Partners in UK offshore wind

MONA OFFSHORE WIND PROJECT

Preliminary Environmental Information Report

Volume 6, annex 27.1: Aviation and radar technical report

Image of an offshore wind farm

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Glossary

Term	Meaning
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 (VFR) (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 Meteorological Conditions	A flight category which allows flight to be conducted under Visual Flight Rules (VFR) defined by in flight visibility and clearance from cloud.

Acronyms

Acronym	Description
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ANO	The Air Navigation Order (ANO) 2022 and Regulations
ANSP	Air Navigation Service Provider
AOC	Air Operators Certificate
ARP	Aerodrome Reference Point
ATC	Air Traffic Control
ATS	Air Traffic Service
BAE	British Aerospace
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CAS	Controlled Airspace
CAT	Commercial Air Transport
CTA	Control Area
EASA	European Union Aviation Safety Agency
EIA	Environmental Impact Assessment
FL	Flight Level
GBS	Global Positioning System
HAR	Helicopter Access Report
HMRI	Helicopter Main Route Indicators
IAIP	Integrated Aeronautical Information Package
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IoM	Isle of Man
ISAR	Integrated Search and Rescue
LAT	Lowest Astronomical Tide
LFA	Low Flying Area
LFS	Low Flying System
LoS	Line of Sight
MAP	Missed Approach Point
MCA	Maritime Coastguard Agency
MDH	Minimum Descent Height
MDS	Maximum Design Scenario
MGN	Maritime Guidance Note
MOD	Ministry of Defence
NUI	Normally Unmanned Installation
NOGEPA	Nederlands Olie en Gas Exploratie en Productie Associatie
OCA	Obstacle Clearance Altitude
OLS	Obstacle Limitation Surfaces
OREI	Offshore Renewable Energy Installations
OSI	Offshore Storage Installation
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Area
PSR	Primary Surveillance Radar
RAF	Royal Air Force
RCS	Radar Cross Section
RDP	Radar Data Processor
SAR	Search and Rescue
SSR	Secondary Surveillance Radar
TEMPSC	Totally Enclosed Motor Propelled Survival Craft

Acronym	Description
UKLFS	UK Low Flying System
VFR	Visual Flight Rules

Units

Unit	Description
%	Percentage
cd	Candela
ft	Feet
km	Kilometre
m	Metre
nm	Nautical mile
rpm	Rotations per minute

1 Aviation and radar technical report

1.1 Introduction

1.1.1.1 This technical report provides a detailed description of aviation and radar activity within the area of the proposed Mona Offshore Wind Project and the wider, east Irish Sea region. This information will be used to inform volume 4, chapter 27: Aviation and radar of the Preliminary Environmental Information Report (PEIR) being undertaken as part of the consenting process for this Project. Appendix 1, Helicopter Access Report (HAR) (Anatec, 2022), of this technical report contains details on weather and airspace access to current Irish Sea (Morecambe Bay) oil and gas installations (platforms) near the Mona Offshore Wind Project.

1.1.1.2 Appendix 2, Instrument Flight Procedures (IFP) assessment, Osprey Consulting Services, (Osprey, 2022) of this technical report details published flight procedures of Irish Sea littoral aerodromes.

1.1.1.3 This technical report has been produced by Osprey on behalf of RPS, which has been appointed as the lead Environmental Impact Assessment (EIA) consultant for the Mona Offshore Wind Project by the Applicant.

1.1.1.4 This technical report considers wind turbines once they are fully installed with regard to aviation and radar.

1.2 Study area

1.2.1.1 To identify and characterise aviation and radar receptors, a broad study area has been defined. The Mona aviation and radar study area is presented in Figure 1.1.

1.2.1.2 The Mona aviation and radar study area covers the aviation radar systems that potentially detect the maximum (highest) wind turbine blade tip (324m above Lowest Astronomical Tide (LAT)) height. It includes the airspace within the following points:

- The NATS Lowther Hill Primary Surveillance Radar (PSR) to the north northeast of the Mona Array Area
- The NATS Great Dun Fell PSR to the northeast of the Mona Array Area
- The Manchester Airport PSR to the southeast of the Mona Array Area
- The NATS Clee Hill PSR to the southeast of the Mona Array Area
- The Ministry of Defence (MOD) Royal Air Force (RAF) Valley PSR location to the southwest of the Mona Array Area
- A point 30km west of the location of the Ronaldsway Airport PSR, on the Isle of Man (IoM)
- The MOD (QinetiQ) West Freugh PSR to the north of the Mona Array Area.

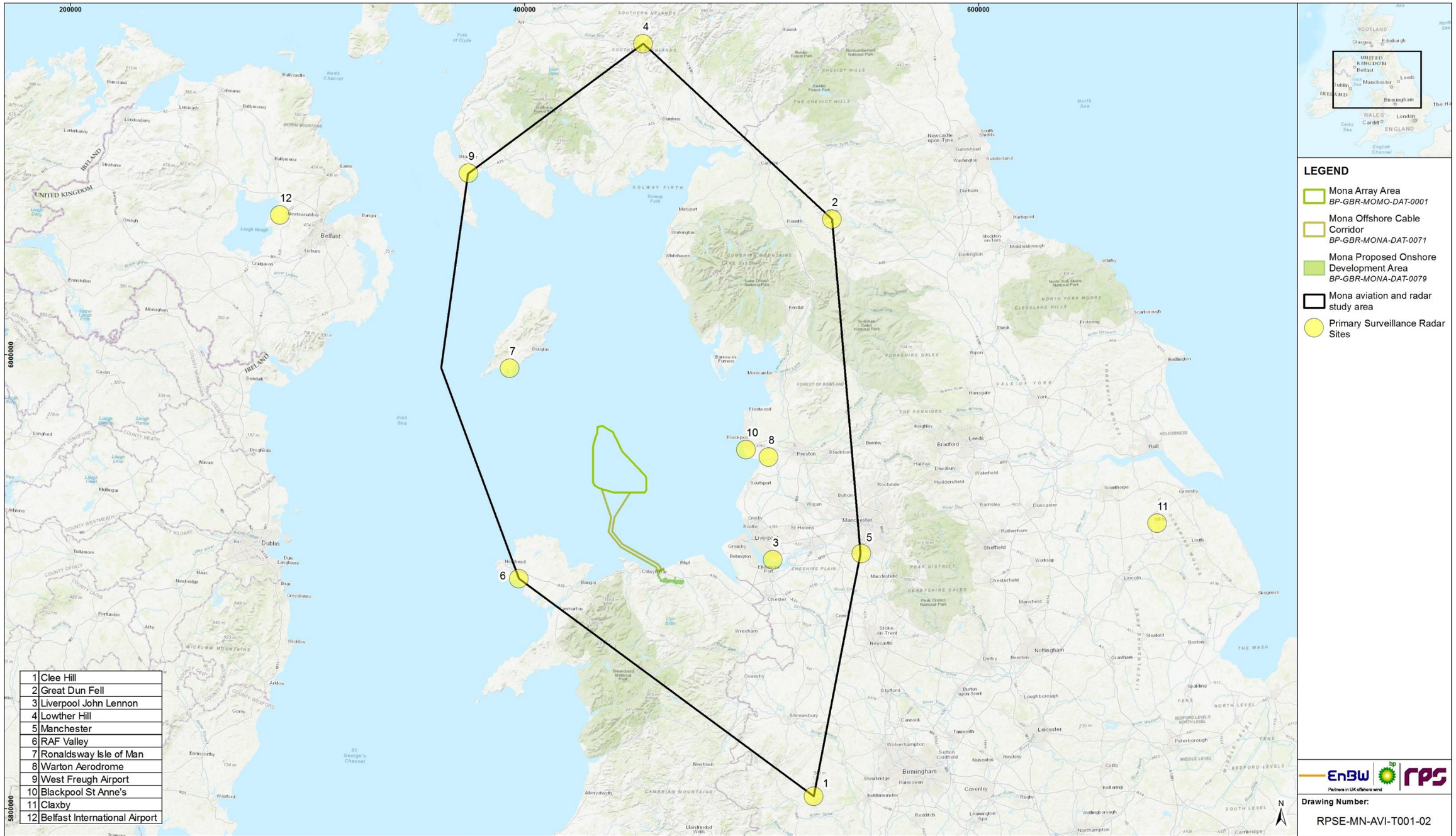


Figure 1.1: The Mona aviation and radar study area.

1.2.1.3 There are a number of aerodromes which may be affected by the development of the Mona Offshore Wind Project, shown on Figure 1.2. Approximate measurements have been taken from the closest boundary of the Mona Offshore Wind Project to the Aerodrome Reference Point (ARP):

- Ronaldsway, IoM Airport located on a bearing of 306°/46.9km
- RAF Valley located on a bearing of 214°/52.3km
- Liverpool Airport located on a bearing of 115°/66.6km
- Manchester Airport located on a bearing of 104°/97.7km
- Blackpool Airport located on a bearing of 066°/47.3km
- BAE Systems (BAE) Warton Aerodrome located on a bearing of 073°/55.3km
- MOD (QinetiQ) West Freugh Aerodrome located on a bearing of 333°/126.1km.

1.2.2 Airspace designation at the Mona Array Area

1.2.2.1 The Mona Array Area would be located within Class G uncontrolled airspace which extends from the surface up to Flight Level (FL) 75 (approximately 7,500ft), as shown in Figure 1.3. In the large central part of the Mona Array Area, and at the southwest edge of the Mona Array Area, Class G airspace is established from the surface to FL 115 (11,500ft) with Class C controlled airspace established above that. Within Class G airspace, any aircraft, civil or military, can enter and transit the airspace without Air Traffic Control (ATC) clearance and subject only to a small set of mandatory rules, as stipulated in the UK Integrated Aeronautical Information Package (IAIP) (CAA, 2022a) En-Route Section 1.4-2 Air Traffic Service (ATS) Airspace Description. Aircraft operating in this area may be in receipt of an ATS; however, within this classification of airspace, pilots are ultimately responsible for their own terrain and obstacle clearance. This is achieved through prudent planning (using published aviation charts, the UK IAIP and local aerodrome instructions) and diligent ‘lookout’ throughout the flight.

1.2.2.2 Located above the Class G airspace, Class C Controlled Airspace (CAS) of the Holyhead Control Area (CTA), is established up to FL 195 (19,500ft) as shown at Figure 1.2; this airspace lowers to a base level of FL 45 (4,500ft) with uncontrolled airspace below at the northwest corner of the Mona Array Area. Aircraft in this Class C airspace are controlled by air traffic controllers located at Ronaldsway Airport (IoM), Liverpool Airport and RAF Valley. Within Class C airspace all flights are subject to air traffic control service with standard separation maintained between aircraft dependent on whether they are flying under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR).

1.2.3 Helicopter Main Routes Indicators context

1.2.3.1 Helicopter Main Route Indicators (HMRIs) support the transport of personnel and equipment to offshore oil and gas installations. HMRIs are routes typically and routinely flown by helicopters operating to and from offshore destinations and are promulgated for the purpose of signposting concentrations of helicopter traffic to other airspace users. HMRI promulgation does not predicate the flow of helicopter traffic. Whilst HMRIs have no airspace status and assume the background airspace classification within which they lie (in the case of the Irish Sea, Class G), they are used by the Air Navigation Service Provider (ANSP) and helicopter operators for flight planning and management purposes. Civil Aviation Authority (CAA) Civil Aviation Publication (CAP) 764 (CAA, 2016) states that HMRIs have no defined lateral dimensions (only route centrelines are charted on navigation charts) and that 2nm either side of the route centreline should be kept obstacle free; no HMRIs cross the Mona Array Area. The HMRI system in the east Irish Sea is shown in Figure 1.2.

In order to maintain a safe operating environment, the CAA recommend, in CAP 764 (CAA, 2016) a consultation zone of 9nm radius around offshore installations serviced by helicopters. This consultation zone is not considered a prohibition on development, but a trigger for consultation between offshore helicopter operators, the operators of existing installations and developers of proposed offshore wind farms, in order to determine a solution that maintains safe offshore helicopter operations. Appendix 1, HAR (Anatec, 2022) of this technical report contains details on weather and airspace access to current Irish Sea (Morecambe Bay) oil and gas installations (platforms) near the Mona Offshore Wind Project.

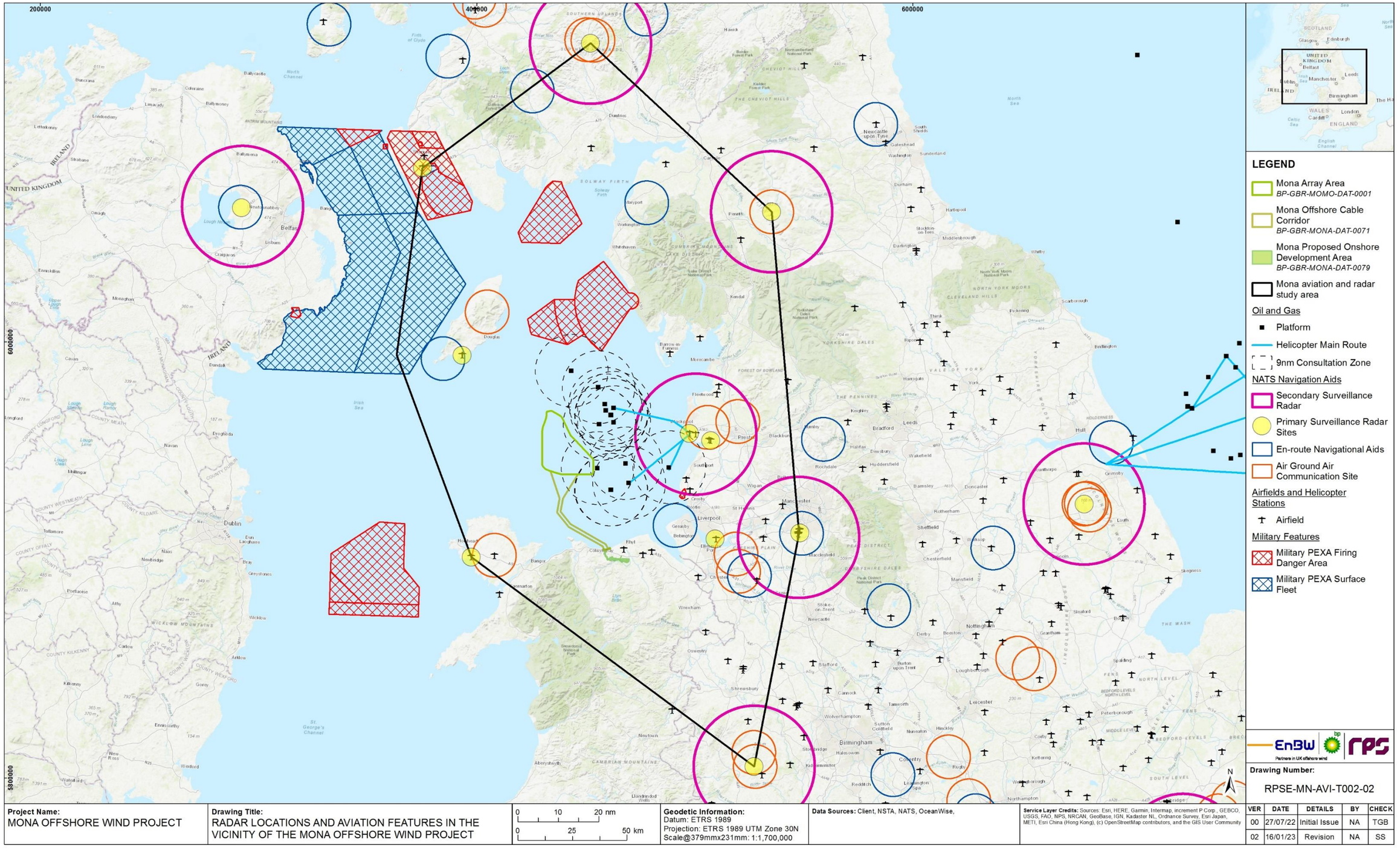


Figure 1.2: Radar locations and features within the vicinity of the Mona Offshore Wind Project.

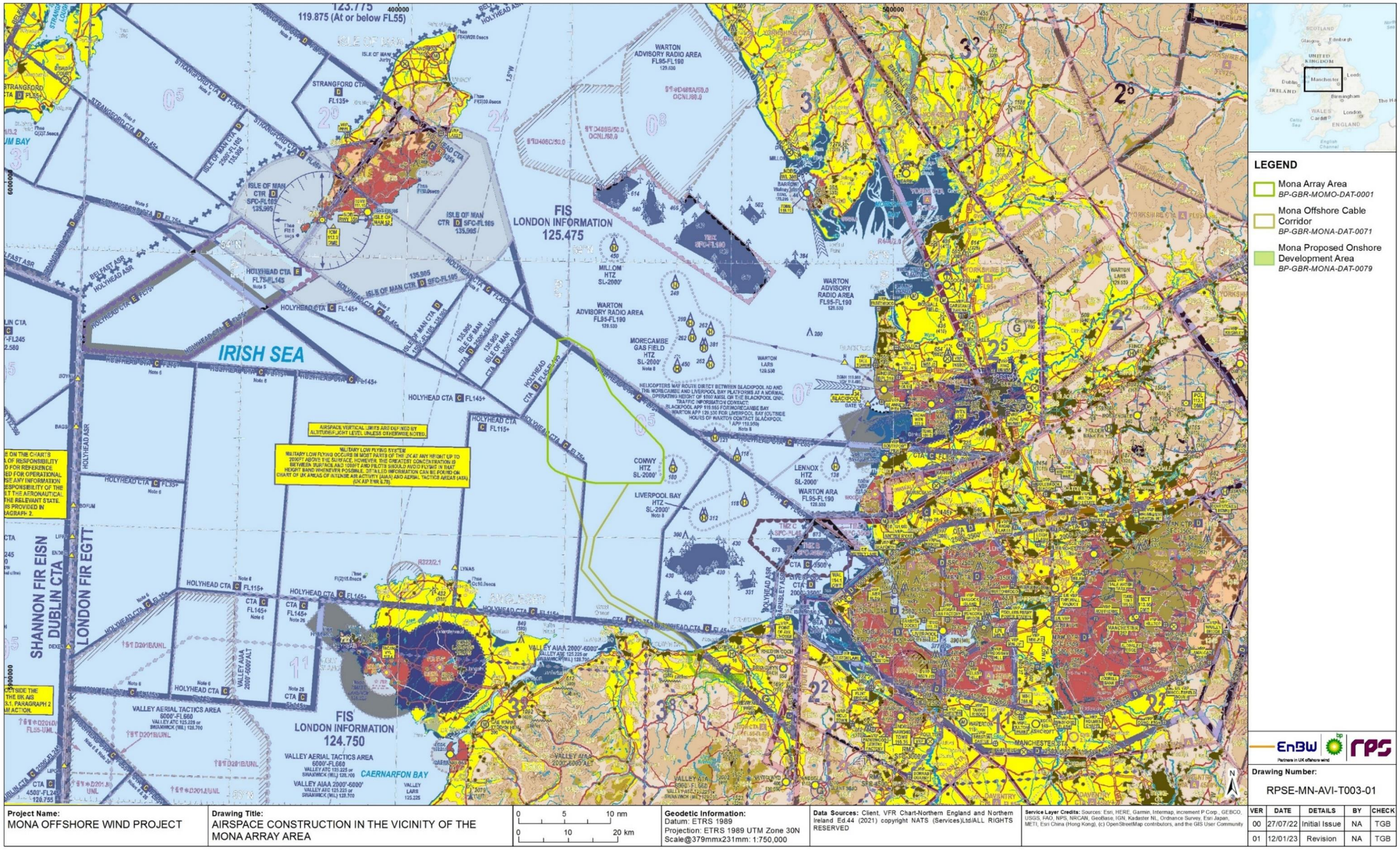


Figure 1.3: Airspace construction in the vicinity of the Mona Array Area.[1]

[1] Data included in this product reproduced under licence from NATS (Services) Ltd © Copyright 2022 NATS (Services) Ltd. All rights reserved.

1.2.3.2 The Mona Array Area extends into the 9nm consultation zones established around six platforms:

- Conwy located 1nm from the Mona Array Area
- Douglas DA located 6nm from the Mona Array Area
- Douglas DP located 6nm from the Mona Array Area
- Douglas DW located 6.1nm from the Mona Array Area
- Calder located 7.1nm from the Mona Array Area
- Hamilton North located 8nm from the Mona Array Area.

1.2.3.3 These platforms and their consultation zones are also presented in Figure 1.2. A 9nm consultation zone should also be a trigger for consultation with the operators of any subsea infrastructure and wells where mobile drilling rigs or vessels may require helicopter access. A HAR has been completed which has assessed the potential impact to helicopter operations to those oil and gas platforms located within proximity to the Mona Array Area. Appendix 1 to this technical report provides the HAR (Anatec, 2022), which contains analysis of the potential of impact of helicopter operations to those platforms within 9nm of the Mona Array Area, together with analysis conclusions.

1.2.4 Instrument Flight Procedures

1.2.4.1 IFP design covers the planning of routes used by pilots and air traffic control from take-off to landing and is a complex and highly regulated process. All IFP design must be undertaken by an approved procedure designer that is authorised by the relevant State. In the UK, all IFP design must be undertaken in accordance with CAA requirements. Wind turbines placed in proximity to IFP may adversely affect IFP safeguarded areas which may result in individual IFP being no longer fit for purpose without mitigation being applied. Appendix 2 to this technical report, IFP Assessment (Osprey, 2022), assesses those Irish Sea littoral aerodromes' flight procedures which are within 50nm of the Mona Offshore Wind Project together with analysis and conclusions.

1.3 Desktop study

1.3.1.1 Through the desktop study the identification of all aviation and radar stakeholders potentially affected by the Mona Offshore Wind Project was established in accordance with regulatory guidelines on safeguarding distances from CAP 764.

