars

The nearest military ATC and AD radars to the Project Area are the Leuchars Station ATC radar and the Buchan AD radar both of which are located more than 120 nm (222 km) from the Project. There is no possibility that the proposed WTG will be in RLOS of either radar. Consequently, no military ATC and AD radar systems will be affected by the Project.





#### 14.5.3.5 Low flying (including UK SAR)

The Project Area is located more than 12 nm (22 km) from the UK coastline and, therefore, is technically outside the UK Military Low Flying System; however, it is recognised that military aircraft may still be required to operate at low-level in the vicinity of the Project. Installation and presence of WTG can pose a physical obstruction to aviation operations and wind turbines can be difficult to see from the air, particularly in poor meteorological conditions, leading to a potential increase in obstacle collision risk. Furthermore, during the construction phase, the presence and movement of installation vessels (with onboard cranes) may also present a potential obstacle collision risk to aircraft operations. Military aircraft can operate down to 100 feet (ft) above surface level over the sea.

UK SAR helicopters conducting operational missions are not constrained by the normal rules of the air and operate in accordance with their Aircraft Operator Certificate (AOC), which allows them flexibility to manoeuvre, as required, for the particular mission being carried out. An Emergency Response Co-operation Plan (ERCoP) will be compiled in conjunction with the Maritime and Coastguard Agency (MCA) and is a likely consent condition requirement for any offshore development. Additionally, a Lighting and Marking Plan (LMP) will need to be developed in conjunction with the relevant aviation stakeholders and agreed prior to the construction of the Project.

#### 14.5.3.6 HMRs

HMRs are established to support the transport of personnel and logistics to offshore oil and gas installations. HMRs provide a network of offshore routes used by civilian helicopters to facilitate an obstacle free zone for safe flight when in-flight Visual Meteorological Conditions (VMC) cannot be met. The HMR structure therefore provides both an identification of common flight paths and a safe means of traffic flow. HMR 095 is the nearest HMR to the proposed WTG and is located approximately 2 nm (3.7 km) to the north; it is primarily used for helicopter flights from Aberdeen Airport to the offshore oil and gas installations in the North Sea.

Construction of turbines within 2 nm either side of an HMR would have the potential to restrict operations below the routine operational altitudes when icing conditions exist. The ability of a helicopter to operate at the expected altitudes would be dependent upon the icing level (the 0° isotherm). In this situation, helicopters operating on HMRs need an 'escape-route' if icing conditions are encountered unexpectedly; this would inevitably involve a descent. However, as outlined in CAP 764, CAA guidance is that, provided there are no WTGs within 2 nm either side, then helicopter operations on HMRs should not be affected.

#### 14.5.3.7 Offshore helicopter installations (other oil and gas platforms)

The nearest offshore helicopter installations to the proposed WTG are the TEPNSUK-operated Culzean platform complex and the Ailsa Floating Storage and Offloading (FSO) facility, which are 1 nm (2 km) and 3 nm (5.5 km) to the east of the WTG site, respectively. During the site selection process for the Project (further information is available in Chapter 3: Site Selection and Consideration of Alternatives), interference with existing helicopter flight paths was highlighted as a safety differentiator during the risk assessment process. The chosen site was identified as 'highly favourable' in terms of helicopter safety and was not deemed to present an obstruction to ongoing flight paths (TEPNSUK, 2023). The Applicant is also aware that the Helideck Certification Agency (HCA) have published Helicopter Landing Certificates for both platforms which allow helicopters to conduct low-visibility procedures in poor weather conditions. Construction of the proposed wind turbine will require the Helicopter Landing Certificates to be re-assessed and, if needed, HCA will limit operations into the platforms to day VMC only. The Applicant has undertaken



to commission HCA to review and revise the Helicopter Landing Certificates for the Culzean platform and Ailsa FSO facility as embedded mitigation measures; see Table 14.6.

The CAA recommend that wind farm developers consult with the owners/operators of offshore helicopter installations when a development is within 9 nm (17 km) of any proposed development. Beyond ongoing operations in the immediate area, the Elgin, Shearwater and Franklin platforms, the nearest of which is located just outside 9 nm (17 km) to the south. The Lomond platform is also located approximately 12 nm (22 km) to the northeast of the proposed WTG. As no additional offshore helicopter installations are within 9 nm of the proposed WTG, helicopter operations into offshore installations are not expected to be affected by the Project.