1.3.1.2 The types of radar operating over the Mona Array Area were considered, together with civil aviation agencies including NATS who are the main en-route ANSP in the UK, regional airports, offshore airborne Search and Rescue (SAR) and military operations of relevance to confirm the baseline.

1.3.1.3 The radar technical effects, Line of Sight (LoS), analysis between the maximum blade tip height and potentially affected civil and military aviation radar systems was completed to establish the theoretical detectability of the wind turbines to those regional radar systems which have the potential to be affected by their operation.

1.3.1.4 The aviation and radar baseline environment was defined through the identification and refinement of aviation and radar stakeholders via a desktop assessment utilising information available in the documents detailed in Table 1.1 that relate to aviation law, policy, process, guidance and the promulgation of information to aviation stakeholders/operators.

1.3.1.5 No site-specific surveys were undertaken during this desk-based study. No consultation was undertaken during this desk-based study.

1.3.1.6 Information on aviation and radar activities within the Mona aviation and radar study area was collected through a detailed desktop review of existing datasets. These are summarised in Table 1.1 below.

Table 1.1: Summary of key desktop sources.

Title	Source	Year	Author
UK IAIP	CAA/NATS	March 2022	CAA/NATS
UK Military AIP	MOD	March 2022	MOD
MOD Lighting Review	MOD	January 2020	MOD
CAP 168 Licensing of Aerodromes	CAA	January 2022	CAA
CAP 393 The Air Navigation Order 2022	CAA	February 2021	CAA
CAP 437 Standards for Offshore Helicopter Landing Areas	CAA	July 2021	CAA
CAP 670 Air Traffic Services Safety Requirements	CAA	June 2019	CAA
CAP 738 Safeguarding of Aerodromes	CAA	October 2020	CAA
CAP 764 Policy and Guidelines on Wind Turbines	CAA	February 2016	CAA
CAP 777 ATC Surveillance Minimum Altitude Charts in UK Airspace Policy and Design Criteria	CAA	Edition 5, September 2018	CAA
European Union Aviation Safety Agency (EASA) Document 923 Safety Instruction Bulletin	EASA	2012	EASA

Title	Source	Year	Author
MGN 654 Marine Guidance Note Safety of Navigation: Offshore Renewable Energy Installations (OREIs), Guidance on UK Navigational Practice, Safety and Emergency Response.	Maritime and Coastguard Agency (MCA)	April 2021	MCA
UK VFR Charts	CAA / NATS	April 2022	CAA / NATS
Statement of the OPERA group on the cohabitation between weather radars and wind turbines	OPERA	November 2009	OPERA

1.3.2 NATS Primary Surveillance Radar

1.3.2.1 There are a number of NATS PSRs which may be affected by the development of the Mona Array Area; the closer ones are shown within Figure 1.2. The following approximate distances are taken from the closest boundary of the Mona Array Area to each NATS PSR potentially affected:

- Clee Hill Radar located on a bearing of 149°/154.9km
- Great Dun Fell (GDF) Radar located on a bearing of 042°/135.7km
- Lowther Hill Radar located on a bearing of 003°/170.2km
- St Anne's Radar located on a bearing of 083°/49.0km
- Manchester (Airport) Radar located on a bearing of 111°/99.7km.

1.3.2.2 The following NATS PSRs provide en-route radar coverage over the Irish Sea airspace and within the declared operational range of all of the NATS PSR sites:

- Lowther Hill
- GDF
- St Anne's
- Clee Hill.

1.3.3 Aerodrome Primary Surveillance Radar

1.3.3.1 Additional aerodrome PSRs are located at the airfields at:

- RAF Valley
- BAE Warton
- West Freugh
- Ronaldsway (IoM)
- Liverpool.

1.3.3.2 The Mona Array Area is within the declared operational range of all of these sites (see Figure 1.2).

1.3.4 Secondary Surveillance Radar

1.3.4.1 CAP 764 states that wind turbine effects on Secondary Surveillance Radar (SSR) are traditionally less than those on PSRs but can be caused due to the physical blanking and diffracting effects of the wind turbine towers, depending on the size of the wind turbines and the array area. These effects are typically only a consideration when the wind turbines are located very close to the SSR (less than 10km). There are no SSR systems within 10km of the Mona Array Area.

1.3.5 Radar Line of Sight modelling

1.3.5.1 The ATDI ICS LT (Version 22.4.7 x64) tool was utilised to model the terrain elevation profile between the identified PSR systems and the Mona Array Area. 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.

1.3.5.2 It should be noted that this is a limited and theoretical desk-based study; in reality there are unpredictable levels of 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 likelihood of the wind turbine being detected such that the operational significance of the Mona Array Area relative to the radar systems can be assessed. 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 a projected array area; the layout of wind turbines does not have a material effect on establishing theoretical radar LoS. Therefore, to enable the analysis, points of reference in the form of a regular grid pattern were established across the projected Mona Array Area with wind turbines on all array vertices at the maximum blade tip height of 324m above LAT, which is considered to be the Maximum Design Scenario (MDS) for aviation. The model does not use precise planned/proposed wind turbine positions, but representative locations within the projected Mona Array Area, on a 4km grid pattern of 38 wind turbines, ensuring an even distribution. The result for a particular location provides an indication of detectability of a wind turbine, based on a maximum upper blade tip height, within a 2km radius of that location; providing a result that covers the whole of the projected Mona Array Area. The qualitative definitions utilised in the LoS assessment are defined in Table 1.2.

Table 1.2: LoS qualitative definitions.

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.

1.3.5.3 A radar LoS analysis across the Mona Array Area has been completed in order to establish theoretical radar detectability of the wind turbines, placed within the Mona Array Area to selected PSR systems located in the UK based on a maximum upper blade tip height of 324m LAT. This is a representative modelling 'datum' height and the error tolerance of the analysis model covers the wind turbine blade tip height of 324m above LAT. Radar operates by alternately transmitting a stream of high-power radio frequency pulses and 'listening' to echoes received back from targets within its radar LoS. Generally, air surveillance (aviation) radars employ a rotating antenna that provides 360° coverage in azimuth; the typical scan rate is 15 rotations per minute (rpm) thus illuminating a given target every four seconds.

1.3.5.4 PSR can distinguish between moving and static targets; for targets that are moving towards or away from the radar, the frequency of the reflected signal from a moving target changes between each pulse (transmit and receive) which is known as the Doppler shift. This can be most practically explained by considering the change in frequency of the engine sound heard by a pedestrian when a car passes by on the road – the sound as the car approaches is higher than the sound heard by the pedestrian as it travels away. The Doppler shift has the effect of making the sound waves appear to bunch up in front of the vehicle (giving a higher frequency) and spread out behind it (lower frequency). The true frequency of the engine is only heard when the car is immediately next to the pedestrian. The aviation radar receiver is 'listening' to the radio waves reflected from the moving object and working out whether the returned signal is of a higher or lower frequency (moving object) or if the returned frequency is the same as the transmitted signal (a stationary object).

1.3.5.5 Wind turbines are a significant cause of PSR false plots or clutter, as the rotating blades can trigger the Doppler threshold (minimum shift in signal frequency) of the Radar Data Processor (RDP) and therefore may be interpreted as aircraft movements (CAP 764). Significant effects have been observed on radar sensitivity caused by the substantial Radar Cross Section (RCS) of the wind turbine structural components (blades, tower and nacelle) which can exceed that of a large aircraft; the effect 'blinds' the radar (or the operator) to wanted targets in the immediate vicinity of the wind turbine. False plots and reduced radar sensitivity may reduce the effectiveness of the radar system itself to an unacceptable level and compromise the provision of a safe radar service to participating aircraft.

Radar Line of Sight modelling summary

1.3.5.6 Initial radar LoS modelling results indicate that theoretically the following PSRs would not detect the wind turbines (based upon a modelled maximum blade tip height of up to 324m LAT (an 'unlikely' or 'no' (Table 1.2) output from the modelling, allowing for model tolerance error):

- Clee Hill
- Manchester
- RAF Valley
- West Freugh.

1.3.5.7 Due to the location of the Mona Array Area possible effects are likely to the operations associated with the following PSRs due to detectability of the wind turbines:

- Lowther Hill; over 170 km from the Mona Array Area, but due to the vertical extent of the wind turbines, the north elements are theoretically likely to be in radar LoS to this NATS PSR (Figure 1.4)
- St Anne's; at 49 km from the Mona Array Area, the wind turbines are theoretically likely to be in radar LoS to this NATS PSR (Figure 1.5)
- GDF; over 135 km from the Mona Array Area, but due to the vertical extent of the wind turbines, the extreme southeast elements are theoretically likely to be in radar LoS to this NATS PSR (Figure 1.6)
- Ronaldsway (IoM); less than 50 km from the Mona Array Area, the wind turbines are theoretically likely to be in radar LoS to this aerodrome PSR (Figure 1.7)
- Liverpool; 50 km from the Mona Array Area, the eastern wind turbines are theoretically likely to be in radar LoS to this aerodrome PSR (Figure 1.8)
- BAE Warton; less than 40 km from the Mona Array Area, the wind turbines are theoretically likely to be in radar LoS to this aerodrome PSR (Figure 1.9).

1.3.5.8 Radar clutter created by the Mona Array Area from detectable wind turbines could cause air traffic controllers to lose aircraft track identity and hence they would be unable to maintain the appropriate separation standard on fixed airspace procedures or other aircraft manoeuvring under their control. Radar LoS analysis results for those aviation radar systems that have provided theoretical radar detectability of the Mona Array Area are provided in Figure 1.4 to Figure 1.8 below.

1.3.6 Meteorological Office radar

1.3.6.1 The Statement of the European Union Meteorological Network Operational Programme for the Exchange of weather Radar information (OPERA) Group, on the cohabitation between meteorological weather radars and wind turbines, states that the deployment of wind turbines within 5km of weather radar is prohibited (OPERA, 2009). The Meteorological (Met) Office radar infrastructure is safeguarded by the Met Office. The Met Office works to wind turbine safeguarding guidelines that stipulate a 20km separation between any development and a weather radar system.

Met Office radar summary

1.3.6.2 The closest Met Office radar system is located at Hameldon Hill (Met Office, 2020), approximately 4.6km southwest of Burnley, Lancashire, 94km from the Mona Array Area. The actual type of the Met Office radar located at Hameldon Hill is unknown.

1.3.7 Military low flying

1.3.7.1 The UK military low flying system covers the open airspace of the whole of the UK and surrounding overseas areas from the surface to 2,000 feet Above Ground Level (AGL) or Above Mean Sea Level (AMSL).

1.3.7.2 Major towns and cities are generally avoided by low flying aircraft; in some areas of the country, a combination of airspace restrictions and topographical features make it difficult for aircrew to greatly vary their routes. The Irish Sea Class G airspace (section 1.2.2), within which the Mona Array Area sits, is in the MOD Low Flying Area (LFA) 17 (part of the UK Low Flying System (UKLFS)), between Cumbria (Lake District) and

North Wales and transiting military aircraft can use this area to avoid the IoM and Manchester Airport CAS (Figure 1.3). Military low flying is a demanding but essential skill for military aircrew, gained through progressive training and continuous practice within the UKLFS. The ability to operate effectively at low level by day and night is vital to fast jet, transport aircraft and helicopters as they support forces on the ground.

1.3.8 Practice and Exercise Areas

1.3.8.1 There are a number of military Practice and Exercise Areas (PEXA) surrounding the Irish Sea; Luce Bay (West Freugh), Kirkcudbright to the north and Eskmeals to the east. However, none of the aviation related PEXA are likely to be impacted by the Mona Offshore Wind Project. The airspace near the Mona Array Area does not contain military restricted airspace or weapons ranges and would not be considered, by the MOD, to be of a priority in terms of the UKLFS.

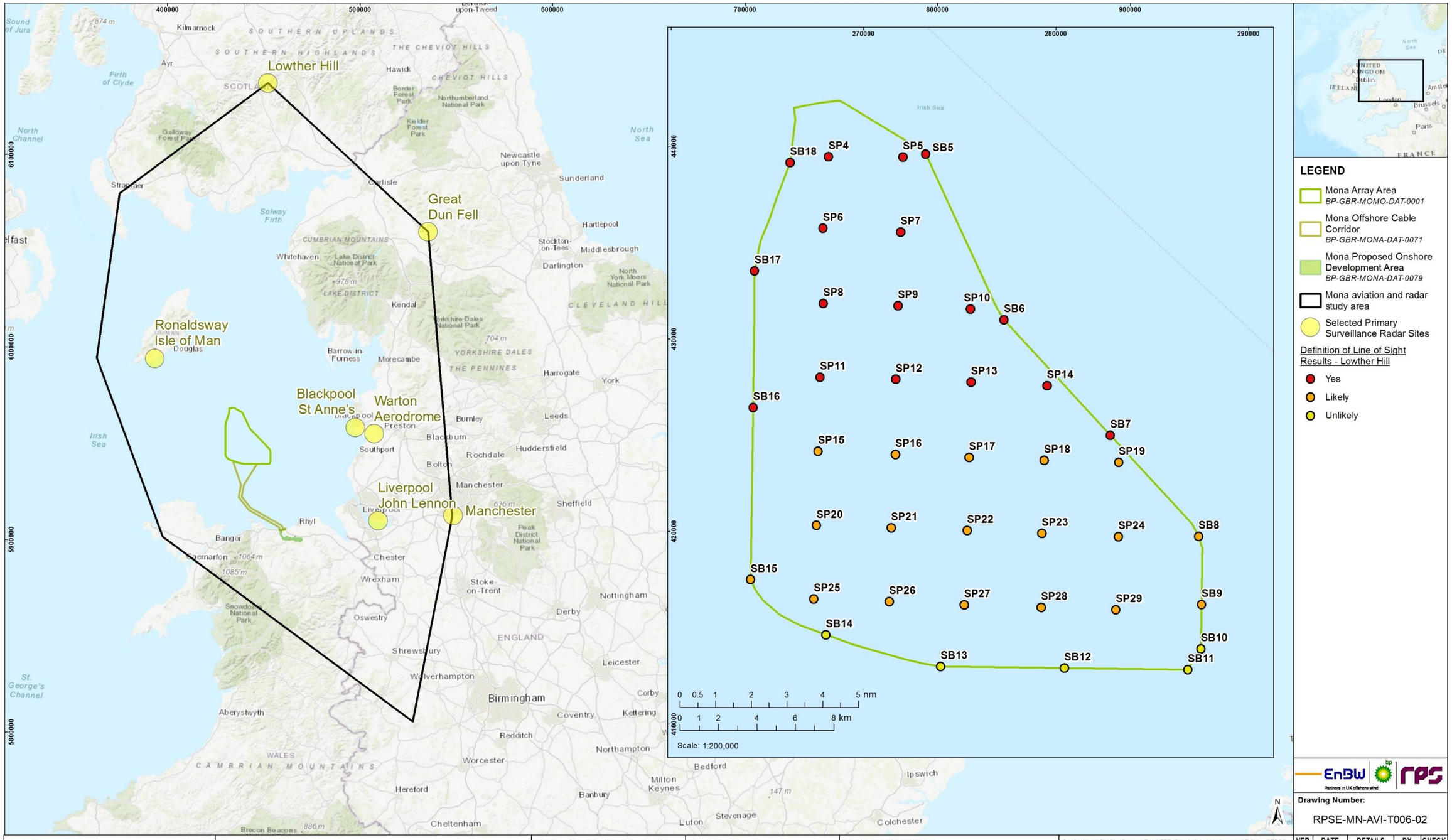


Figure 1.4: NATS Lowther Hill Radar LoS of the Mona Array Area (not to scale).

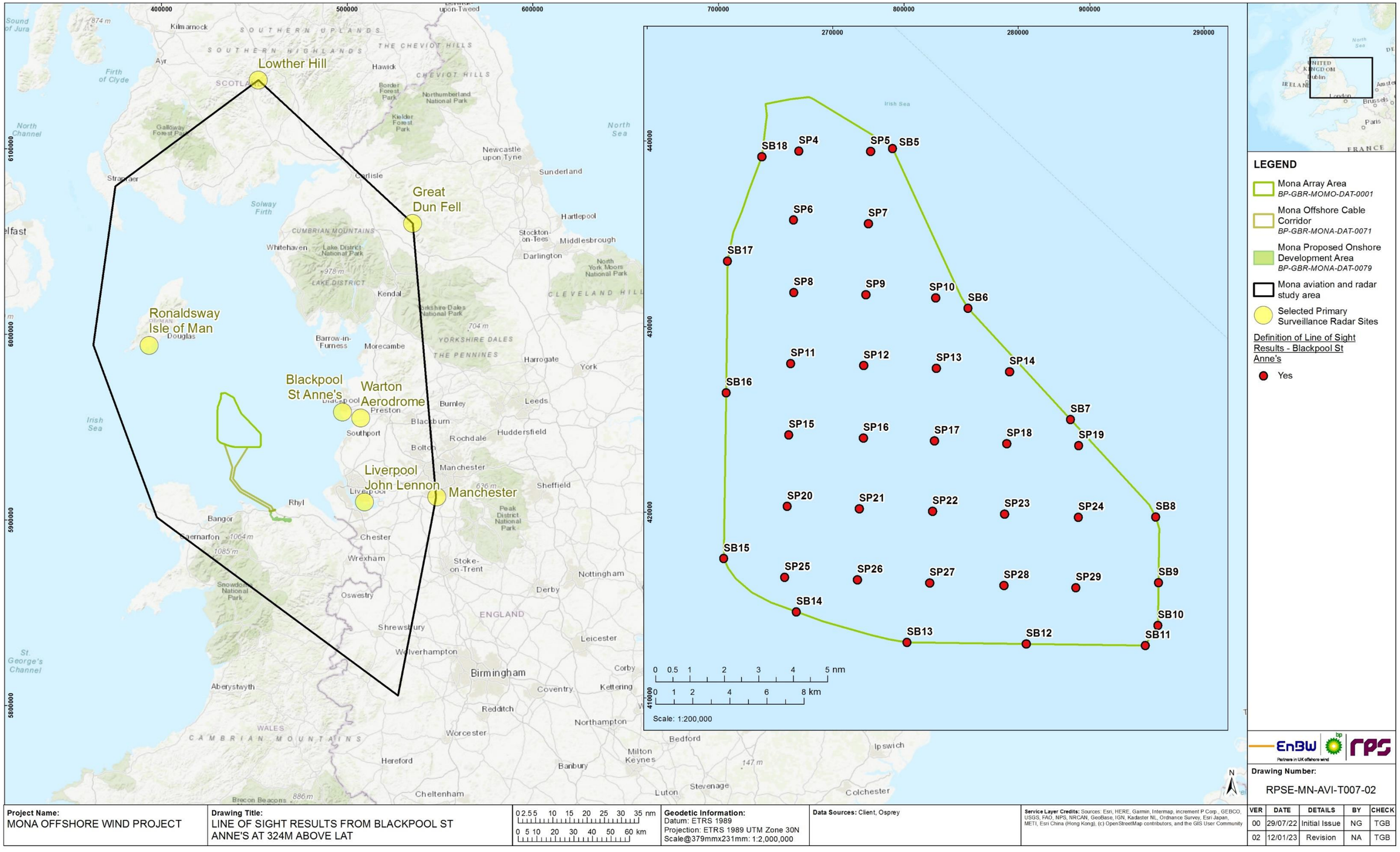


Figure 1.5: NATS St Anne's Radar LoS of the Mona Array Area (not to scale).

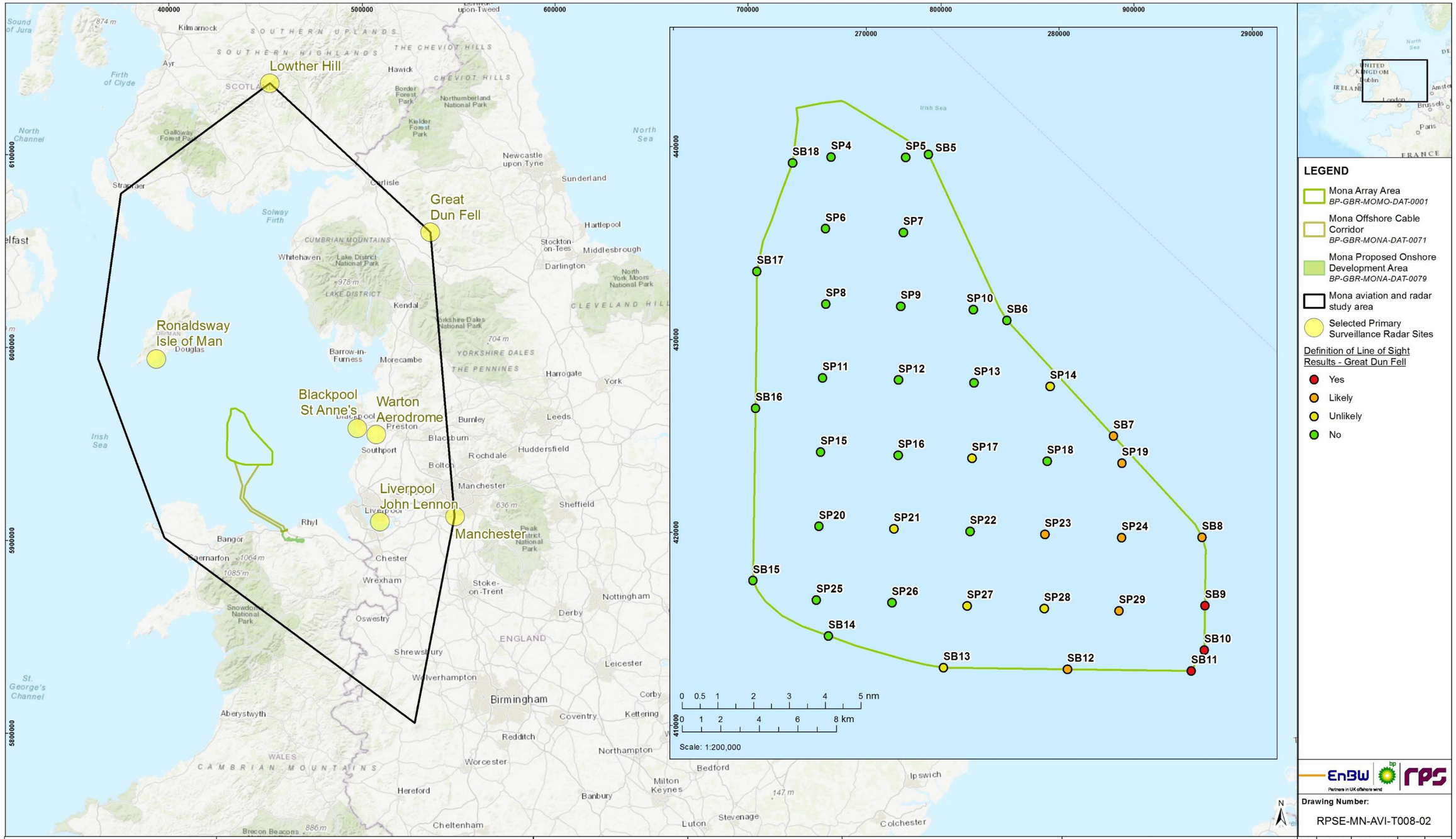


Figure 1.6: NATS Great Dunn Fell Radar LoS of the Mona Array Area (not to scale).

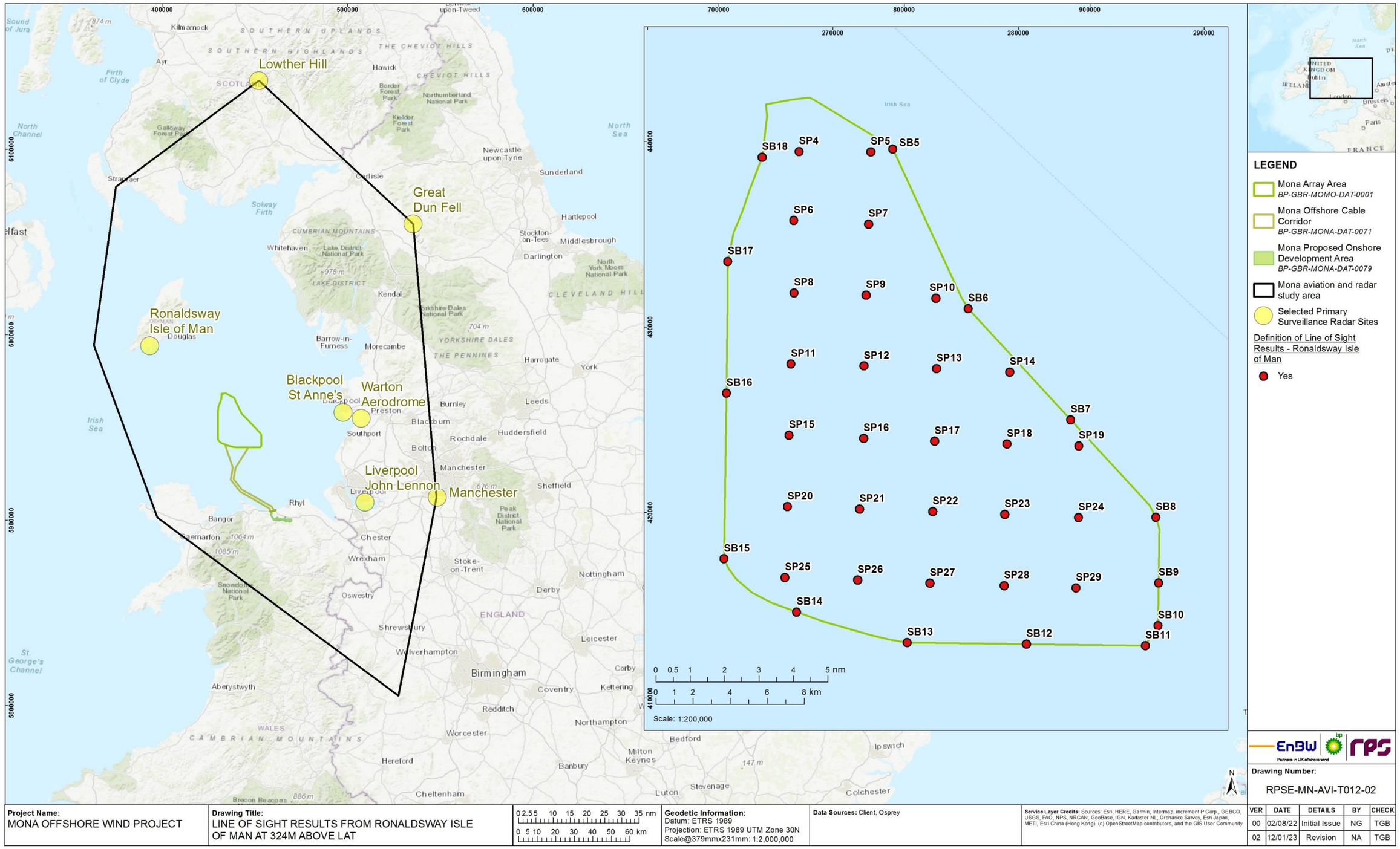


Figure 1.7: Ronaldsway (IoM) Airport Radar LoS of the Mona Array Area (not to scale).

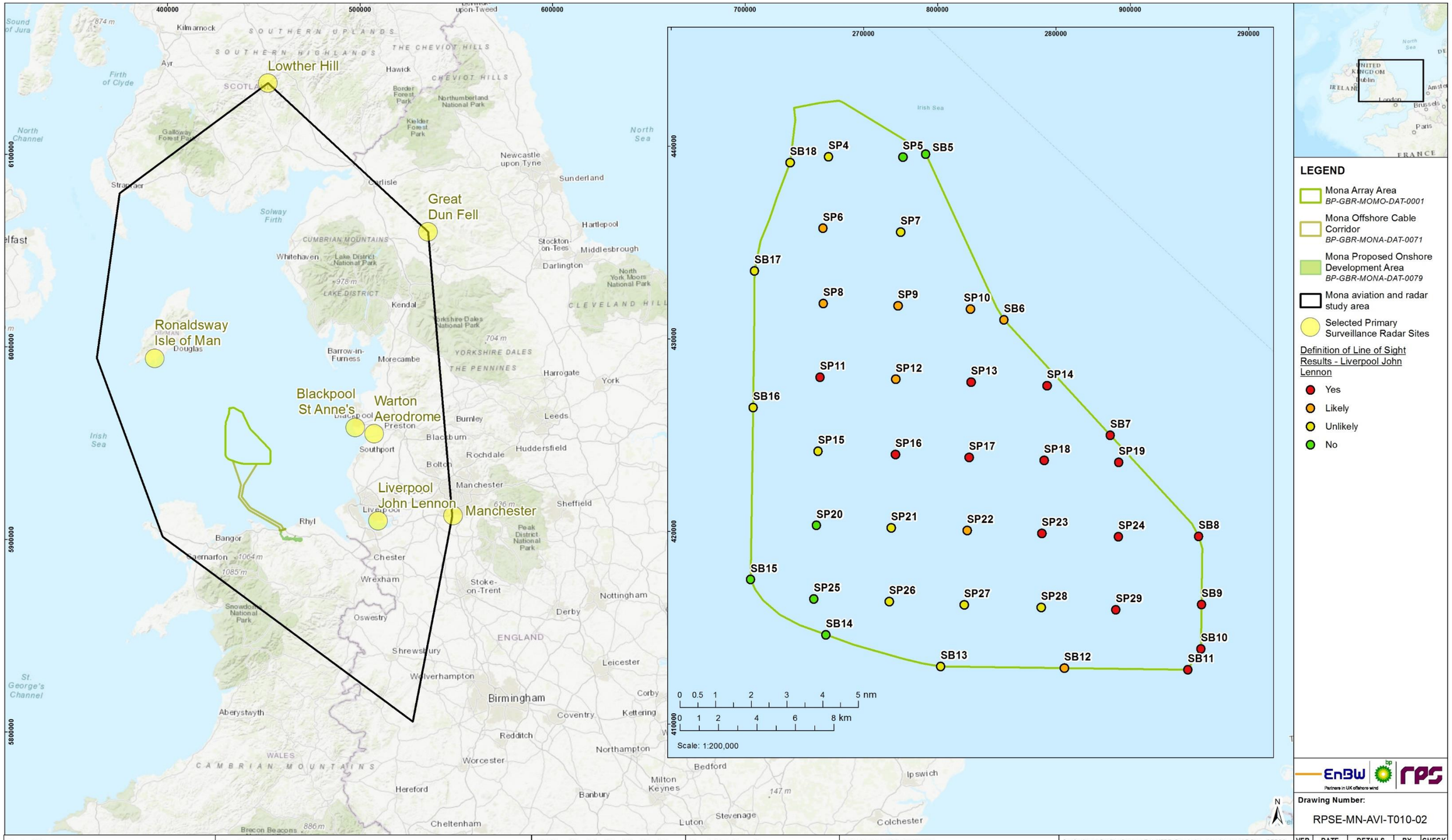


Figure 1.8: Liverpool Airport Radar LoS of the Mona Array Area (not to scale).

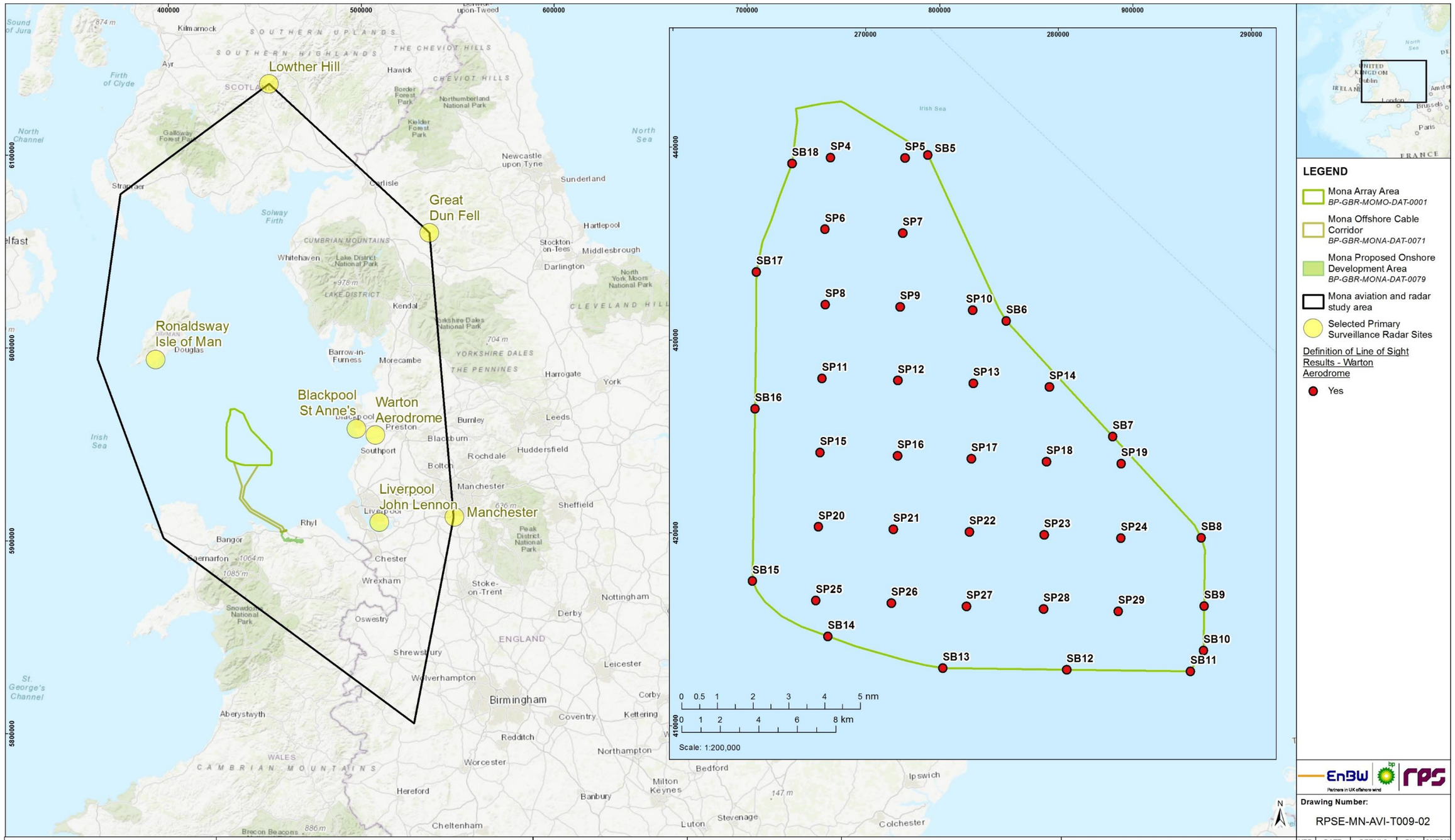


Figure 1.9: BAE Warton Radar LoS of the Mona Array Area (not to scale).

1.3.9 Aeronautical Offshore Search and Rescue operations

1.3.9.1 The civil aviation operator Bristow Inc. VTOL (Bristow) are contracted to HM Coastguard (the MCA) to conduct UK maritime Search and Rescue (SAR) operations; SAR helicopter operations are overseen by the Flight Operations Division of the CAA. To complete the role Bristow operates under its Air Operator Certificate (AOC) which provides certain exemptions to execute SAR operations in low visibility and other conditions.

1.3.9.2 The development of the Mona Offshore Wind Project would lead to a change of the operating environment should airborne SAR operations be required within or close to the Array Area. When on an operational mission, SAR aircraft are not constrained by the normal rules of the air and operate in accordance with their AOC. This allows SAR pilots total flexibility to manoeuvre using best judgement thus making them highly adaptable to the environment and conditions in which they are operating.

1.4 Ronaldsway (IoM) airport

1.4.1.1 Ronaldsway, IoM Airport, is the main civilian airport on the IoM; owned by the Manx Government and operated by the Department of Infrastructure. It is in the south of the IoM at Ronaldsway near Castletown, 6nm southwest of Douglas, the island's capital. The airport has scheduled services to the United Kingdom and the Republic of Ireland and in 2018 just under one million passengers passed through the airport. Aircraft approaching from, and departing to, the east will transit above and close to the Mona Array Area along the airways structure depicted in Figure 1.3.

1.4.2 Obstacle Limitation Surfaces

1.4.2.1 Flight operations at and within the vicinity of an aerodrome, can be affected by obstacles inside and outside the aerodrome’s boundary. The CAA issues regulatory guidance (CAP 738) (CAA, 2020) on how aerodromes should manage operations in relation to obstacles and the licensing of an aerodrome depends on the extent to which these areas are free from current or new obstacles.

1.4.2.2 The regulatory guidance states that certain areas of the subject aerodrome’s local airspace must be defined to assess the significance of existing or proposed obstacles in its vicinity; these are Obstacle Limitation Surfaces (OLS). The OLS are determined according to the classification of the aerodrome and its runway length. The safeguarded areas are represented by a number of complex 2-D planes and 3-D shapes around the aerodrome; the absence of obstacles within these areas contributes to the safety of both visual and instrument-based flight operations in the vicinity of the aerodrome.

1.4.2.3 For Ronaldsway (IoM), the runway length in excess of 1,100m but less than 1,200m results in an assumed Aerodrome Reference Code of 3, should the guidance stipulated in the CAP 168 [Chapter 3] be applied. In this instance, the maximum lateral extent of the OLS established for a Code 3 classification, is 10km from the IoM Airport ARP.

1.4.3 Instrument Flight Procedures

1.4.3.1 Licenced Airports ensure safe operations in the vicinity of the airport by minimising, as far as practicable, any penetration of the OLS. Whilst the OLS offers vital protection to aircraft against new and existing developments, they do not ensure that IFPs remain unaffected by such developments. It is vital that airports are made aware of any new development that may require an increase to the published Obstacle Clearance Altitude (OCA) associated with IFPs.

1.4.3.2 The CAA publishes a number of aeronautical charts related to procedures for the operation of aircraft to and from Ronaldsway (IoM) Airport. Figure 1.10 provides an illustration of a standard track which aircraft fly on arrival to the airport.

1.4.3.3 The northern tip of the Mona Array Area is located 24.3nm (45km) from the extended centreline of Ronaldsway (IoM) Airport Runway 26 and close to the Reporting Point (RP) ‘VANIN’ in Figure 1.10 below.

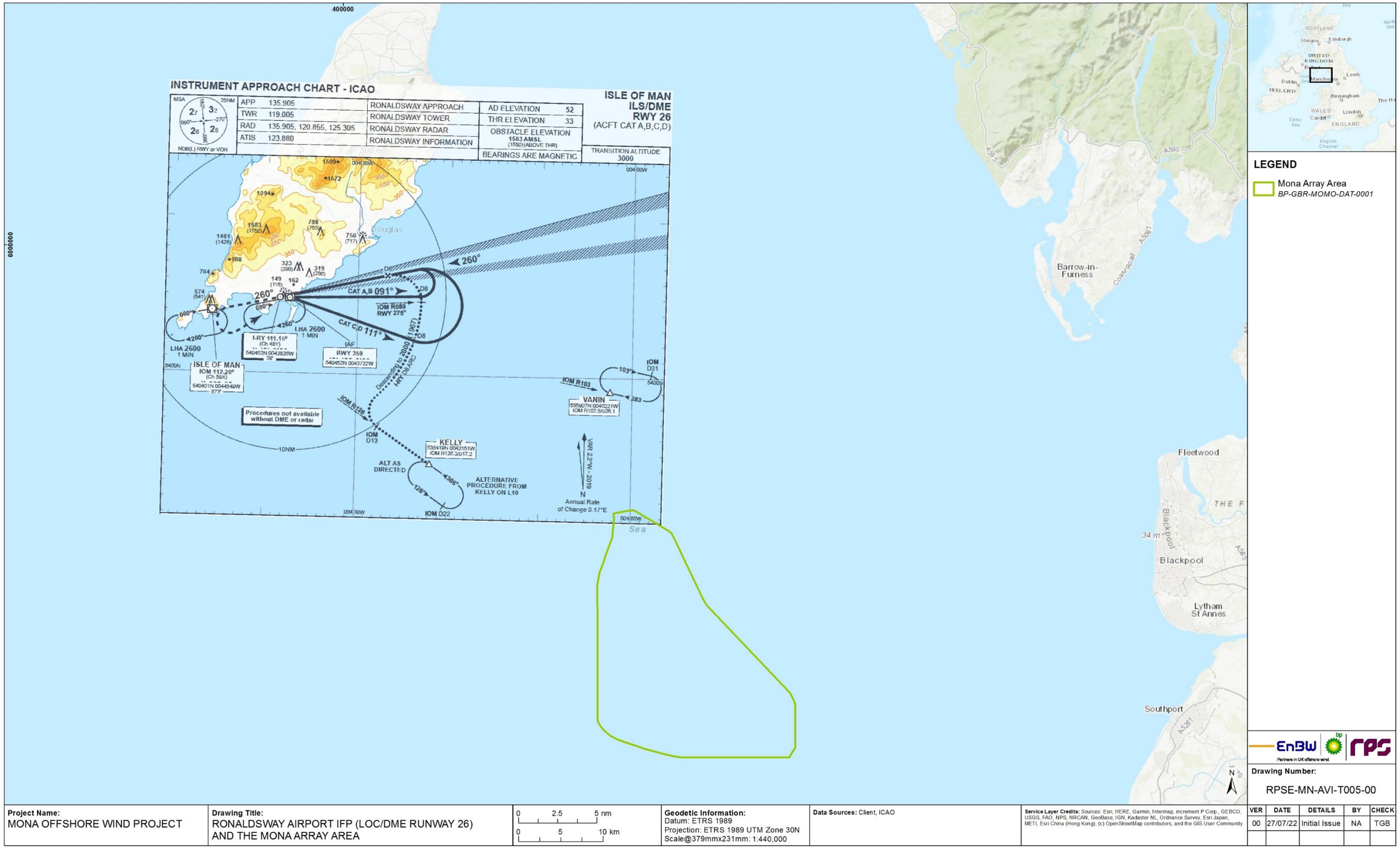


Figure 1.10: Ronaldsway (IoM) Airport IFP (LOC/DME Runway 26) and the approximate location of the Mona Array Area (green outline) (not to scale).

1.4.4 Ronaldsway (IoM) PSR

1.4.4.1 The Mona Array Area is located within the Airport's PSR coverage area which provides data for the control of aircraft operating in the airspace above the Mona Array Area.

1.4.4.2 Air Traffic Controllers are responsible for the control and separation of aircraft on departure and approach to the airport and other en-route air traffic. Controllers are required to maintain standard lateral separation of 5nm between aircraft under their control and unknown aircraft (or clutter that looks like a real aircraft or could be assumed to be masking returns from a real aircraft). Radar clutter created by the Mona Offshore Wind Project from detectable wind turbines could cause air traffic controllers to lose aircraft track identity and hence they would be unable to maintain the appropriate separation between aircraft manoeuvring under their control.

1.4.5 Surveillance Minimum Altitude Chart

1.4.5.1 The minimum altitude available to ATC for vectoring arriving flights within the Surveillance Minimum Altitude Chart (SMAC) is 300m (984ft) above the highest obstacle within the SMAC or SMAC sector.