#### **14.5.3.8 Local Airspace Restrictions (Prohibited/Restricted/Danger Areas and Military PEXAs)**

The Project Area lies underneath Air-to-Air Refuelling Area (AARA) 3 which is established from Flight Level (FL) 100 (10,000 ft) up to FL 290 (29,000 ft). An AARA is utilised by military aircraft to practice transferring aviation fuel from one aircraft (the tanker) to another (the receiver) while both aircraft are in flight. This is the only restricted airspace in the vicinity of the Project but, as operations with the AARA are carried out no lower than 10,000 ft, the Project will not affect military operations within this airspace.

#### **14.5.3.9 Met Office Radar**

The closest Met Office radar system is located at Hill of Dudwick near Ellon, Aberdeenshire. It is located more than 120 nm (222 km) from the Project Area which is outside the 20 km safeguarding area for radars of this nature.

### **14.5.4 Future baseline**

Currently, there are no planned changes to the airspace environment that are expected to affect any future baseline for aviation and radar. Therefore, the future baseline for aviation and radar is not expected to differ from the current baseline as presented in Section 14.5.3.

### **14.5.5 Summary and key issues**

The key sensitive aviation and radar receptor identified from the baseline characterisation study, that are the focus of the impact assessment is potential impact on military low flying and UK SAR helicopter operations.

Potential receptors and impacts scoped into the assessment are provided in Table 14.3.



Table 14.3 Summary and key issues for aviation and radar

PROJECT AREA	
SUMMARY AND KEY ISSUES	<b>14.5.5.1 Construction:</b>
	<ul style="list-style-type: none"> <li>Potential impact on military low flying and UK SAR helicopter operations due to the presence of obstacles (WTG in construction)</li> </ul>
	<b>14.5.5.2 Operation and Maintenance:</b>
	<ul style="list-style-type: none"> <li>Potential impact on military low flying and UK SAR helicopter operations due to the presence of obstacles (WTG in operation)</li> </ul>
	<b>14.5.5.3 Decommissioning:</b>
	No impacts identified

## 14.5.6 Data gaps and uncertainties

The data used in this chapter are detailed in Section 14.5.1. The data used are the most up to date publicly available information which can be obtained from the applicable data sources as cited. Data has also been provided through consultation, as detailed in

Table 14.1. It is considered that the data employed in the assessment are robust and sufficient for the purposes of the impact assessment presented.

### 14.5.7 Key Parameters for Assessment

As detailed in Chapter 6: EIA Methodology, this assessment considers the Maximum Design Scenario (MDS) for the Project parameters which are predicted to result in the greatest environmental impact, known as the 'realistic worst-case scenario'. The MDS represents, for any given receptor and potential impact on that receptor that would result in the greatest potential for change.

Given that the MDS is based on the Project Design Envelope (PDE) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no worse effects than assessed in this impact assessment. Table 14.4 presents the worst-case for potential impacts on aviation and radar during construction, operation and maintenance and decommissioning.

Table 14.4 Worst case scenario specific to aviation and radar receptor impact assessment

POTENTIAL IMPACT	MAXIMUM DESIGN SCENARIO (MDS)	JUSTIFICATION
<b>Construction</b>		
<b>Potential impact on military low flying and UK SAR helicopter operations due to presence of obstacles (WTG in construction).</b>	<ul style="list-style-type: none"> <li>• Installation of up to one WTG with maximum tip height up to 134 metres (m) above mean sea level (MSL); and</li> <li>• 112 m maximum rotor diameter.</li> </ul>	These parameters represent the maximum design scenario for height of infrastructure and associated installation equipment within the Project, which has the greatest potential for obstruction to air traffic.
<b>Operation and maintenance</b>		
<b>Potential impact on military low flying and UK SAR helicopter operations due to presence of obstacles (WTGs).</b>	<ul style="list-style-type: none"> <li>• Operation of up to one WTG with maximum tip height up to 134 m above MSL; and</li> <li>• 112 m maximum rotor diameter.</li> </ul>	These parameters represent the maximum design scenario for height of infrastructure and associated installation equipment within the Project, which has the greatest potential for obstruction to air traffic.



POTENTIAL IMPACT	MAXIMUM SCENARIO (MDS)	DESIGN	JUSTIFICATION
Decommissioning			

The MDS for decommissioning will be the same or less than during construction.

## 14.6 Methodology for Assessment of Effects

An assessment of potential impacts is provided separately for the construction, operation and maintenance and decommissioning stages.

In assessing the significance of the effects from the Project, the criteria for the assessment for aviation and radar differ from those set out in chapter 6: EIA methodology. Defining set categories of receptor sensitivity and magnitude of impact is not appropriate for aviation as baseline aviation activities and equipment are typically highly sensitive to impacts and any magnitude of restriction on, or compromise to, activities or equipment (without embedded mitigation) is considered to be high; however, embedded mitigation measures can reduce the sensitivity of a receptor and the magnitude of impact. Therefore, the sensitivity of receptor and magnitude of impact have been explained via professional reasoning and judgement rather than via set definitions of different categories. These judgements have fed into the determination of significance as shown in Table 14.5 and represent a deviation from the standard methodology presented within chapter 6: EIA Methodology.

Table 14.5 Impact assessment matrix for determination of significance

SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT			
	High	Medium	Low	Negligible
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Each level of significance can be described as follows:

- Major - Regular, frequent or permanent effects which require changes to existing operational and/or technical practice in order to mitigate adequately, or which are not capable of being mitigated adequately;
- Moderate - Periodic effects experienced which may require alterations to existing operational practice;
- Minor - Occasional effects experienced which do not require any alteration of existing operational and technical practice;
- Negligible - Normally no measurable change from baseline conditions which therefore do not require any alteration of existing operational and technical practice.

For the purposes of this assessment:

- A level of effect of moderate or more will be considered a 'significant' effect; and
- A level of effect of minor or less will be considered 'not significant'.

Effects of moderate significance or above are therefore considered important in the decision-making process, whilst effects of minor significance or less warrant little, if any, weight in the decision-making process.

## 14.7 Embedded Mitigation

As described in chapter 6: EIA methodology, certain measures have been adopted as part of the Project development process to reduce the potential for impacts to the environment, as presented in Table 14.6. These have been accounted for in the assessment presented below. The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of the effects on aviation and radar receptors.

Table 14.6 Embedded mitigation measures relevant to aviation and radar

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
<b>Approval and implementation of a LMP</b>	The LMP will set out specific requirements in terms of aviation lighting to be installed on the WTG, as required under CAA (2016). CAP 393, Air Navigation: The Order and the Regulations (2016). The LMP will be prepared in consultation with the CAA, MoD, MCA and Northern Lighthouse Board (NLB) will consider requirements for aviation lighting as specified in Article 223 of the UK ANO, 2016 and changes to International Civil Aviation Organisation Annex 14, Volume 2, Chapter 6, paragraph 6.2.4 promulgated in 2016.	Primary	Secured through conditions attached to the Marine Licence.
<b>All structures more than 91.4 m in height will be charted</b>	All structures more than 91.4 m in height will be charted on aeronautical charts and reported to the Defence Geographic Centre (Digital Vertical Obstruction File) at least ten weeks prior to construction in line with the LMP and Development Specification and Layout Plan (DSLPL).  Consultation with the CAA, MCA, MoD and NLB prior to agreement of the LMP and the DSLP.	Primary	Secured through conditions attached to the Marine Licence.
<b>Consultation with the CAA</b>	The CAA will be informed of the locations, heights and lighting status of the wind turbines, including estimated and actual dates of construction and the maximum heights of any construction equipment to be used, prior to the start of construction	Primary	Secured through conditions attached to the Marine Licence.