1.4.5.2 Figure 1.11 provides an illustration of the Ronaldsway (IoM) Airport SMAC together with the approximate location of the Mona Array Area.

1.4.5.3 The minimum altitude available within the SMAC, or SMAC sector, is determined by reviewing obstacles within the boundary of the SMAC, or SMAC sector. It is possible for an aircraft to stray from the SMAC undetected by the pilot or the controller; consequently, obstacles outside the SMAC need to be considered when calculating minimum altitudes for use inside the SMAC. This area is referred to as a Primary SMAC Buffer (PSB) and attracts a full Minimum Obstacle Clearance (MOC) value of 300m (984ft) (CAP 777) (CAA, 2018). The width of the PSB is dependent on the surveillance radar lateral separation certified for use with the ATC SMAC. Once this review of obstacles has been completed, the addition of 300m (984ft) to the elevation of the highest obstacle within the resultant area will determine the minimum initial altitude available. The resultant figure is then rounded up to the nearest 'hundreds of feet'.

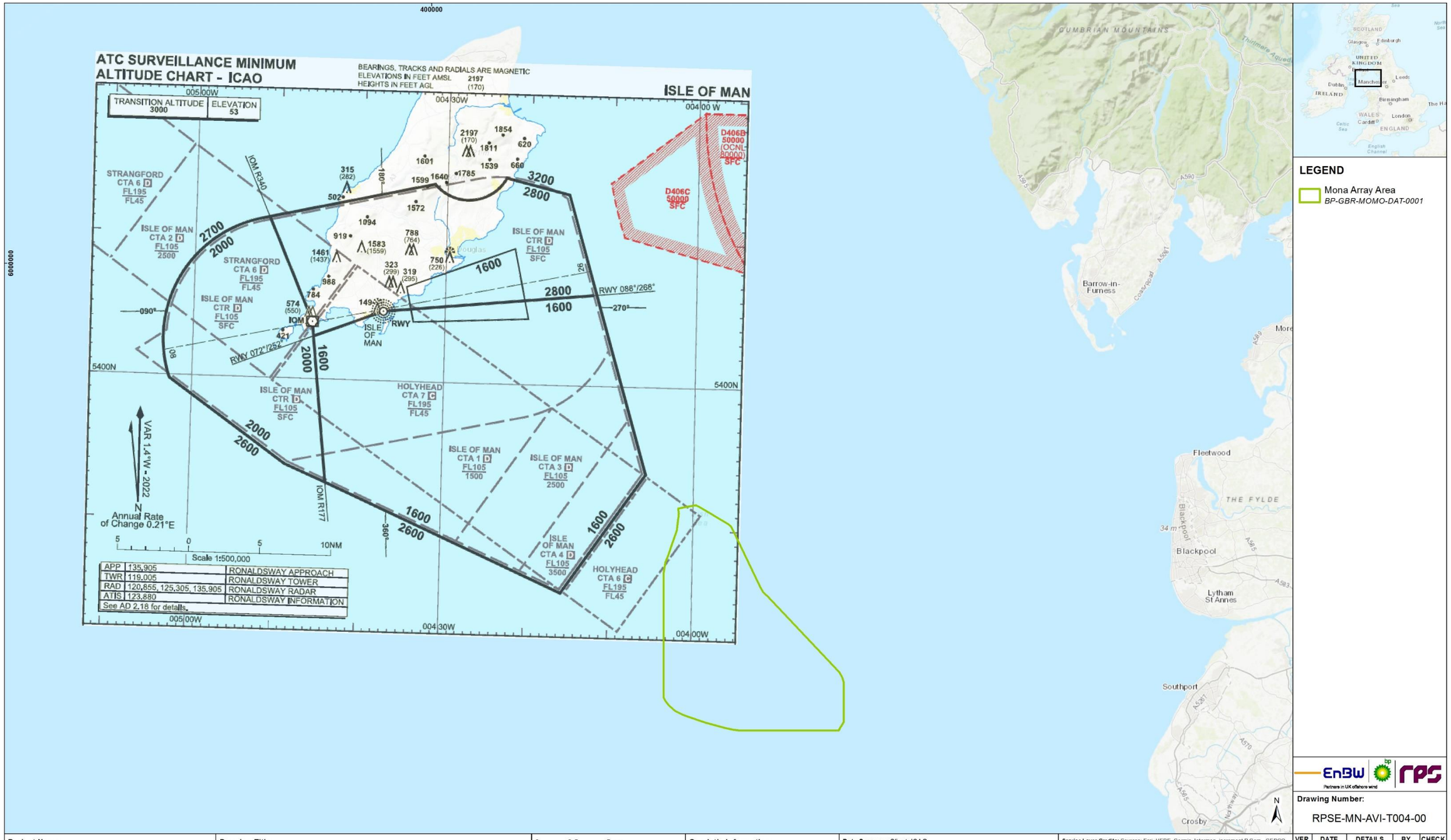


Figure 1.11: Ronaldsway (IoM) Airport SMAC and the approximate location of the Mona Array Area (green outline) (not to scale).

1.4.6 Ronaldsway (IoM) airport summary

1.4.6.1 At its closest point the Mona Array Area is located over 46km from the Airport ARP.

A number of the Airport's Instrument Approach Procedures are located close to the Mona Array Area; these routes are safeguarded with the establishment of containment areas that may be compromised by the construction and presence of the Mona Offshore Wind Project. Appendix 2 to this technical report, IFP Assessment (Osprey, 2022), assesses and provides conclusions on the impact the Mona Array Area will create to the Ronaldsway (IoM) OLS, IFP and SMAC at the assessed blade tip height of 324m above LAT.

1.4.6.2 Ronaldsway (IoM) Airport PSR system will theoretically detect wind turbines at a maximum blade tip height of 324m LAT (modelled at 320m AMSL and blade tips higher than this will be theoretically seen), as there is no blocking terrain between the PSR location and the Mona Array Area.

1.5 References

Civil Aviation Authority (CAA) (2022a) UK Integrated Aeronautical Information Package (IAIP).

CAA (2016) Civil Aviation Publication (CAP) 764, Policy and Guidelines on Wind Turbines.

CAA (2022b) CAP 393, The Air Navigation Order (ANO).

CAA (2020) CAP 738, Safeguarding of Aerodromes.

CAA (2018) CAP 777, ATC Surveillance Minimum Altitude Charts in UK Airspace Policy and Design Criteria.

Maritime and Coastguard Agency (MCA) (2021) Marine Guidance Note (MGN) 654.

Ministry of Defence (MOD) (2020) Lighting Review.

Operational Programme for the Exchange of Weather Radar Information (OPERA) (2009). Statement on the cohabitation between weather radars and wind turbines.

Anatec Limited (Anatec) (2022) Mona and Morgan Offshore Wind Farm Helicopter Access Report (HAR).

Osprey Consulting Services (Osprey) Morgan and Mona Windfarms - Instrument Flight Procedure (IFP) Impact Assessment.

Appendix A: Helicopter Access Report (HAR)

A.1 Executive summary

A.1.1 Regulations

1.5.1.1 Commercial Air Transport (CAT) Regulations have been applied to identify the current helicopter access available without any nearby wind farms. The access is then updated to take account of the Mona Offshore Wind Project. Finally, the cumulative effect of the Morgan Generation Assets and Morecambe Offshore Windfarm is included to assess the impact on helicopter access, in line with planning guidance. The report applies a worse case assumption that wind turbines are built up to the proposed boundaries.

A.1.2 Meteorological data

1.5.1.2 The meteorological data analysed was from the Met Office Integrated Data Archive System (MIDAS) (Met Office, 2019). It contains land surface observations data from the Met Office station network that have been designated as public sector information and provided under an Open Government Licence. One dataset within the database contained hourly aviation data from RAF Valley. RAF Valley is situated on the northwest part of Anglesey.

1.5.1.3 A series of filters were applied to the meteorological data to identify Day and Night Visual and Instrument Meteorological Conditions, also when flying could not take place. The output is shown in tables for each year. In addition, the wind direction for Instrument Meteorological Conditions were analysed and plotted.

A.1.3 Analysis and results

1.5.1.4 The impact of the Mona Offshore Wind Project on helicopter access to seven platforms, floating facilities and wellheads that are located within 9nm of the Mona Offshore Wind Project was assessed. The assessment indicated that there would be no impact on the following installations from the Mona Offshore Wind Project:

- Dalton R1 well
- Dalton R2 well
- OSI (Offshore Storage Installation)
- Douglas platform
- Calder platform (NUI)
- Hamilton North platform (NUI)

1.5.1.5 For the following installation the Mona Offshore Wind Project could restrict access under Instrument Meteorological Conditions:

- Conwy platform (NUI) - the Mona boundary is 1 nautical mile (nm) away. This could result in day access of an average of 97.1% being reduced to 89.5%, and night access of 93.4% could be reduced to 64.6% or less.

1.5.1.6 In the cumulative scenario where the Morgan Generation Assets and Morecambe Offshore Windfarms are also built, only impacted installations (in this instance the Conwy platform (NUI)) have the potential to result in a cumulative effect with another wind farm. However, since there is a 9nm clear approach from the NE into the prevailing south-westerly winds with more than 3nm available for a go-around or take-off, neither the Morgan Generation Assets nor the Morecambe Offshore Windfarm impact the Conwy platform (NUI) and no cumulative impact is identified.

A.1.4 Safety considerations

1.5.1.7 The SAR helicopters operated on behalf of the MCA are not constrained by CAT meteorological limits. The Mona Offshore Wind Project will have a layout which will need to be compliant with MGN 654, and so SAR access to installations adjacent to the Mona Offshore Wind Project will still be available. SAR helicopters will be tasked for major incidents, accidents and urgent medivacs, rather than CAT helicopters. Therefore, any reduction in CAT helicopter access will result in a logistic impact on the installation operator, rather than a safety impact.

A.2 Introduction

1.5.1.8 Anatec were commissioned by the Applicant to undertake a Helicopter Access Report (HAR) for the purpose of informing the Aviation and Radar assessment of the proposed Mona Offshore Wind Project. Furthermore, this report was produced as part of the Applicant's obligations under CAP 764 (CAA, 2016), where the operator of any offshore helicopter destination within 9nm of a wind farm must be consulted at the planning stage of a wind farm.

1.5.1.9 The methodology used to assess the operational impact has been accepted by helicopter operators and oil and gas operators on a number of previous offshore wind farm projects. Eleven years of meteorological data from RAF Valley, situated on the north west of Anglesey, was extracted from the Met Office Integrated Data Archive System (MIDAS). The data was recorded hourly, resulting in 96,391 data points.

A.2.1 Commercial Air Transport regulations

1.5.1.10 Commercial Air Transport (CAT) flights, such as crew change flights to gas platforms, are regulated under the following requirements.

A.2.1.1 Offshore Approvals

1.5.1.11 Offshore operations are regulated under Specific Approval for Helicopter Offshore Operations (SPA.HOFO) (CAA, 2018):

1.5.1.12 "Offshore operation" means a helicopter operation that has a substantial proportion of any flight conducted over open sea areas to or from an offshore location. An offshore operation includes, but is not limited to, a helicopter flight for the purpose of:

- Support of offshore oil, gas and mineral exploration, production, storage and transport
- Support of offshore wind turbines and other renewable-energy sources
- Support of ships including sea pilot transfer.

A.2.1.2 Meteorological limits

1.5.1.13 The limitations presented within this section, based on CAT Regulations, have been applied to the meteorological data to identify when wind farms will affect helicopter access to the infrastructure presented in en-route descent.

1.5.1.14 An en-route descent, where a helicopter may descend from Instrument Meteorological Conditions (IMC) into Visual Meteorological Conditions (VMC), and so make a visual approach to the platform, is permitted when:

- Day – cloud base ≥600 feet (ft) and visibility ≥4,000 metres (m)
- Night – cloud base ≥1,200ft and visibility ≥5,000m.

A.2.1.3 Instrument Meteorological Conditions

1.5.1.15 IMC conditions are assumed to exist when the weather limits are below those for flight under VMC. When the conditions are below those for an en-route descent, an Airborne Radar Approach (ARA) is mandatory.

A.2.1.4 Airborne Radar Approach

1.5.1.16 An ARA is flown to a platform when the weather conditions are below the VMC limits. The minima for an ARA are:

- A descent to a Minimum Descent Height (MDH) of 200ft by day or 300ft by night (or deck height plus 50ft if higher)
- A Missed Approach Point (MAP) no closer than 0.75nm (1,390m) from the installation; this distance is based on the limitations of the Radio Detection and Ranging (Radar) in mapping mode and how it is displayed to the crew.

1.5.1.17 As the helicopter has to be below cloud and in sight of the installation before proceeding visually beyond the MAP, in practical terms this results in the following minimum weather conditions:

- Day – cloud base ≥200ft and visibility ≥1390m
- Night – cloud base ≥300ft and visibility ≥1390m.

A.2.2 Helicopter approach profiles

1.5.1.18 The distance required for a safe helicopter approach to an installation depends on the profile flown, which in turn depends on the meteorological conditions. There are three basic profiles: firstly, the most commonly flown is the day visual approach; in degraded visual conditions, such as night, a stabilised approach is flown; finally, in conditions of low visibility or low cloud the ARA is flown.

A.2.2.1 Day visual approach

1.5.1.19 A day visual approach can be conducted when the cloud base is greater than 600ft and the visibility is greater than 4,000m. This type of approach is routinely flown by day inside and adjacent to wind farms. For example, routine flights are flown by day to a platform inside the Hornsea Two Wind Farm where the closest wind turbine blades are 910m away; another example is the Blythe Platform which has wind turbines in an arc 1,200m from the helideck.

A.2.2.2 Stabilised approaches

1.5.1.20 In VMC but where degraded visual conditions exist such as at night, the helicopter industry best practice is to fly a stabilised approach (HeliOffshore, 2020). Part of the stabilisation criteria is the requirement to maintain a constant heading into wind for 1nm of the final approach. To enable this, the distance between the wind turbines and the helideck must allow enough space to position to the 1nm final point. So, typically 2nm is required in total. If sufficient distance is not available, then access to the installation would not be possible at night when the wind direction requires an approach in a direction from the wind farm towards the helideck.

A.2.2.3 Airborne Radar Approach profile

1.5.1.21 The ARA profile is shown in Figure A1 and Figure A2. The helicopter's radar is used as the primary means of navigation and obstacle avoidance, supported by Global Positioning System (GPS).

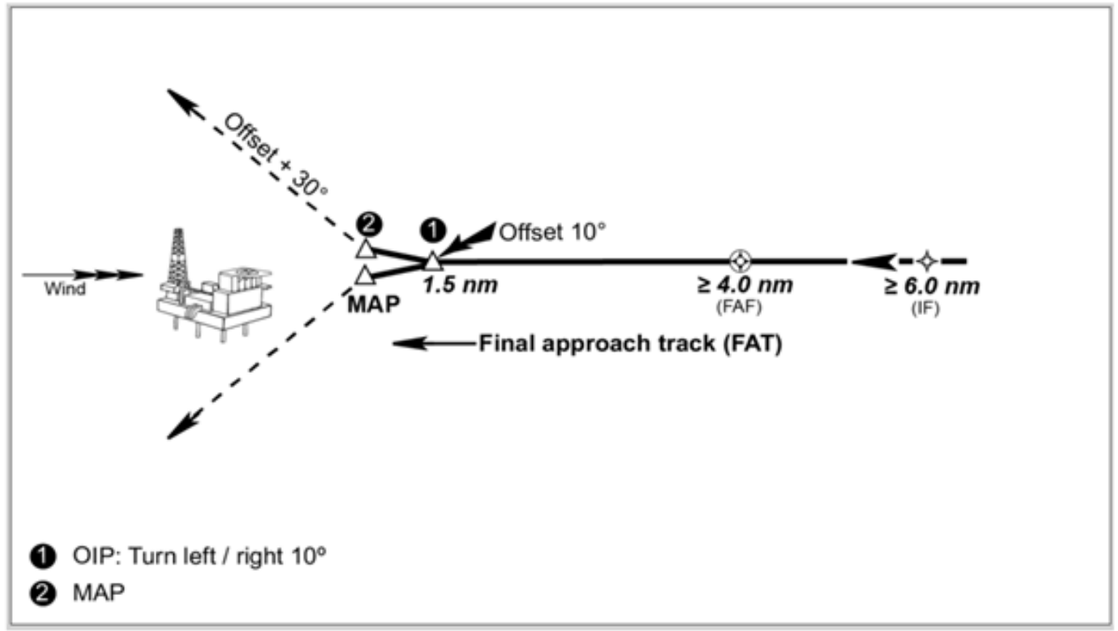


Figure A1: ARA Horizontal Profile.

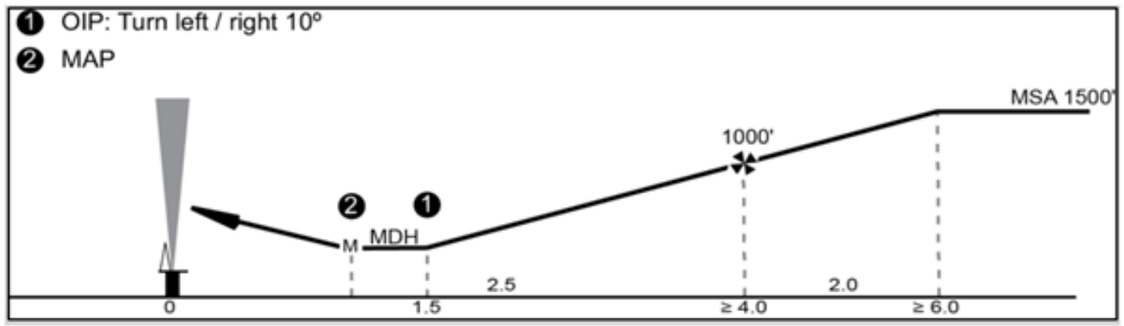


Figure A2: ARA Vertical Profile.

1.5.1.22 For the purposes of this assessment, it is assumed a 9nm approach arc clear of obstructions is required for an ARA. This distance will allow a helicopter to conduct a direct approach, descending from the Minimum Safe Altitude overhead the wind turbines to achieve the Initial Approach Fix (IAF) at 1,500 ft, or to conduct an arc approach maintaining a 1nm lateral separation distance from the wind turbines.

A.2.2.4 No-fly conditions

1.5.1.23 Any of the following conditions would result in flights being cancelled, or being unable to land at an offshore installation:

- Sea state (significant wave height) ≥6m
- Wind speed ≥60 knots (kt); this is a general limit, but it should be noted that some Normally Unmanned Installations (NUIs) have values as low as 30kt due to reduced deck friction
- Unable to land from an ARA – cloud base <200ft by day or <300ft at night or visibility <1,390m
- Forecast Triggered Lightning (Wilkinson et al., 2012)
- For a helicopter lacking an approval for flight in icing conditions, icing conditions occurring at 1,500ft when a VMC transit is not permitted is assessed.

1.5.1.24 It is noted that icing conditions are defined as an air temperature below 0 degrees Celsius (°C), with an inflight visibility less than 1,000m and visible moisture present. In practical terms this means that there is the potential for icing in cloud when the temperature is below 0°C. When a VMC transit is not permitted due to low cloud or poor visibility the conditions are IMC. In IMC over the sea, the aircraft has to avoid all obstacles by 1,000 ft vertically. A default value for obstacles over water is 500ft, and so the minimum transit height is 1,500ft above sea level. Using a lapse rate of 2°C per thousand feet, a surface temperature of 3°C or less indicates that any cloud at 1,500 ft or higher meets the definition of icing conditions.

1.5.1.25 The meteorological data used in this report did not include sea state or Triggered Lightning. Therefore, when the annual percentage of no-fly conditions was calculated, it is likely that this report will slightly underestimate the true value of no-fly conditions. Furthermore, high winds have not been included in the no-fly criteria as different operational limitations apply to various helidecks, ranging from 25kt to the standard 60kt. Reduced limitations are often temporary in nature, for example excessive guano causing the helideck to fail a friction test, resulting in a 30kt limitation. Furthermore, regulatory changes introduced under CAA Safety Directive SD-2022-001 (CAA, 2022) are likely to affect the frequency of access in future years as improved firefighting, helideck lighting and wind and motion limits will constrain access to any helideck which has not been upgraded. As it is not possible to predict which helidecks will be upgraded, current limitations for individual installations are identified in section A.1 but the generic limitations shown in Figure A2 and Figure A3 applied.

A.3 Methodology

1.5.1.26 This assessment has applied the CAT weather limits, as a series of filters, to the meteorological data provided in order to understand the potential operational impact on the gas infrastructure within 9nm of the wind farms.

1.5.1.27 Any planned obstructions within a radius of 9nm are taken into account in this assessment.

1.5.1.28 The assessment is focused on identifying any reduced access when operating under CAT Regulations, but access under SAR Regulations is also considered.

A.3.1 Assumptions

1.5.1.29 The following assumptions were used:

- As the exact locations and height of the wind turbines is not yet known, it is assumed that the boundary of the wind farm forms a solid wall of wind turbines and they are greater than 1,000ft high
- For an ARA, an approach arc clear of obstacles out to 9nm is required. This will allow a circling approach to a Final Approach Fix (FAF) at 6nm
- An approach up to 30° out of wind may be made providing the resulting angle of drift is no more than 10°.

A.3.2 Infrastructure assessed

1.5.1.30 The infrastructure assessed is shown in **Table A 1**. The Helideck Certification Agency website (helidecks.org) was consulted for information on the operating period and approvals of helidecks.

Table A 1: Details of assessed infrastructure.

Installation Name	Type	Operator	Status	Distance from Mona Array Area (nm)
Conwy Platform	NUI Day and Night	ENI	Active	1.0
Dalton Well R1	Wellhead	Chrysaor	Active	8.3
Dalton Well R2	Wellhead	Chrysaor	Active	8.0
OSI (Offshore Storage Installation.)	Floating Storage Day and Night	Eni	Active	5.8
Douglas	Complex Day and Night	Eni	Active	6.0
Calder	NUI Day Only	Spirit Energy	Active	7.0
Hamilton North	NUI Day Only	Eni	Active	8.0

A.3.3 Meteorological data provided

1.5.1.31 The meteorological data analysed was obtained from the MIDAS (Met Office, 2019). It contains land surface observations data from the Met Office station network that have been designated as public sector information and provided under an Open Government Licence. One dataset within the database contained hourly aviation data from RAF Valley. RAF Valley is situated on the northwest part of Anglesey. It is in the same air mass as the Morgan and Mona Array Areas and so will be representative of the conditions experienced in the wind farms. Hourly data from 1 January 2011 to 31 December 2021 was analysed; a total of 96,391 data points. There were 466 data points (0.5% of the total) where the wind value was missing.

1.5.1.32 The following parameters were used:

- Timestamp – year/month/day/hour/minute/second
- Visibility – recorded in decametres and converted to metres
- Cloud base – recorded in decametres and converted to feet
- Wind direction – degrees
- Wind speed – knots
- Air temperature – °C.

A.3.4 Meteorological analysis

1.5.1.33 The meteorological limits, defined in the Regulations were applied as a series of filters to the data. The filters identified when the conditions were:

- Day VMC
- Night VMC
- Day IMC
- Night IMC
- No-fly, when the conditions were below offshore limits and so an ARA could not be flown.

1.5.1.34 The data was then summarised in a series of tables and graphs to identify if and when CAT flights might have reduced access to the different offshore facilities.

A.4 Operational restrictions

1.5.1.35 This section will use the methodology described in section A.3 and apply it to the operational helicopter environment. Following this, section A.6 onwards will identify any restrictions on helicopter access specific to the facilities shown in Figure A1.

A.4.1 Approach limitations

1.5.1.36 Applying the meteorological limits described in section A.2.2.4 to the meteorological data provides the percentage of occasions when each approach type is permitted or required.

1.5.1.37 Figure A2 shows the percentage of day and night VMC access, i.e., when an en-route descent into visual conditions can be made, and a visual approach and take-off to/from a platform is available. This takes no account of any obstructions within 9nm.

Table A 2: Day and Night VMC Access.

Year	Day VMC (%)	Day IMC (%)	Night VMC (%)	Night IMC (%)
2011	91.2	8.8	60.7	39.3
2012	89.9	10.1	64.8	35.2
2013	90.5	9.5	71.0	29.0
2014	93.3	6.7	69.2	30.8
2015	90.0	10.0	63.3	36.7
2016	89.2	10.8	67.5	32.5
2017	85.7	14.3	57.8	42.2
2018	88.6	11.4	66.6	33.4
2019	89.4	10.6	66.2	33.8
2020	88.3	11.7	63.2	36.8
2021	88.3	11.7	60.1	39.9
Mean	**89.5**	**10.5**	**64.6**	**35.4**

1.5.1.38 Table A 2 does not consider when the conditions did not permit flying (i.e., the conditions identified in section A.2.2.4. An average of 2.8% of daylight conditions did not permit flying, so leaving 7.6% (10.5% - 2.8%) usable for IMC. For night conditions, 6.7% were unusable, leaving 28.8% (35.4% - 6.7%) usable. When considering the loss of access, the usable IMC figures should be applied and not all IMC periods. This information is presented in Table A.3. The no flying conditions identified are conservative, as no account could be taken of high sea states or Triggered Lightning which would further reduce the number of flyable hours.

Table A 3: Usable IMC access.

Year	Usable IMC Day (%)	Day IMC (%)	Day No Fly (%)	Usable IMC Night (%)	Night IMC (%)	Night No Fly (%)
2011	**5.3**	8.8	2.5	**31.6**	39.3	7.7
2012	**7.1**	10.1	3.0	**30.7**	35.2	4.5
2013	**6.7**	9.5	2.8	**22.6**	29.0	6.4
2014	**5.5**	6.7	1.2	**26.7**	30.8	4.1
2015	**7.2**	10.0	2.8	**29.5**	36.7	7.2
2016	**6.9**	10.8	3.9	**26.8**	32.5	5.7
2017	**10.1**	14.3	4.2	**32.9**	42.2	9.3
2018	**8.4**	11.4	3.0	**26.9**	33.4	6.5
2019	**8.8**	10.6	1.8	**28.2**	33.8	5.6
2020	**8.7**	11.7	3.0	**30.0**	36.8	6.8
2021	**8.8**	11.7	2.9	**30.3**	39.9	9.6
Mean	**7.6**	**10.5**	**2.8**	**28.8**	**35.4**	**6.7**

A.4.2 Wind data

1.5.1.39 The wind sectors for an approach and take-off, under Day IMC, are shown in Figure A3. This shows that the predominant wind direction for Day IMC conditions is from the southwest. The no-fly conditions calculated are likely to be an underestimate, as the meteorological data set did not contain information on sea state or Triggered Lightning.

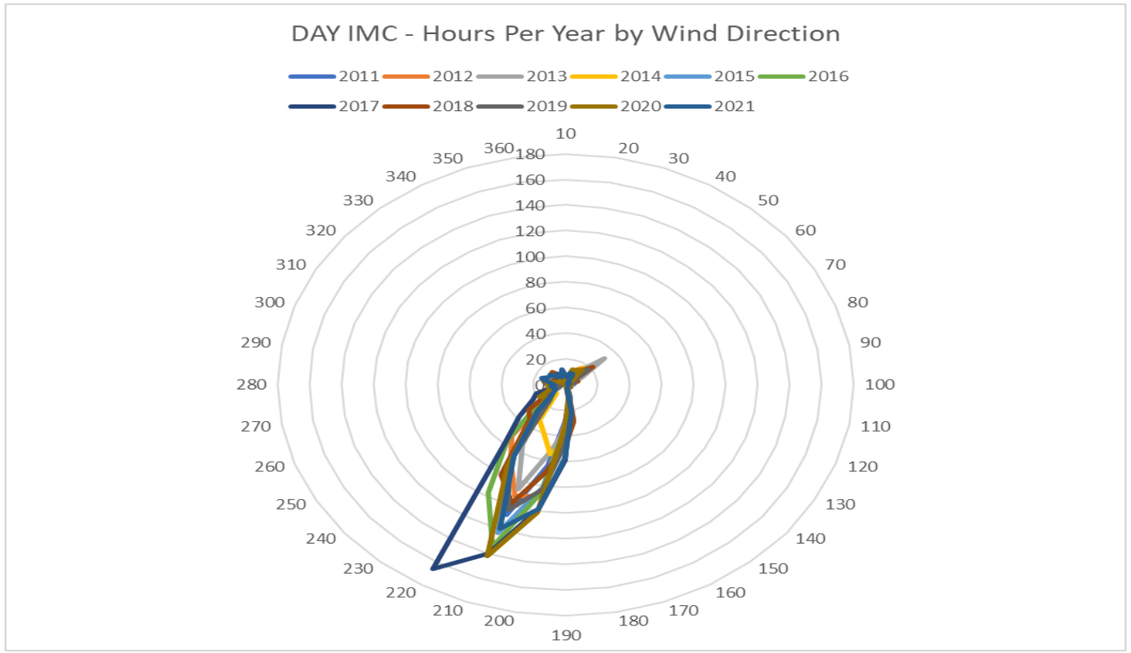


Figure A3: DAY IMC Condition Wind Direction Hours Per Year.

1.5.1.40 Although the majority of flying will be conducted under daylight conditions, a number of the platforms are approved for night operations. Figure A4 shows the day and night IMC hours from 2011-2021, and the wind directions which generated IMC.

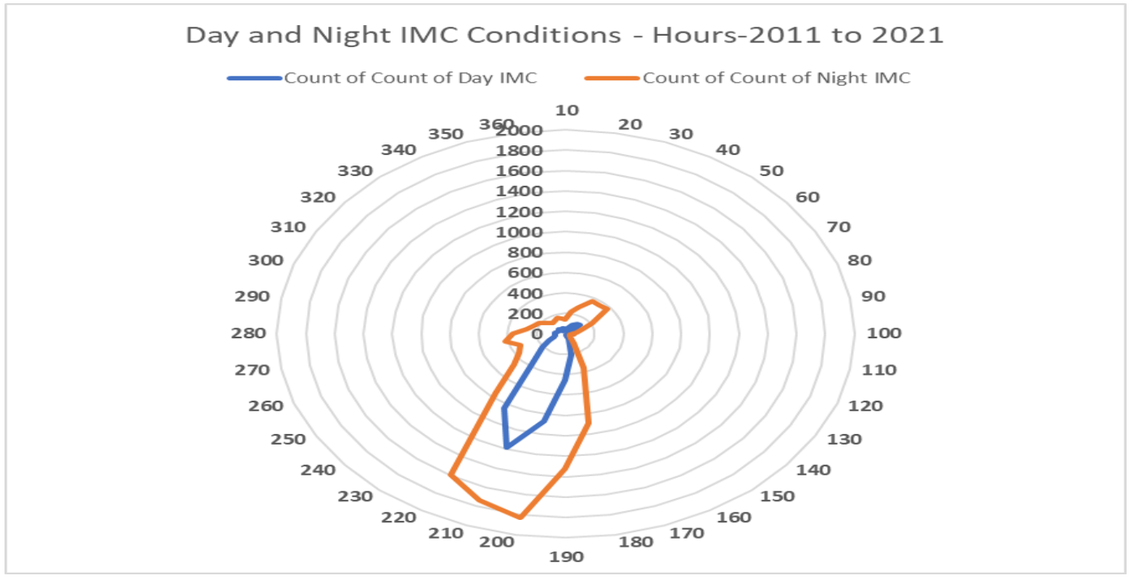


Figure A4: Day and Night IMC Hours – 2011 to 2021.

A.5 Emergency conditions

1.5.1.41 The methodology used so far in this report addresses helicopter access under CAT Regulations. Emergency down manning of any installation, critical Medivacs and SAR are not constrained by CAT Regulations as these flights are generally flown by the Coastguard SAR aircraft operating under CAP 999 (CAA, 2014). The Coastguard helicopters are operated as State Aircraft under National Regulations and are not constrained by the higher weather limits in CAT Regulations. Also, commercial SAR can be flown with some alleviations from CAT Regulations. Such SAR arrangements have existed in the United Kingdom, Norway and the Netherlands for decades and include SAR coverage provided by the Integrated Search and Rescue (ISAR) Consortium in Aberdeen (formerly Jigsaw Aviation), SAR helicopters based in the Ekofisk Field, and SAR helicopters under contract to Nederlands Olie en Gas Exploratie en Productie Associatie (NOGEPA), the Dutch equivalent of Oil & Gas UK.

1.5.1.42 CAP 999 defines the SAR operating minima as:

Operating minima for the dispatch and continuation of a SAR operational flight are at the discretion of the aircraft commander. However, he is to consider the urgency of the task, crew and aircraft capability and the requirement to recover the aircraft safely.

1.5.1.43 Due to the SAR autopilot modes and enhanced sensors fitted to the Coastguard SAR helicopters, a shorter distance is required to enter the field and manoeuvre to land on platforms, even in poor weather. The Mona Offshore Wind Project will be designed in accordance with MGN 654 (MCA, 2021), which permits helicopter SAR operations within a wind turbine array, and so SAR access will also be available to platforms adjacent to the Mona Offshore Wind Project.

1.5.1.44 Furthermore, in the event of an emergency on the platform resulting in an explosion, fire or release of hydrocarbons, helicopters will be unable to land and so other means of escape, such as Totally Enclosed Motor Propelled Survival Craft (TEMPSC) and/or Seascape systems will be required. Although helicopters are usually the preferred means of down manning an installation, they cannot be the primary means of down manning in all cases.

1.5.1.45 Icing conditions will not affect the Coastguard SAR helicopters are they are certified and equipped for flight in icing conditions.

1.5.1.46 In summary, although a reduction in helicopter access under CAT Regulations will impose a logistic restriction on an offshore installation, it will not result in a reduced level of safety, as SAR helicopters will still be able to access an installation.

A.6 Infrastructure specific access

1.5.1.47 This section will now identify how helicopter operations may be constrained by current and future windfarms. It will be done in two parts: firstly, identifying current access and then taking account of any restrictions due to the Mona Offshore Wind Project. Section A.7 will identify any cumulative impact from the Morgan Generation Assets and Morecambe Offshore Windfarm currently in the planning phase.

1.5.1.48 Platforms within 9nm of the Mona Offshore Wind Project were considered, as presented in Figure A.5.

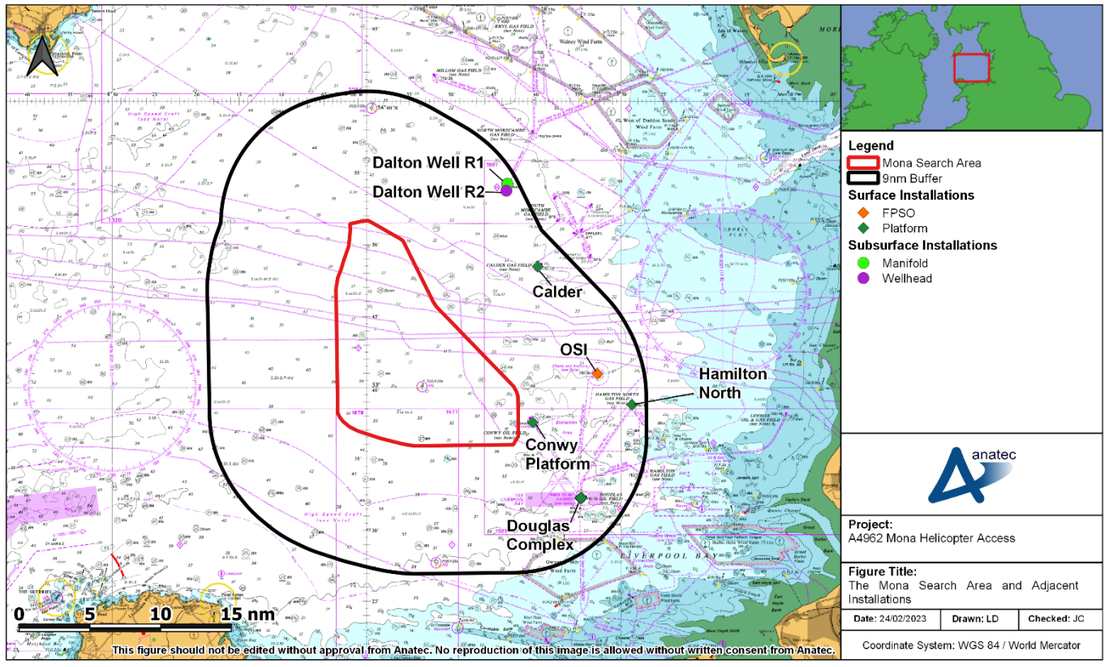


Figure A 5: The Mona Search Area and Adjacent Installations

1.5.1.49 The Helideck Certification Agency website was used to obtain current information on the certification standards of each helideck.

A.6.1 Conwy platform

HELIDECK Elev **116 ft**	VAR **2** **W**	POSITION **N53 37.55 W003.40.36**	EGJY **Conwy**		
HEIGHT OF INSTALLATION: **132ft** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **122.380**	NDB **No**	Issue Dat **Apr 20**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **ENI**		Issued I **Helide** **Certifica** **Agenc**
HELIDECK D value: 17m P/R/H Category: F Max Weight: 6.8t Circle & H Lights: Fitted					

5:1	NE, SW & NW access platforms

Figure A 6: Details of Conwy Platform.

1.5.1.50 The Conwy platform is a NUI approved for day and night operations. It is located 1nm east of the southeast corner of the Mona Array Area .

A.6.1.1 Current access

1.5.1.51 Currently there are no restrictions on access. Current access is 97.1% of daylight condition (Day VMC 89.5% (Figure A2) plus 7.6% usable IMC (Figure A3)) and 93.4% of night conditions (Night VMC 64.6% (Figure A2) and Usable Night IMC 28.8% (Figure A3)).

A.6.1.2 Future access

1.5.1.52 For an ARA to be flown, a sufficient approach distance free from obstacles must be provided, typically 9nm. In addition, sufficient distance must be available for a take-off, or go-around, taking account of the reduced helicopter performance following an engine failure. In addition to the take-off distance required following an engine failure, an additional 1nm buffer must be applied. For the Conwy platform IMC conditions usually apply with a wind from the southwest, see Figure A3.

1.5.1.53 If the Mona Offshore Wind Project is built up to the boundary of the Mona Array Area, then sufficient distance is still available for an ARA as the approach arc to the north east is clear of obstructions. The go-around, or take-off in IMC will predominately be towards the southwest, where the boundary of the Mona Array Area is 1nm away. 1nm is insufficient for an IMC take-off and a take-off out of the ambient wind direction is not recommended for helicopter handling and performance reasons. Therefore, if wind turbines are built up to the current boundary, access will be limited to day VMC and possibly some limited night VMC conditions, when a stabilised approach does not encroach on the Mona Offshore Wind Project. This will give access of an average of 89.5% of daylight conditions, with Night VMC access to be discussed with the helicopter operators.

1.5.1.54 If wind turbines are not located on the edge of the Mona Array Area to the southwest of Conwy, then a sufficient distance could be available for a take-off into IMC, thereby permitting an ARA to be flown. That would also improve night VMC access. The data indicates that IMC usually occurs with a wind direction between 200° and 220°.

A.6.1.3 Summary

1.5.1.55 At present day and night operations to Conwy are not restricted. If the Mona Offshore Wind Project is built up to the boundary of the Mona Array Area shown in Figure A 5, only Day VMC and some limited Night VMC operations will be possible. To restore the current access, the southwest tip of the Mona Array Area will need to be modified to provide sufficient distance for a take-off into IMC, taking account of reduced helicopter performance following an engine failure on take-off and the requirement for an additional 1nm safety buffer free from obstruction.

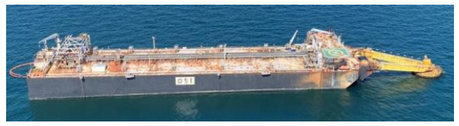
A.6.2 Dalton well R1 and R2

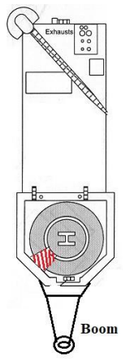
1.5.1.56 The R1 wellhead is located 8.3nm from the Mona Array Area. The R2 is located 8.0nm from the Mona Array Area. A drilling rig or diving support vessel may require to work over these wellheads.

1.5.1.57 The predominant wind direction for IMC conditions is from the southwest, see Figure A3. The location of these wellheads allows a clear 9nm ARA approach in IMC. The Mona Array Area is situated 8nm southwest of the wellheads, so allowing for the 1nm safety buffer, 7nm is available for a take-off into IMC or go-around. There will be no loss of access by day or night.

A.6.2 Offshore Storage Installation (OSI)

HELIDECK Elev **87 ft**	VAR **2 W**	POSITION **N53 41.0 W003 32.7**	EGOI **OSI**		
HEIGHT OF INSTALLATION: **129** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **Tfc/Log:122.380**	NDB **391** **DBG**	Issue Date **12 Sep 2022**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **ENI Liverpool Bay**		Issued By **Helideck Certification Agency**
HELIDECK D value: **13.68m** P/R/H Category: **1** Max Weight: **4.3t** Circle & H Lights: **Yes**					





Wind (T°)	Kts	Limitation /Comment
225-245 rel to ships head		1. Tanker (FSU) Category 1 2. PLHS in place for AW169 operations due to radar tower obstruction in LOS 3. Table 1 to be used if overflight of 5:1 items unavoidable 4. Approved for AW169 operations 5. CAA Dispensation for SD2020/003 (HMS Rev.9B).

Figure A 7: Details of the Offshore Storage Installation (OSI).

1.5.1.58 The OSI is a vessel approved for day and night operations. It is located 5.8nm to the northeast of the Mona Array Area.

A.6.2.1 Current access

1.5.1.59 Currently there are no restriction on access. Current access is 97.1% of daylight condition (Day VMC 89.5% (Figure A2) plus 7.6% usable IMC (Figure A3)) and 93.4% of night conditions (Night VMC 64.6% (Figure A2) and Usable Night IMC 28.8% (Figure A3).

A.6.2.2 Future access

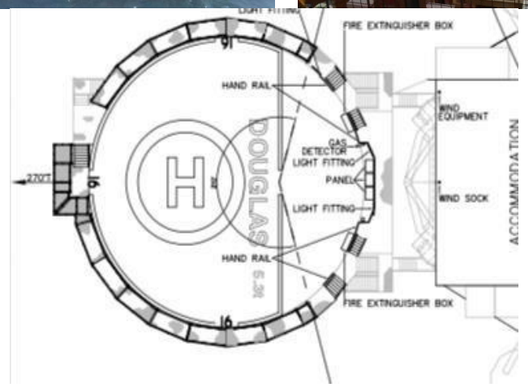
1.5.1.60 Due to the location of the platform and IMC conditions prevailing with a southwesterly wind, sufficient distance is available for an ARA. Even with a westerly wind, taking account of the 1nm safety buffer and reduced performance following an engine failure, 5.8nm is a sufficient distance for a take-off into IMC or go-around.

A.6.2.3 Summary

1.5.1.61 Due to its location, and the fact that IMC conditions predominately exists with a south westerly wind, the Mona Offshore Wind Project will not affect access to the OSI.