MITIGATION MEASURE	DESCRIPTION	FORM (PRIMARY OR TERTIARY)	HOW MITIGATION WILL BE SECURED
Production of an ERCoP	An ERCoP will be produced for the Project to ensure the emergency response plan will provide sufficient information about the project, actions and details required in the event of an emergency situation. This will ensure that MCA recommended standards and procedures are followed as well as ensuring appropriate lighting and marking is in place to facilitate aeronautical safety during SAR helicopter operations when rendering assistance to vessels and persons in the vicinity of the Project Area.	Primary	Secured through conditions attached to the Marine Licence.
Notice to Airmen (NOTAM)	Any temporary obstacles associated with WTGs which are more than 91.4 m in height (e.g. construction infrastructure such as cranes and/or meteorological masts) are to be alerted to aircrews by means of NOTAM, in line with consultation with the CAA.	Tertiary	Secured through conditions attached to the Marine Licence.
Development Specification and Layout Plan (DSLPL)	The DSLP will confirm the final specification and layout of the Project. The Plan will include coordinates of Project infrastructure and the final design parameters of the Project.	Tertiary	Secured through conditions attached to the Marine Licence.
Review and Revise Helicopter Landing Certificates for the Culzean platform and Ailsa FSO facility.	Revision of Helicopter Landing Certificates will ensure that low-visibility procedures into the Culzean and Ailsa helicopter platforms continue to be carried out safely, or, if needed, be restricted to day VMC only.	Tertiary	Secured through conditions attached to the Marine Licence(s) consent.

## 14.8 Assessment of Impacts

### 14.8.1 Potential effects during construction

#### 14.8.1.1 Potential impact on military low flying and SAR helicopter operations due to presence of obstacles (WTGs in construction)

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 (i.e. good weather conditions), pilots are ultimately responsible for seeing and avoiding obstructions such as WTGs and will be aware of their presence through the notification procedures set out in Table 14.6.





The installation and presence of WTGs pose physical obstructions to aviation operations carried out in the vicinity of windfarms. WTGs can be difficult to see from the air, particularly in poor meteorological conditions, leading to a potential increase in obstacle collision risk. Furthermore, during the construction phase, the presence and movement of installation vessels (with onboard cranes) could also present a potential obstacle collision risk to aircraft operations. However, in the case of the Project, the cranes used on site during the construction phase will not exceed the height of the WTG (i.e. 134 m above MSL).

In terms of low flying operations, pilots are required to set a Minimum Safe Altitude to identify the lowest altitude, set in areas, that ensures safe separation between their aircraft and known obstacles. MoD outlined in their Scoping Response (see Section 14.3) that the Applicant was committed to lighting and charting the WTG and confirmed that, in the interests of air safety, the WTG should be fitted with MoD accredited aviation safety as set out in Table 14.6.

In terms of SAR operations, the MCA will be consulted on the lighting and marking arrangements and on the specific layout of the WTG and export cable corridor with the aim of seeking compatibility with SAR helicopter operations in the event of rescue missions in the vicinity of the Project. This consultation will continue as layout plans are refined prior to construction (see Table 14.6). The final lighting and marking arrangements will be captured in the LMP and the DSLP.

Military low flying and SAR helicopter operations are high value receptors because all aviation impacts are high value. However, implementation of embedded mitigation measures (as described in Table 14.6) ensures that low flying and SAR helicopter operations will have low vulnerability, since any impacts are unlikely to affect long term functioning of low flying and SAR helicopter operations.

Following implementation of embedded mitigation measures, low flying and SAR helicopter operations are deemed to be of low sensitivity to the potential risk of collision with obstacles. The impact is also considered to be of low magnitude. Consequently, the overall effect is considered to be negligible which is not significant in EIA terms.

**Evaluation of significance**

Following implementation of embedded mitigation measures (Table 14.6), the sensitivity will be low and the magnitude of the impact will be low. The overall effect on military low flying and SAR helicopter operations during construction is considered to be **negligible** and **not significant** in EIA terms.

Sensitivity	Magnitude of impact	Consequence
Low	Low	Negligible

**Impact significance - NOT SIGNIFICANT**

## 14.8.2 Potential effects during operation and maintenance

### 14.8.2.1 Potential impact on military low flying and SAR helicopter operations due to presence of obstacles (WTGs in operation)

The potential impact on military low flying and SAR helicopter operations due to presence of obstacles during the operation and maintenance phase is exactly as detailed in Section 14.8.1 for the construction phase.

In addition, during maintenance periods, it may be necessary to use surface vessels with crane capabilities for replacement of component parts e.g. blades or the WTG itself. These temporary obstacles will be addressed under the NOTAM system as set out in Table 14.6.