A.6.3 Douglas platform

HELIDECK Elev **146 ft**	VAR **Check**	POSITION **N53 32.2 W003 34.8**	EGJM **Douglas**		
HEIGHT OF INSTALLATION: **255ft** HIGHEST OBSTACLE WITHIN 5NM: **490ft**			VHF **122.380**	NDB **N/A**	Issue Date **10/6/22**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **Yes**			Operating Company **ENI**		Issued By **Helideck Certification Agency**
HELIDECK D value: **16.01** P/R/H Category: **F** Max Weight: **5.3** Circle & H Lights: **Yes**					



Wind (T°)	Kts	Limitation /Comment
• 050-120	All	6. Manned platform 7. Caution possible turbulence - turbulence reports requested 8. Table 1(T) if overflight of west access is unavoidable 9. Approved for AW139 (6.8t).

Figure A 8: Details of the Douglas platform.

1.5.1.62 The Douglas platform is manned complex approved for day and night operations. It is located 6.0 nm southeast of the Mona Array Area.

A.6.3.1 Current access

1.5.1.63 Currently there are no restriction on access. Current access is 97.1% of daylight condition (Day VMC 89.5% (Figure A2) plus 7.6% usable IMC (Figure A3) and 93.4% of night conditions (Night VMC 64.6% (Figure A2) and Usable Night IMC 28.8% (Figure A3).

A.6.3.2 Future access

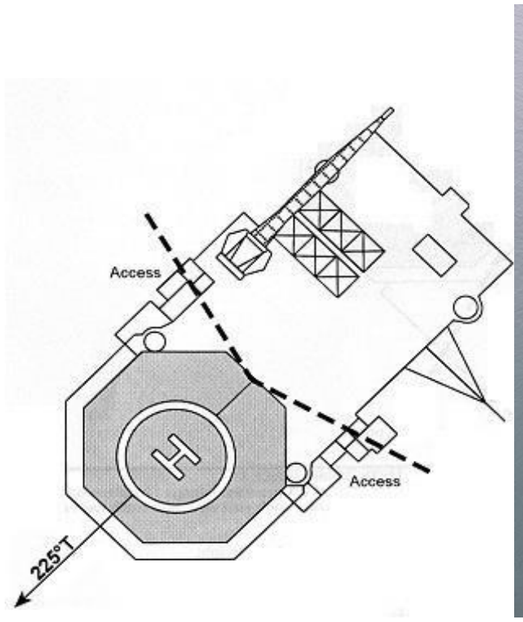
1.5.1.64 Due to its location, an unobstructed approach is available for an ARA, go-around and take-off into IMC conditions. There will be no reduction in access to the Douglas platform.

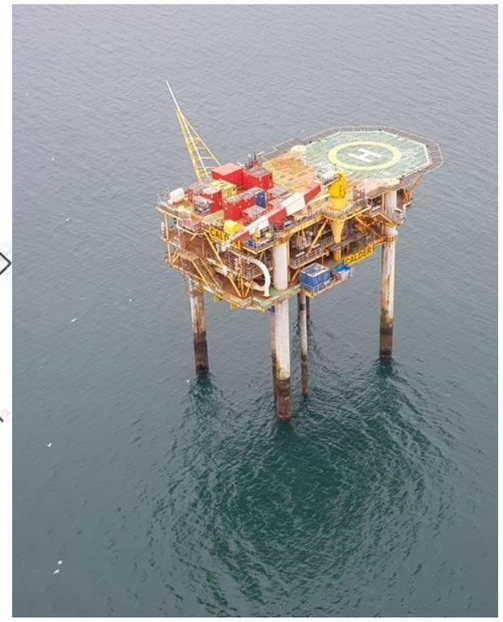
A.6.3.3 Summary

1.5.1.65 Due to its location, and the fact that IMC conditions predominately exists with a south westerly wind, the Mona Offshore Wind Project will not affect access to the Douglas platform.

A.6.4 Calder platform

HELIDECK Elev **105 ft**	VAR **2** **W**	POSITION **N53 48.5 W003 39.8**	EGCE **Calder**		
HEIGHT OF INSTALLATION: **133ft** HIGHEST OBSTACLE WITHIN 5NM: **Check**			VHF **122.380**	NDB **Nil**	Issue Date **11/2/22**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **Sprit Energy**		Issued By **Helideck Certification Agency**
HELIDECK D value: **16.66** P/R/H Category: F Max Weight: **7.0** Circle & H Lights: No					





Wind (T°)	Kts	Limitation /Comment
		10. NUI 11. Daylight operations only - Windsock not illuminated and Circle & "H" lighting unserviceable 12. Table 1(T) if overflight of 5:1 items unavoidable.

Figure A 9: Details of Calder platform.

1.5.1.66 The Calder platform is a NUI approved for day only operations. It is located 7.0nm northeast of the Mona Array Area.

A.6.4.1 Current access

1.5.1.67 At present there is the option of using an ARA to approach and land on the Calder platform under daylight conditions only. For the period 2011 to 2021, access is available for 97.1% of daylight condition (Day VMC 89.5% (Figure A2) plus 7.6% usable IMC (Figure A3)).

A.6.4.2 Future access

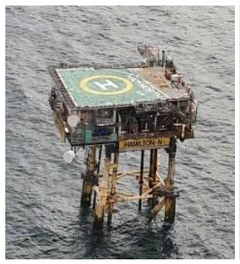
1.5.1.68 Due to the location of the Calder platform, an ARA can be flown and a sufficient distance is available for a go-around or take-off into IMC. Therefore, the daytime access will remain unaffected.

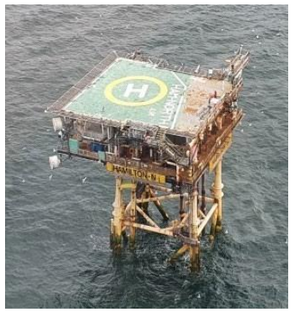
A.6.4.3 Summary

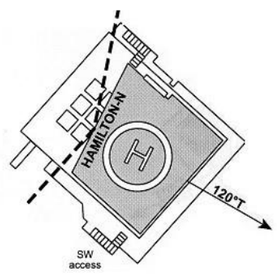
1.5.1.69 Due to the location of the Calder platform in relation to the Mona Offshore Wind Project, daytime access will remain unaffected.

A.6.5 Hamilton North platform

HELIDECK Elev **112 ft**	VAR **2 W**	POSITION **N53 38.77** **W003 28.67**	**EGGZ Hamilton North**		
HEIGHT OF INSTALLATION: **116** HIGHEST OBSTACLE WITHIN 5NM: **OSI 121**			VHF **122.380**	NDB -	Issue Date **12 Sep 2022**
FUELLING INSTALLATION: **No** STARTING EQUIPMENT: **No**			Operating Company **ENI Liverpool Bay**		Issued By **Helideck Certification Agency**
HELIDECK D value: **14.65m** P/R/H Category: **F** Max Weight: **4.9t** Circle & H Lights: **Not Fitted**					





Wind (T°)	Kts	Limitation /Comment
		13. NUI - No automatic fire-fighting facilities 14. Daylight operations only – TDPM+H lights not fitted 15. Table 1 (T) if overflight of 5:1 items unavoidable 16. Approved Friction Surface - No net 17. Deck closed when Jack-up alongside 18. Name abbreviated on deck to HAM-NORTH.

Figure A 10: Details of the Hamilton North platform.

1.5.1.70 The Hamilton North platform is a NUI approved for daylight operations only. It is located 8.0nm east of the Mona Array Area.

A.6.5.1 Current access

1.5.1.71 At present there is the option of using an ARA to approach and land on the Hamilton North Platform under daylight conditions only. For the period 2011 to 2021, access is available for 97.1% of daylight condition (Day VMC 89.5% (Figure A2) plus 7.6% usable IMC (Figure A3)).

A.6.5.2 Future access

1.5.1.72 Due to its location, an unobstructed approach is available for an ARA, go-around and take-off into IMC conditions. There will be no reduction in access to the Hamilton North platform.

A.6.5.3 Summary

1.5.1.73 Due to its location, and the fact that IMC conditions predominately exists with a south westerly wind, the Mona Offshore Wind Project will not affect access to the Hamilton North Platform.

A.7 Cumulative Assessment

1.5.1.74 In addition to the Mona Offshore Wind Project, there is a proposal to develop the Morgan Generation Assets and Morecambe Offshore Windfarms. This section will identify the cumulative effect of the three proposed wind farms. Figure A 11 shows the Morgan Generation Assets and Morecambe Offshore Windfarm in relation to the Mona Offshore Wind Project.

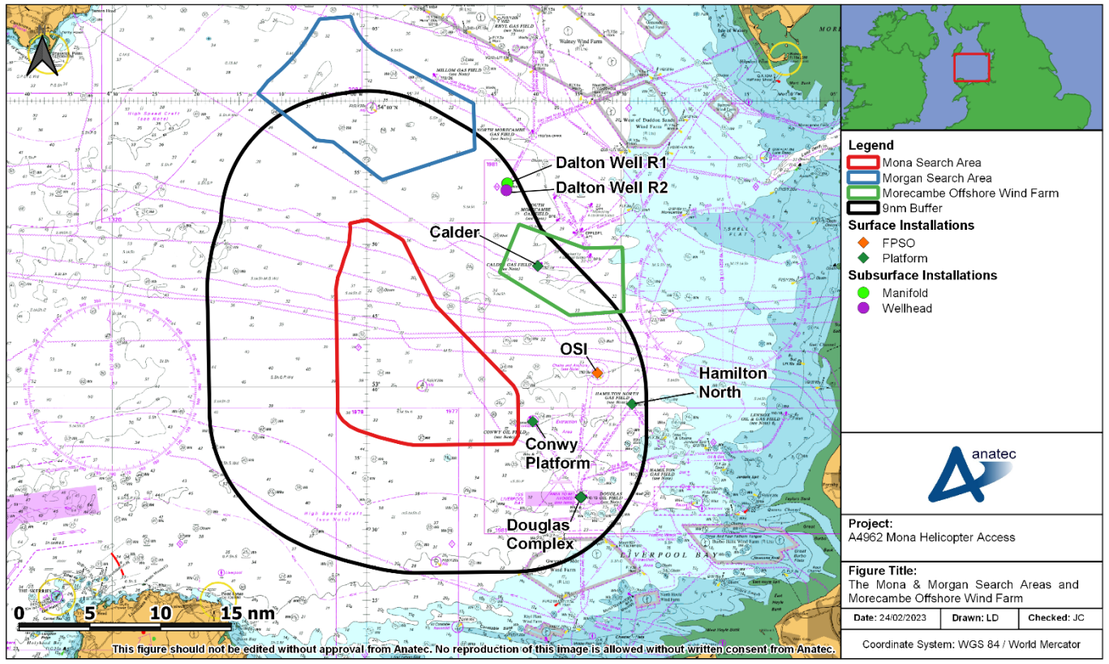


Figure A 11: The Mona and Morgan Search Areas and Morecambe Offshore Windfarm.

1.5.1.75 The cumulative assessment considers whether installations already impacted by the Mona Offshore Wind Project will have additional impact from the Morgan Generation Assets or Morecambe Offshore Windfarm.

1.5.1.76 As demonstrated in Section A.6, only the Conwy platform is affected by the Mona Offshore Wind Project. Figure A3 and Figure A4 show that IMC conditions are most prevalent with a south-westerly wind direction. Since there is a 9nm clear approach from the NE into the prevailing south-westerly winds with more than 3nm available for a go-around or take-off (see Figure A.11), the Conwy platform (NUI) will not have access altered by the presence of the Morgan Generation Assets or Morecambe Offshore Windfarm.

1.5.1.77 Therefore no cumulative impact is identified.

A.7.1 Helicopter Icing Considerations

1.5.1.78 If the Morgan Generation Assets and/or Morecambe Offshore Windfarm was built, it is highly unlikely that it will increase the transit time to any of the installations due to icing, or other factors.

A.7.2 References

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Appendix B: Instrument Flight Procedure (IFP) Assessment

Morgan and Mona Windfarms – Impact Assessment

Impact Assessment for Obstacle Limitation Surfaces (OLS) and Instrument Flight Procedures (IFPs)

Date: 23/01/2023
Author: Kyra Thompson and Daniel Figueras under the Supervision of Liam Clarke
Revision: V1
Osprey Ref: 71794-001

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Registered in England and Wales under No: 06034579

Document Details

Reference	Description
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	Impact Assessment for Obstacle Limitation Surfaces (OLS) and Instrument Flight Procedures (IFPs)
Document Ref	71794-001
Issue	V1
Date	23/01/2023
Client Name	RPS Energy
Classification	Commercial in Confidence

Issue	Amendment	Date
Draft	Client Review	06/12/2022
V1	Initial Release	23/01/2023

Approval Level	Authority	Name
APD	Osprey CSL	Kyra Thompson and Daniel Figueras under the supervision of Liam Clarke
IAPD	Osprey CSL	Sam Shuttlewood
Design Authority	Osprey CSL	Mark Wakeman

Executive Summary

Osprey CSL has been commissioned by RPS Energy to assess the potential impact of Mona and Morgan Windfarms in the vicinity of Manchester, Liverpool John Lennon, Isle of Man Ronaldsway, Warton, Blackpool and RAF Valley Airports, with turbine tip heights of 324m Above Mean Sea Level (AMSL)*.

This report includes an assessment of the potential impact the Windfarms may have in relation to the Obstacle Limitation Surfaces (OLS) and the Instrument Flight Procedures (IFPs) serving each of the airports.

*This has been used for Lowest Astronomical Tide (LAT) as per Section 1.3.

OLS

None of the Windfarms affects the OLS of the airports analysed in this report.

IFPs

For a summary of Impact to IFPs see below table:

NOTE: A full IFP review will need to be conducted by the Approved Procedure Design Organisation (APDO) for each Airport at the relevant stage in the planning process. Any actions suggested in this report will need to be agreed and developed with the individual Airport Safeguarding Teams through their appointed APDO. Any mitigation or redesign must be actioned by the Procedure Sponsor (Airport). This Impact Assessment highlights those procedures that may be impacted but is not a formal IFP Safeguarding Review as defined by UK CAA CAP 738 or an APDO Review as defined by CAP785. Such formal reviews will be required through separate commercial agreement between the developer and the individual Airports.

Windfarm / Airport	Mona Windfarm	Morgan Windfarm
Manchester	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Liverpool	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Warton	No Impact on IFPs. **Impact on WTN TAC MSA 25NM SW Sector.** MOCA needs increasing from 1800ft to 2100ft. Although there is no impact to the WTN NDB MSA, it is likely this would be raised to remain consistent with the WTN TAC MSA. **See Section 4.2.20** Other IFPs unaffected.	No Impact on IFPs. No Impact on IFPs.
Isle of Man	No Impact on OLS. **Impact on ATCSMAC 1600ft SMAA.** MOCA needs increasing from 1600ft to 2100ft. See Section 5.2.1 No Impact on IFPs.	No Impact on OLS. **Impact on ATCSMAC 1600ft SMAA.** MOCA needs increasing from 1600ft to 2100ft. See Section 5.2.1 **Impact on IFP NDB(L)/DME RWY26 for DME I-RY Inoperative (CAT C, D).** Base turn MOCA needs increasing from 2000ft to 2100ft (which has knock-on effects on procedure). NO DME OCA needs increasing from 810ft to 1100ft. **See Section 5.2.11.** Other IFPs unaffected.
Valley	No Impact on OLS. **Impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs	No Impact on OLS. **Impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs

	increasing to 2100ft QFE 2200ft QNH. See Section 6.2.1 **Impact on MSA VYL 25NM NW Sector.** MOCA needs increasing from 1900ft to 2100ft. See Section 6.2.22 Other IFPs unaffected.	increasing to 2100ft QFE 2200ft QNH. See Section 6.2.1 Other IFPs unaffected.
Blackpool	No Impact on OLS. **Impact on MSA 25NM NDB(L) BPL SW Sector.** MOCA needs increasing from 2000ft to 2100ft. **See Section 7.2.10.** Other IFPs unaffected.	No Impact on OLS. No Impact on IFPs.
Barrow/Walney Island	**It should be noted that although a thorough assessment of Barrow/Walney Island Airport has not been included in this Safeguarding report, an informal check has highlighted that the MSA would be impacted by both Mona and Morgan Windfarms which could, in turn, affect the IFPs associated with the Airport.**	

Table 1 - Conclusions Summary

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1 Introduction

1.1 Overview

Osprey CSL has been commissioned by RPS Energy to assess the potential impact of Mona and Morgan Windfarms, in relation to the airports at: Manchester, Liverpool John Lennon, Isle of Man Ronaldsway, BAE Warton, Blackpool and RAF Valley, with turbine tip heights of 324m Above Mean Sea Level (AMSL)*.
This report includes assessment of the potential impact the windfarms may have in relation to the Obstacle Limitation Surfaces (OLS) and the Instrument Flight Procedures (IFPs) at each airport.

1.2 Scope

This report assesses the windfarms in relation to the OLS and IFPs at each airport and has been completed with the use of the latest published procedures in the State Aeronautical Information Publication (AIP), effective date 06 OCT 22 and the UK Miliary AIP, AIRAC Cycle 2211, effective date 03 NOV to 01 DEC 22.

The survey data used is the SLC Aerodrome Survey Report dated Sep 2021 for Manchester Airport, Paul Fassam Geomatics Survey Report dated Sep 2021 for Liverpool Airport, Pell Frischmann Survey Report dated Sep 2021 for RAF Valley and Pell Frischmann Survey Report dated Aug 2021 for BAE Warton.
Autodesk AutoCAD, ASD PD Toolkit and ICAO Software was used to compile drawings and evaluate the impact.

1.3 Data Provided by Client

The client provided shapefiles for each of the proposed windfarms which were converted to Lat/Long files in UTM84-30N using Global Mapper software to provide a compatible format which could be uploaded into AutoCAD.

The client provided estimated maximum turbine tip elevations of 324m above Lowest Astronomical Tide (LAT) for both developments. This was confirmed via email on 24the OCT 2022.

We have considered LAT as AMSL for assessment purposes in this report.

UK Airports use AMSL as the reference datum for OLS and IFP surfaces, so this report considers the elevation of the windfarms at AMSL (which is more restrictive than using the height of the windfarms at LAT) and therefore offers more protection.

Figure 1 – Development Boundaries

All Figures shown in this report that contain an Aerial Map Background, are from Autodesk AutoCAD 2019 embedded Online Maps Data.
© 2022 Microsoft Corporation
© 2022 Maxar
© CNES (2022) Distribution Airbus DS
© 2022 Earthstar Geographics SIO

1.4 Obstacle and Orientation

The site location was added to the AutoCAD Model with distance to the airports shown below:

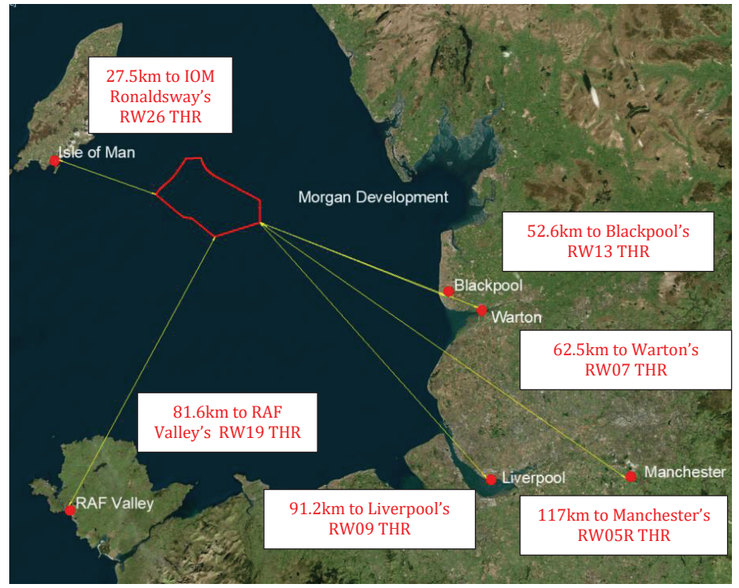

Figure 2 - Location of Morgan Development in Relation to Airports

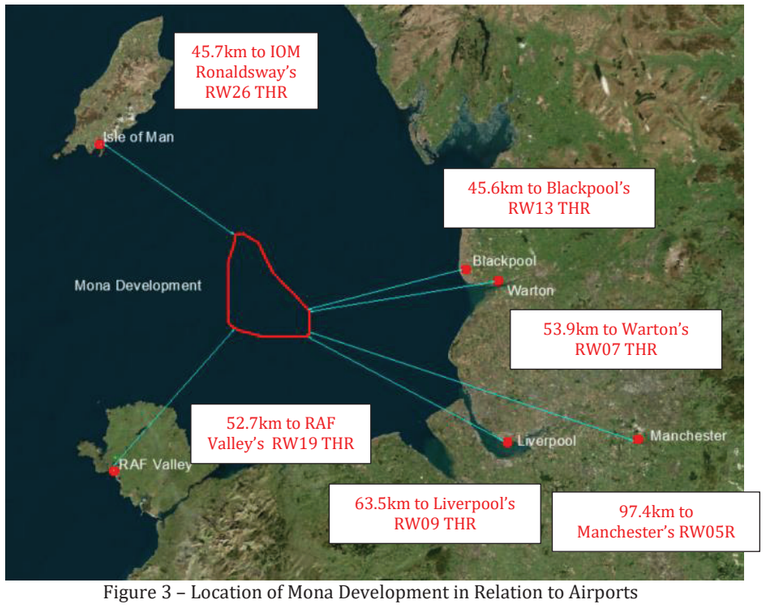

Figure 3 – Location of Mona Development in Relation to Airports

2 Manchester Airport OLS and IFP Assessment

2.1 OLS Assessment

2.1.1 Overview

The OLS for Manchester Airport has been constructed in accordance with Annex 14 and CAP 168.

2.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA
1	2	3	4	5
05R	3047 M	3347 M	3047 M	2864 M
23L	3200 M	3500 M	3200 M	2864 M
23L	3121 M	3421 M	3121 M	
23L	2955 M	3255 M	2955 M	
23L	2849 M	3149 M	2849 M	
23L	2504 M	2804 M	2504 M	
05L	3014 M	3229 M	3014 M	2587 M
23R	2897 M	3197 M	2897 M	2714 M
05L	2771 M	2986 M	2771 M	
05L	2432 M	2647 M	2432 M	
05L	2036 M	2251 M	2036 M	
23R	2567 M	2867 M	2567 M	
23R	2121 M	2421 M	2121 M	

Figure 4 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
05L	051.06°	3048 x 45 M	RWY surface: Concrete and asphalt, Non grooved PCN 94/F/C/W/T	532051.20N 0021715.95W 167.0 FT	THR 212.0 FT	05L - 0.49% Up 23R - 0.49% Down
23R	231.09°	3048 x 45 M	RWY surface: Concrete and asphalt, Non grooved PCN 94/F/C/W/T	532140.75N 0021533.41W 167.0 FT	THR 249.0 FT	05L - 0.49% Up 23R - 0.49% Down
05R	051.04°	3050 x 45 M	RWY surface: Concrete and asphalt, Grooved PCN 79/F/C/W/T	531955.10N 0021838.38W 167.0 FT	THR 186.0 FT	05R - 0.46% Up 23L - 0.48% Down
23L	231.07°	3050 x 45 M	RWY surface: Concrete and asphalt, Grooved PCN 79/F/C/W/T	532053.35N 0021637.95W 167.0 FT	THR 227.0 FT	05R - 0.46% Up 23L - 0.48% Down

Figure 5 - Threshold Details

Runway 05L, 23R and 05R have ILS approaches and all runways are more than1800m in length.

Runway 05L is a CODE 4, Precision Instrument Runway

Runway 23R is a CODE 4, Precision Instrument Runway

Runway 05R is a CODE 4, Precision Instrument Runway **(Lowest Threshold, 56.77m)**

Runway 23L is a CODE 4, Non-Precision Runway

2.1.3 OLS Construction

The OLS for Manchester Airport is shown below along with an image in relation to the proposed windfarm locations.

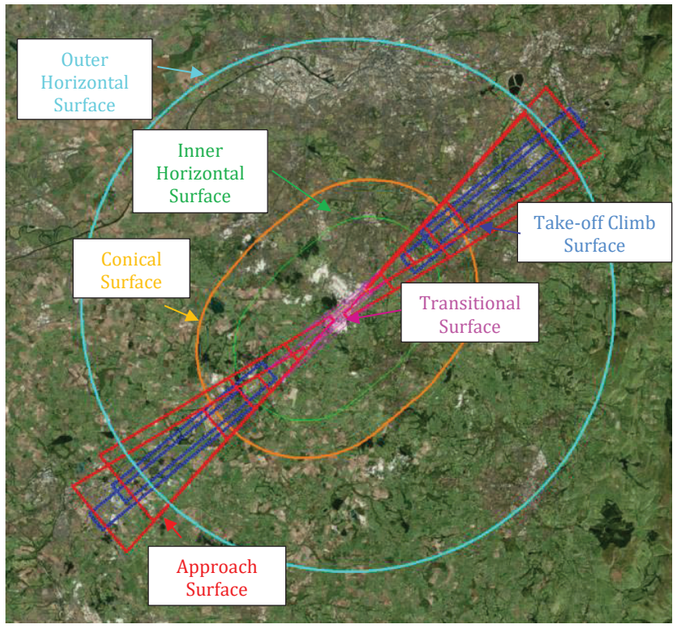

Figure 6 – OLS for Manchester Airport

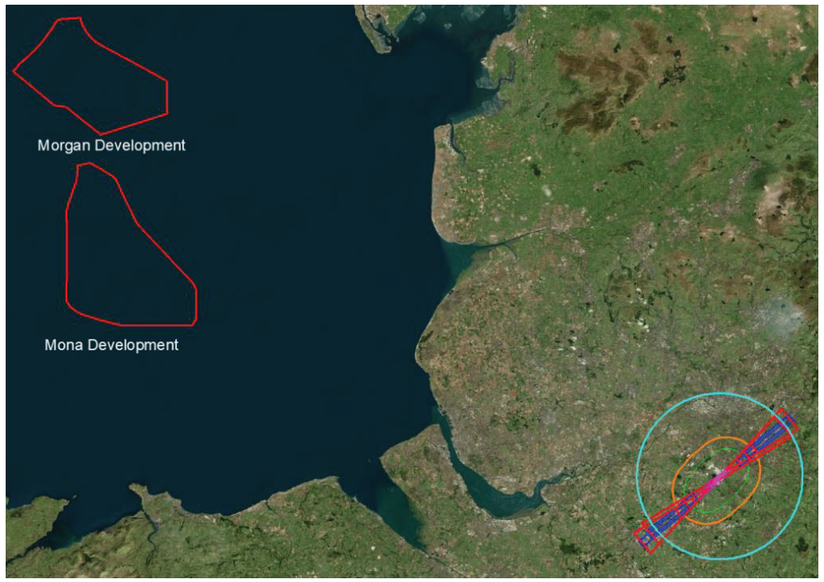

Figure 7 - Manchester OLS in Relation to Windfarms

2.1.4 OLS Analysis

The OLS for Manchester Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The windfarms will have no impact on the OLS for Manchester Airport.

2.2 IFP Assessment

The ATCSMAC and IFPs assessed are as follows:

<u>AIRAC 11/2022 (Effective 03 NOV 2022)</u>

- AD 2.EGCC-5-1 ATC SURVEILLANCE MINIMUM ALTITUDE CHART (02 JAN 20);
- AD 2.EGCC-6-1 SID MONTY 1R 1S 1Y 1Z (06 OCT 22);
- AD 2.EGCC-6-2 SID 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y (06 OCT 22);
- AD 2.EGCC-6-3 SID LISTO 2S 2Z (06 OCT 22);
- AD 2.EGCC-6-4 SID LISTO 2R 2Y (06 OCT 22);
- AD 2.EGCC-6-5 SID POL 5R 4S 1Y 1Z (06 OCT 22);
- AD 2.EGCC-6-6 SID SONEX 1R 1Y/DESIG 1S 1Z (06 OCT 22);
- AD 2.EGCC-6-7 SID SANBA 1R 1Y (06 OCT 22);
- AD 2.EGCC-7-1 STAR RNAV1 (DME/DME or GNSS) LAKEY 1M SETEL 1M TILNI 1M (06 OCT 22);
- AD 2.EGCC-7-2 STAR RNAV1 (DME/DME or GNSS) LIBSO 1M OTBED 1M (06 OCT 22);
- AD 2.EGCC-7-3 STAR RNAV1 (DME/DME or GNSS) MAKUX 1M MALUD 1M OKTEM 1M PENIL 1M (06 OCT 22);
- AD 2.EGCC-7-4 RNAV1 (DME/DME or GNSS) ELVOS 1M LESTA 1M (06 OCT 22);
- AD 2.EGCC-8-1 ILS/DME (I-MC) RWY 05R (28 FEB 19);
- AD 2.EGCC-8-2 ILS/DME (MCT) RWY 05R (28 FEB 19);
- AD 2.EGCC-8-3 LOC/DME (I-MC) RWY 05R (28 FEB 19);
- AD 2.EGCC-8-4 VOR/DME RWY 05R (28 FEB 19);
- AD 2.EGCC-8-5 ILS/DME (I-MM) RWY 05L (28 FEB 19);
- AD 2.EGCC-8-6 ILS/DME (MCT) RWY 05L (28 FEB 19);
- AD 2.EGCC-8-7 LOC/DME RWY 05L (28 FEB 19);
- AD 2.EGCC-8-8 VOR/DME RWY 05L (28 FEB 19);
- AD 2.EGCC-8-9 ILS/DME (I-NN) RWY 23R (28 FEB 19);
- AD 2.EGCC-8-10 ILS/DME (MCT) RWY 23R (28 FEB 19);
- AD 2.EGCC-8-11 LOC/DME RWY 23R (28 FEB 19);
- AD 2.EGCC-8-12 VOR/DME RWY 23R (28 FEB 19);
- AD 2.EGCC-8-13 VOR/DME RWY 23L (28 FEB 19);
- AD 2.EGCC-8-14 RNP RWY 23L (05 NOV 20).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

2.2.1 AD 2.EGCC-5-1 ATC SURVEILLANCE MINIMUM ALTITUDE CHART

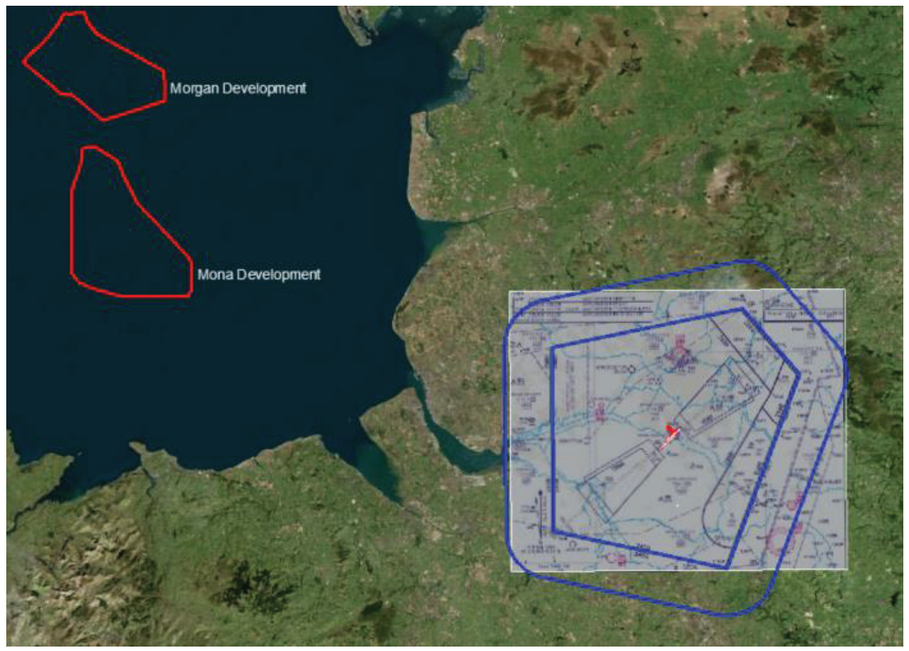

Figure 8 – Windfarms in Relation to ATCSMAC

Both windfarms lie outside the lateral buffer of all Surveillance Minimum Altitude Areas (SMAAs).

The proposed Windfarm would not impact Manchester Airport's ATCSMAC.

2.2.2 SIDs (Departures)

Both windfarms are located outside the initial departure splays for all departures.

Figure 9 – Initial Departure Splays

Aircraft in a turn would have to be at a minimum altitude of 757ft.

The closest point between the most restrictive Manchester DER (Departure End of Runway) and the closest windfarm (Mona) point is 97633.72m. In such distance, minus 150m (width of departure areas at DER), aircraft would have climbed an altitude of 0.033 * 97483.72m = 3216.96m / 10554ft above DER.

This provides sufficient clearance as the maximum MOC for SIDs is 300m and therefore aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacle.

There is no impact on the Departures.

2.2.3 STARs (Arrivals)

All Arrivals terminate at or above FL070.

The maximum possible elevation of the windfarms, before affecting the Minimum Initial Altitude of FL070, has been calculated.

7000ft = 2133.6m

2133.6m – 300m Minimum Obstacle Clearance (MOC) = 1833.6m AMSL.

The maximum elevation of both windfarms (324m) is below this altitude; therefore, the procedure would be unaffected.

The proposed windfarms will have no impact on any of published Arrival Procedures.

2.2.4 ILS/DME (I-MC) RWY 05R

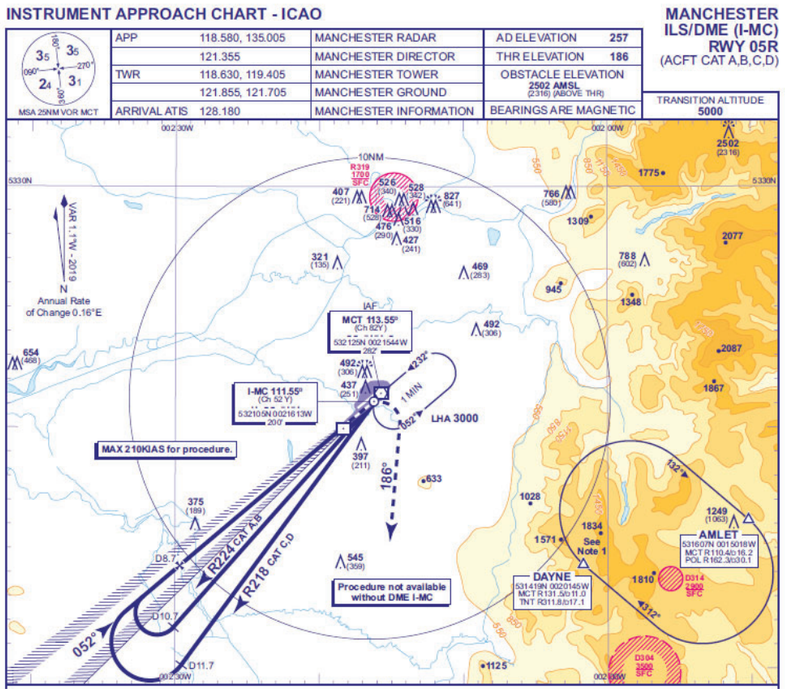

Figure 10 – ILS/DME (I-MC) RWY 05R Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME Procedure to Runway 05R.

Figure 11 – ILS/DME (I-MC) RWY 05R OAS

Additionally, the procedure features two reversals: a CAT A,B and a CAT C,D base turn. The minimum altitude within the base turns is 3000ft. Provided the obstacles were inside the protection areas the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the base turn is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the ILS/DME (I-MC) RWY 05R Procedure.

2.2.5 ILS/DME (MCT) RWY 05R

See Section 2.2.4.

The proposed windfarms will not have an impact on the ILS/DME (MCT) RWY 05R Procedure.

2.2.6 LOC/DME (I-MC) RWY 05R

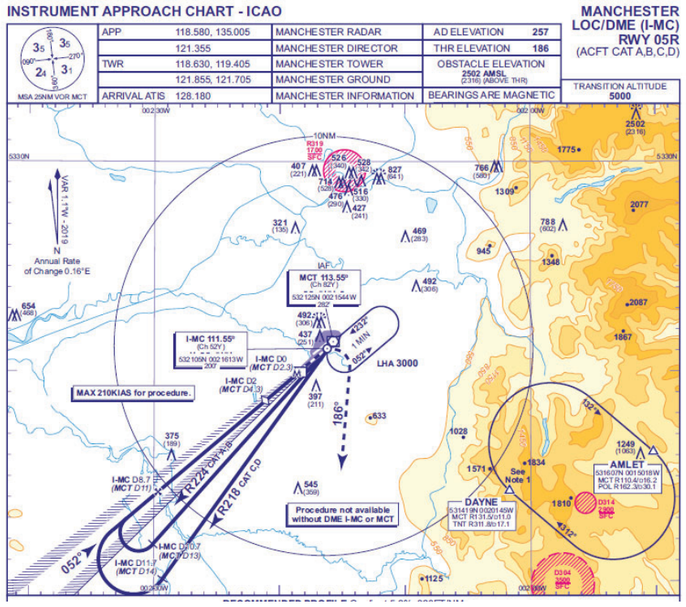

Figure 12 – LOC/DME (I-MC) RWY 05R Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC Procedure to Runway 05R.

Additionally, base turns were assessed on Section 2.2.4, without any impact noted.

The proposed windfarms will not have an impact on the LOC/DME (I-MC) RWY 05R Procedure.

2.2.7 VOR/DME RWY 05R

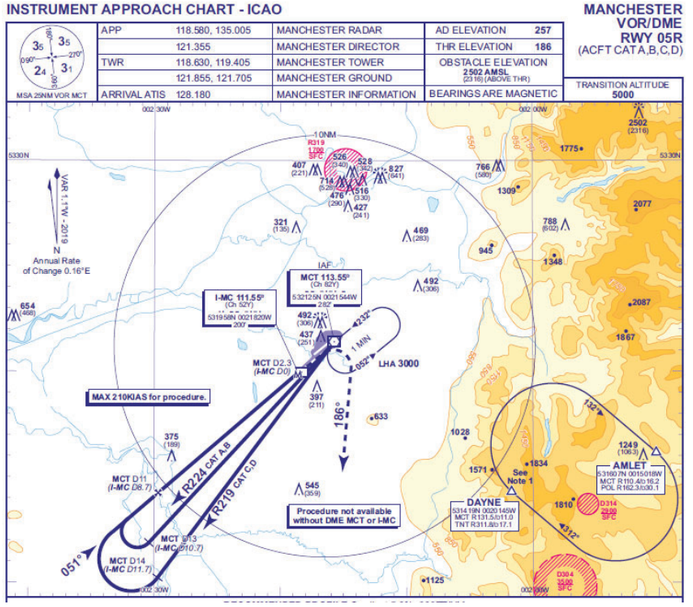

Figure 13 – VOR/DME RWY 05R Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 05R.

Figure 14 – VOR/DME RWY 05R Protection Areas

Additionally, the procedure features two reversals: a CAT A,B and a CAT C,D base turn. The minimum altitude within the base turns is 3000ft. Provided the obstacles were inside the protection areas, the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the base turn is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 05R Procedure.

2.2.8 ILS/DME (I-MM) RWY 05L

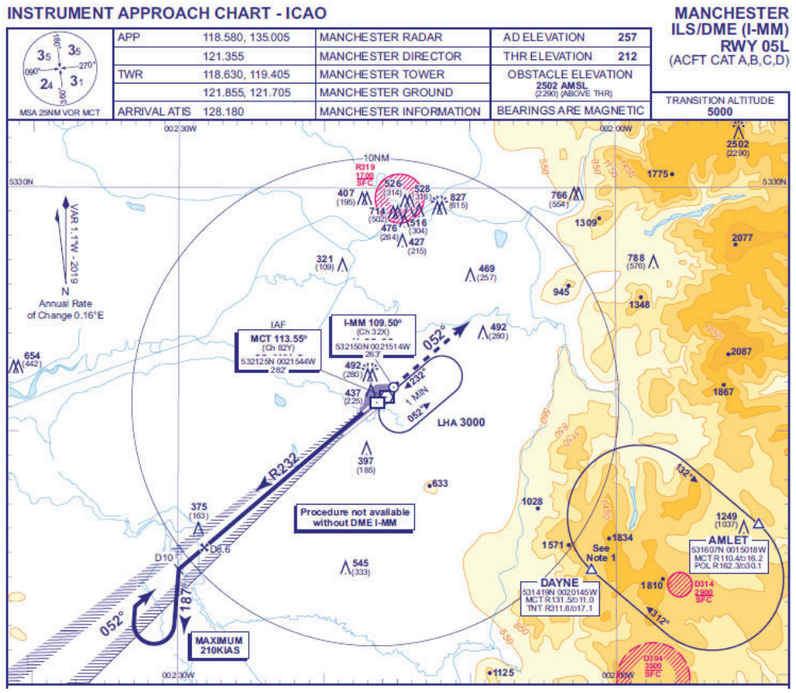

Figure 15 – ILS/DME (I-MM) RWY 05L

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME (CAT I and II) Procedure to Runway 05L.

Figure 16 – ILS/DME (I-MC) CAT I & II RWY 05L OAS

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3000ft. Provided the obstacles were inside the protection areas the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the ILS/DME (I-MM) RWY 05L Procedure.

2.2.9 ILS/DME (MCT) RWY 05L

See Section 2.2.8.

The proposed windfarms will not have an impact on the ILS/DME (MCT) RWY 05L Procedure.

2.2.10 LOC/DME RWY 05L

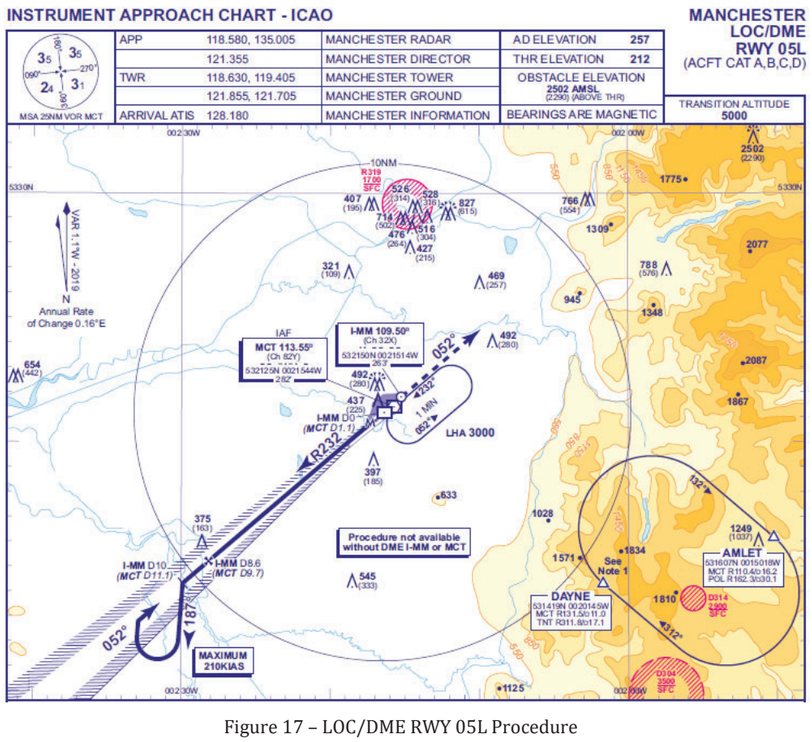

Figure 17 – LOC/DME RWY 05L Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC Procedure to Runway 05L.