Military low flying and SAR helicopter operations are high value receptors because all aviation impacts are high value. However, implementation of embedded mitigation measures (as described in Table 14.6) ensures that low flying and SAR helicopter operations will have low vulnerability, since any impacts are unlikely to affect long term functioning of low flying and SAR helicopter operations.

Military low flying and SAR helicopter operations are therefore deemed to be of low sensitivity to the potential risk of collision with obstacles. The impact, therefore, is considered to be of low magnitude. Consequently, the overall effect is considered to be negligible which is not significant in EIA terms.

#### Evaluation of significance

Following implementation of embedded mitigation measures (Table 14.6), the sensitivity will be low and the magnitude of the impact will be low. The overall effect on military low flying and SAR helicopter operations during operation and maintenance is considered to be **negligible** and **not significant** in EIA terms.

Sensitivity	Magnitude of impact	Consequence
Low	Low	Negligible

**Impact significance - NOT SIGNIFICANT**

## 14.8.3 Potential effects during decommissioning

Given the nature of the decommissioning activities, which will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar to or less than those assessed for the construction stage.

## 14.8.4 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction, operation and maintenance and decommissioning of the Project is provided in Table 14.7.



No significant effects on aviation and radar receptors were identified. Therefore, secondary mitigation measures in addition to the embedded mitigation measures listed in Section 14.7 are not considered necessary.

Table 14.7 Summary of potential effects

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF IMPACT	CONSEQUENCE (SIGNIFICANCE EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT EFFECT)
<b>Construction</b>						
<b>Presence of obstacles (WTGs in construction)</b>	Military low flying and SAR helicopter operations	Low	Low	Negligible (not significant)	None required above embedded mitigation measures	Negligible (not significant)
<b>Operation and maintenance</b>						
<b>Presence of obstacles (WTGs in operation)</b>	Military low flying and SAR helicopter operations	Low	Low	Negligible (not significant)	None required above embedded mitigation measures	Negligible (not significant)
<b>Decommissioning</b>						

Any impacts will be the same, or less, than those identified during the construction phase.

## 14.9 Proposed Monitoring

No aviation and radar monitoring to test the predictions made within the assessment of effects is considered necessary.

## 14.10 Cumulative Effects Assessment

In terms of assessing aviation and radar cumulative effects, the impact on any aviation receptor is generally treated as a standalone, Project specific impact. Whilst other WTG developments may be located in close proximity, the impact on each receptor is considered on a case-by-case basis and any significant effect is sufficient to trigger an objection from the relevant aviation stakeholder. However, if one windfarm has an unacceptable effect on an aviation receptor, it will not impact upon any other windfarm. In terms of mitigation, an agreement for one development through consultation with a relevant stakeholder may be of relevance to a neighbouring development, however, it is still necessary for negotiations and discussions with aviation stakeholders on these mitigation measures to be carried out under separate arrangements.

The predicted effects from the Project on aviation and radar receptors are considered to be localised to within the footprint of the Project. Given that the WTG is not considered detectable by any radar system, the Project will not present any cumulative effect on radar systems. Furthermore, given the distance of the Project from known offshore and onshore developments, the Project is also not considered to present any cumulative effect on military low flying or SAR helicopter operations in the region.

There is no potential for the predicted impacts to interact with impacts from other projects and activities in the aviation and radar Study Area that can lead to a cumulative effect on receptors. Consequently, no further assessment with respect to cumulative effects is required.

## 14.11 Inter-Related Effects

Inter-relationships are defined as the interaction between the impacts assessed within different topic assessment chapters on a receptor. It is assessed that no other chapters and impacts are related to the assessment of potential effects on aviation and radar. Therefore, inter-relationships for aviation and radar receptors do not need to be considered further.

## 14.12 Transboundary Effects

Transboundary effects arise when impacts from a development within one European Economic Area (EEA) state's territory affects the environment of another EEA state(s).

There is no potential for transboundary impacts upon aviation and radar receptors due to construction, operation and maintenance and decommissioning of the Project. The potential impacts are localised and are not expected to affect other EEA states. Therefore, transboundary effects for aviation and radar receptors do not need to be considered further.



## 14.13 Summary of Impacts and Mitigation Measures

No secondary mitigation, over and above the embedded mitigation measures proposed in Section 14.7 is either required or proposed in relation to the potential effects of the Project on aviation and radar as no significant impacts are predicted.

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