Additionally, the reversal was assessed on Section 2.2.8, without any impact noted.

The proposed windfarms will not have an impact on the LOC/DME RWY 05L Procedure.

2.2.11 VOR/DME RWY 05L

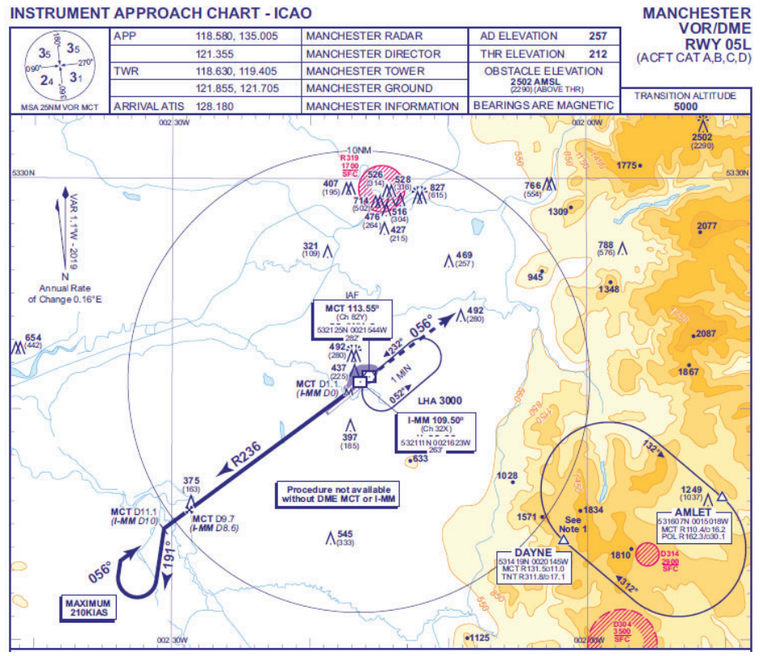

Figure 18 – VOR/DME RWY 05L Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 05L.

Figure 19 – VOR/DME RWY 05L Protection Areas

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3000ft. Provided the obstacles were inside the protection areas, the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3000ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 05L Procedure.

2.2.12 ILS/DME (I-NN) RWY 23R

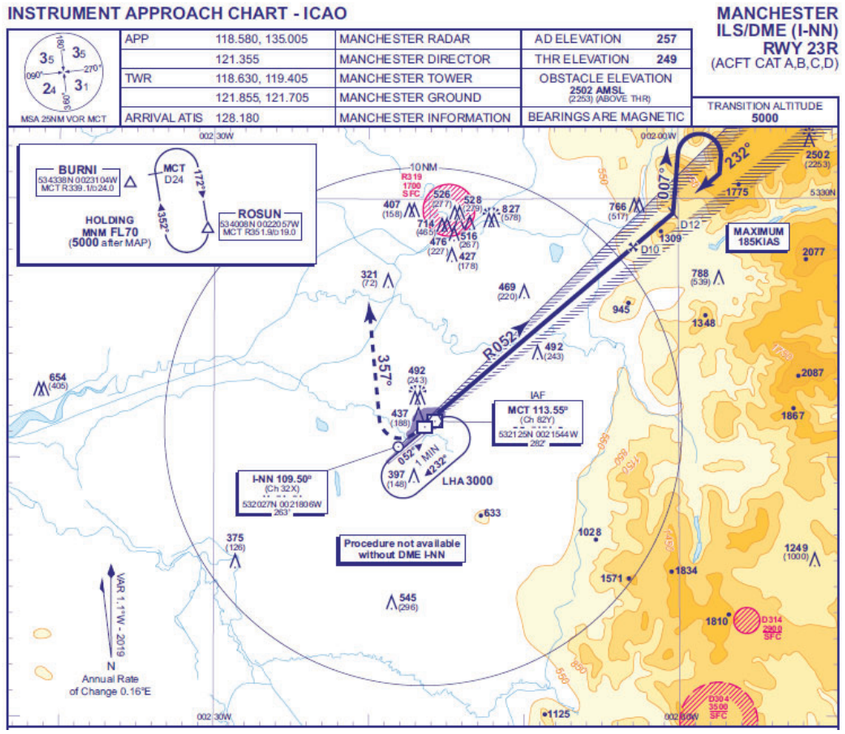

Figure 20 – ILS/DME (I-NN) RWY 23R

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME (CAT I and II) Procedure to Runway 23R.

Figure 21 – ILS/DME (I-NN) CAT I & II RWY 23R OAS

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3500ft. Provided the obstacles were inside the protection areas, the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3500ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the ILS/DME (I-NN) RWY 23R Procedure.

2.2.13 ILS/DME (MCT) RWY 23R

See Section 2.2.12.

The proposed windfarms will not have an impact on the ILS/DME (MCT) RWY 23R Procedure

2.2.14 LOC/DME RWY 23R

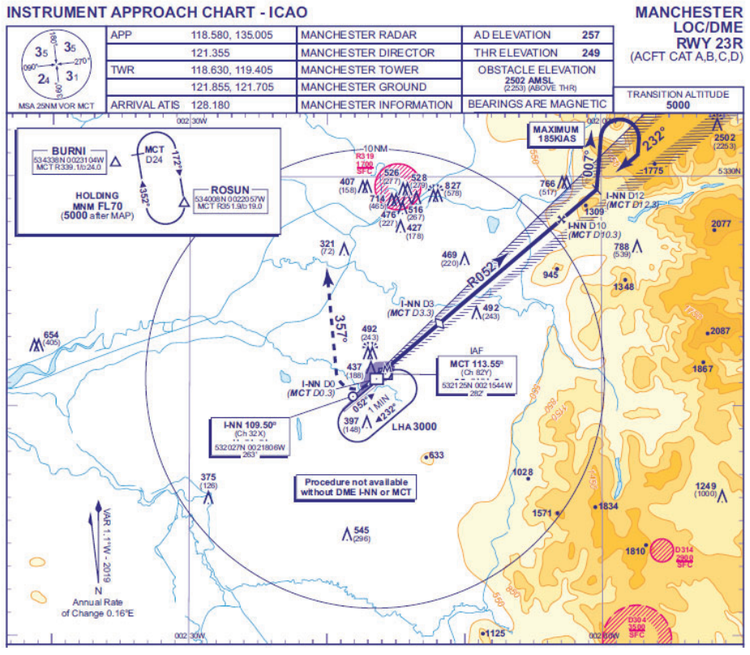

Figure 22 – LOC/DME RWY 23R

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC Procedure to Runway 23R.

Additionally, the reversal was assessed on Section 2.2.1, without any impact noted.

The proposed windfarms will not have an impact on the LOC/DME RWY 23R Procedure.

2.2.15 VOR/DME RWY 23R

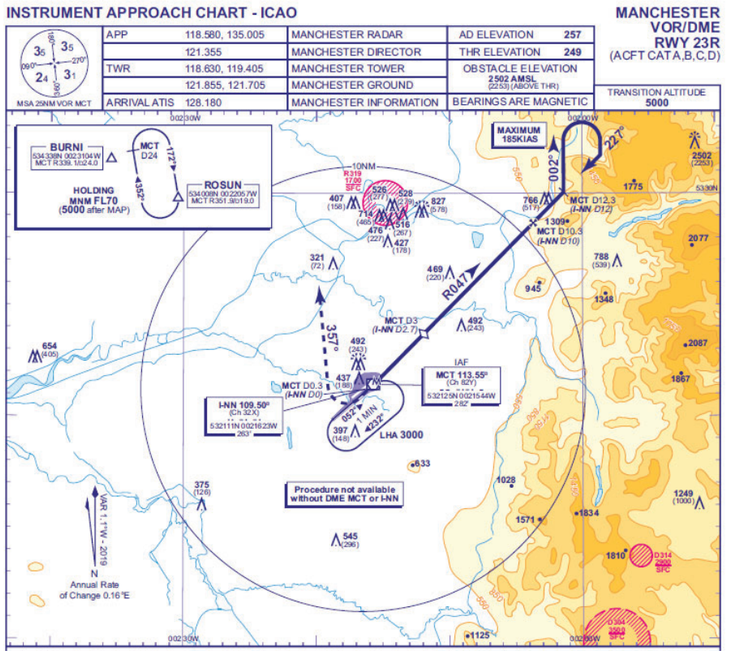

Figure 23 – VOR/DME RWY 23R

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 23R.

Figure 24 – VOR/DME RWY 23R Protection Areas

Additionally, the procedure features a reversal published on the approach chart (45°/180° Procedure Turn). The minimum altitude within the reversal is 3500ft. Provided the obstacles were inside the protection areas, the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the reversal is 3500ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 23R Procedure.

2.2.16 VOR/DME RWY 23L

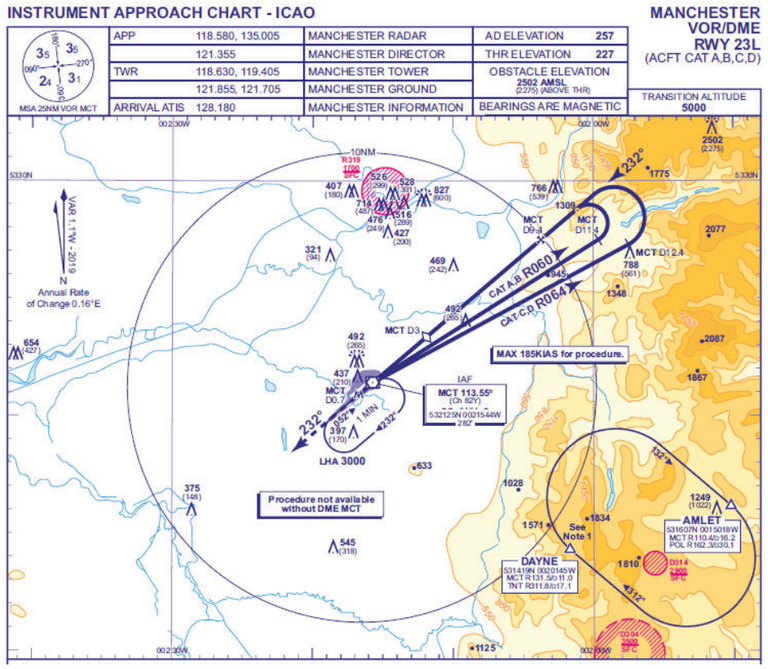

Figure 25 – VOR/DME RWY 23L

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the VOR/DME Procedure to Runway 23L.

Figure 26 – VOR/DME RWY 23L Protection Areas

Additionally, the procedure features two reversals: a CAT A,B and a CAT C,D base turn. The minimum altitude within the base turns is 3500ft. Provided the obstacles were inside the protection areas, the highest MOC required over the obstacles would be full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacles. As the minimum altitude within the base turn is 3500ft, this provides sufficient margin to clear the obstacles safely.

The proposed windfarms will not have an impact on the VOR/DME RWY 23L Procedure.

2.2.17 RNP RWY 23L

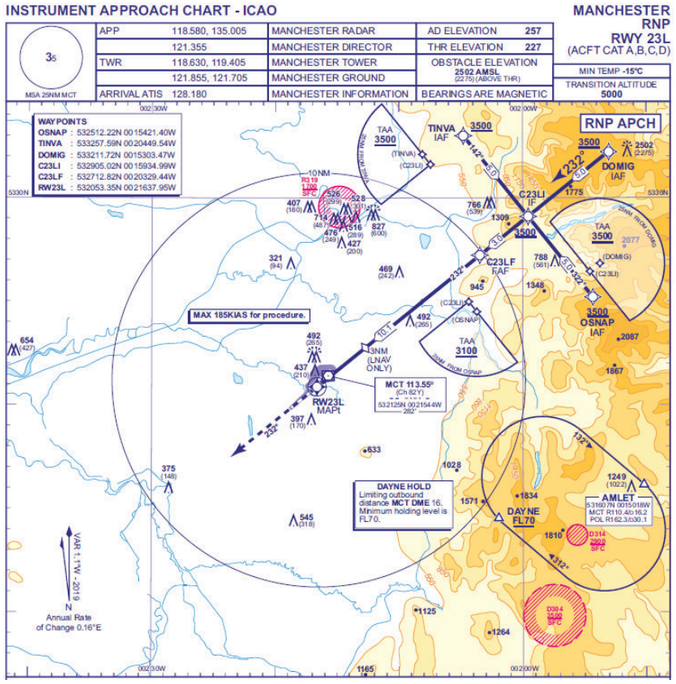

Figure 27 – RNP RWY 23L

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the RNP Procedure to Runway 23L.

Figure 28 – RNP RWY 23L Protection Area

Additionally, Terminal Arrival Altitudes (TAAs) on each of the Initial Approach Fixes (IAFs; TINVA, OSNAP and DOMIG) have been constructed:

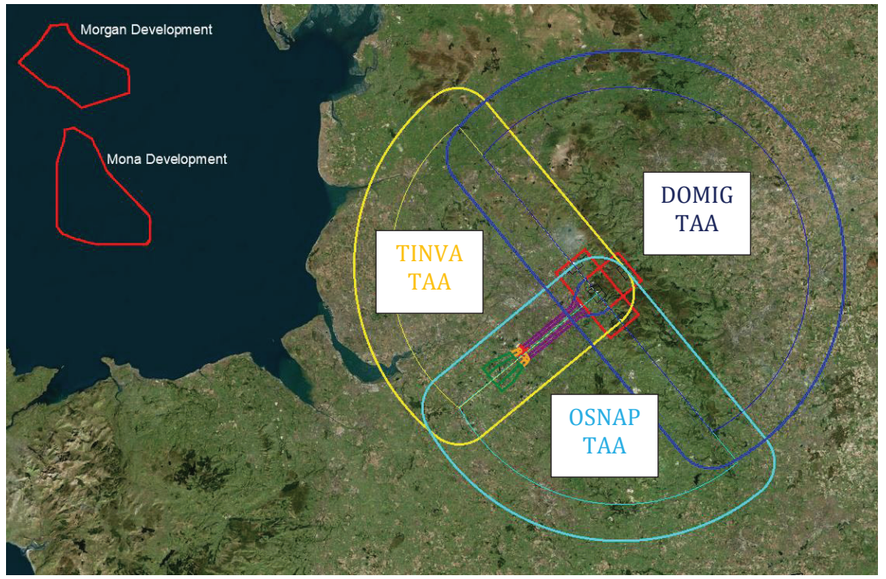

Figure 29 - Windfarms vs RNP RWY 23L TAAs

As both windfarms are outside the protection areas for the TAAs, they will not cause an impact.

The proposed windfarms will not have an impact on the RNP RWY 23L Procedure.

2.2.18 Visual Manoeuvring (Circling)

The proposed windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

Figure 30 – Circling Protection Area

The proposed windfarms would have no impact on the Visual Circling.

2.2.19 Visual Segment Surface (VSS)

The proposed windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Manchester Airport Runways.

2.2.20 Holding

The Lowest Holding Altitude (LHA) for any of the Manchester Holds is 3000ft.

The maximum possible elevation of the windfarms, before affecting the LHA of 3000ft, has been calculated.

- 3000ft = 914.4m
- 914.4m – 300m MOC = 614.4m AMSL. The maximum windfarm elevation is below this altitude.

The proposed windfarms would have no impact on any of the holds for Manchester Airport.

2.2.21 Minimum Sector Altitude (MSA)

<u>MSA 25NM VOR MCT</u>

The Morgan and Mona Windfarms lie outside the MSA protection areas for all sectors and their associated buffers.

Figure 31 – VOR MCT MSA vs Windfarms

The proposed windfarms would have no impact on the published VOR MCT MSA.

MSA 25NM ARP

We have additionally protected for an MSA based on the ARP owing to the fact the minimum levels shown outside the ATCSMAC are based on the ARP as per note 4 in the ATCSMAC chart:

"4. Minimum Sector Altitudes are based on obstacles and spot heights within 25NM of the Aerodrome Reference Point"

The Morgan and Mona Windfarms lie outside the MSA protection areas for all sectors and their associated buffers.

Figure 32 –ARP MSA vs Windfarms

The proposed windfarms would have no impact on the published ARP MSA.

3 Liverpool John Lennon Airport OLS and IFP Assessment

3.1 OLS Assessment

3.1.1 Overview

The OLS for Liverpool Airport has been constructed in accordance with Annex 14 and CAP 168.

3.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA
1	2	3	4	5
09	2163 M	2364 M	2163 M	2102 M
27	2286 M	3429 M	2292 M	2286 M
09	1990 M	2191 M	1990 M	
27	2066 M	3099 M	2072 M	

Figure 33 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
09	085.59°	2286 x 46 M	RWY surface: Asphalt, Grooved PCN 77/F/C/W/T	531958.39N 0025157.61W 171.0 FT	THR 59.6 FT	RWY 09 0.78% Up RWY 27 0.78% Up
27	265.62°	2286 x 46 M	RWY surface: Asphalt, Grooved PCN 77/F/C/W/T SWY surface: Asphalt PCN 77/F/C/W/T	532003.90N 0024957.76W 170.8 FT	THR 77.8 FT	RWY 09 0.78% Up RWY 27 0.78% Up

Figure 34 - Threshold Details

Runways 09 and 27 have ILS approaches and both runways are more than 1800m in length.

Runway 09 is a CODE 4, Precision Instrument Runway (**Lowest threshold, 18.16m**)

Runway 27 is a CODE 4, Precision Instrument Runway

3.1.3 OLS Construction

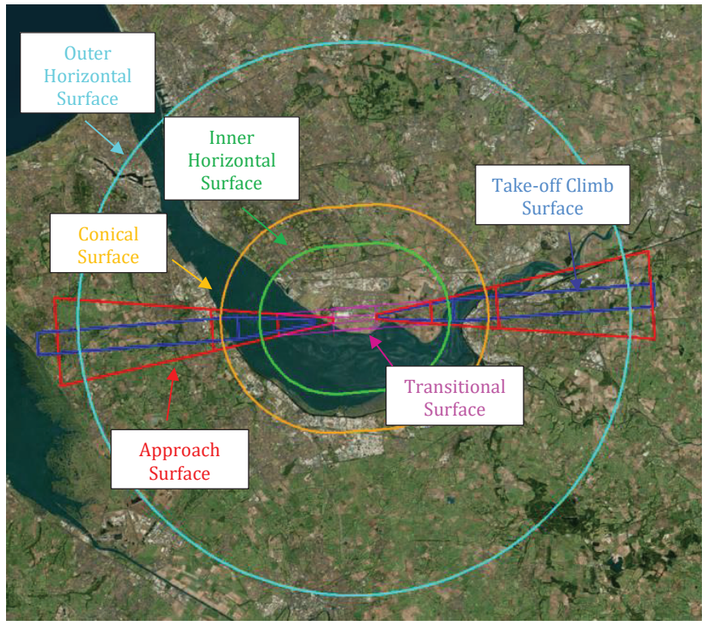

Figure 35 - OLS for Liverpool Airport

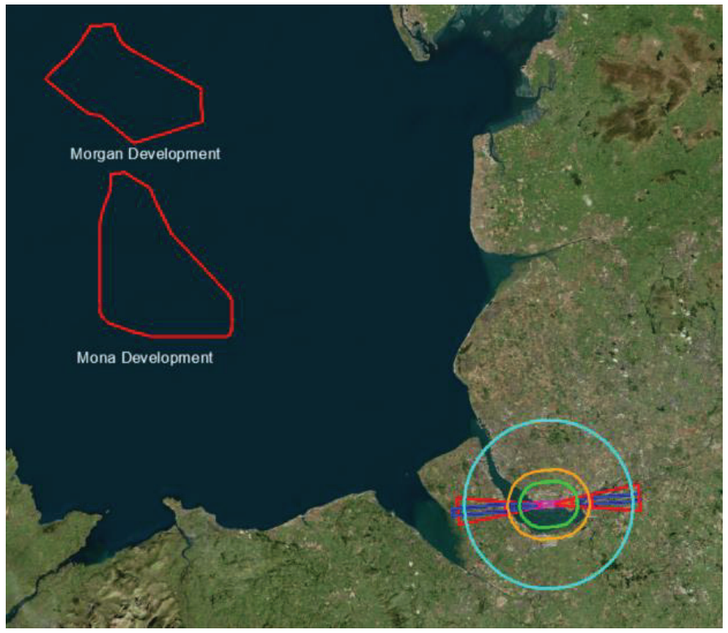

Figure 36 - Liverpool OLS in Relation to Windfarms

3.1.4 OLS Analysis

The OLS for Liverpool Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The windfarms will have no impact on the OLS for Liverpool Airport.

3.2 IFP Assessment

The ATCSMAC and IFPs assessed are as follows:

<u>AIRAC 11/2022 (Effective 03 NOV 2022)</u>

- AD 2.EGGP-5-1 ATCSMAC (25 APR 19);
- AD 2.EGGP-6-1 SID POLE HILL (28 JAN 21);
- AD 2.EGGP-6-2 SID REXAM (28 JAN 21);
- AD 2.EGGP-6-3 SID BARTN 1T 1V (28 JAN 21);
- AD 2.EGGP-6-4 SID WALLASEY/NANTI (28 JAN 21);
- AD 2.EGGP-7-1 STAR RNAV1 (DME/DME or GNSS) GASKO 1L LAKEY 1L LIBSO 1L POL 1L VEGUS 1L (11 AUG 22);
- AD 2.EGGP-7-2 STAR RNAV1 (DME/DME or GNSS) BOFUM 1L PENIL 1L (19 MAY 22);
- AD 2.EGGP-7-3 STAR RNAV1 (DME/DME or GNSS) ELVOS 1L LESTA 1L OKTEM 1L (19 MAY 22);
- AD 2.EGGP-8-1 ILS/DME/NDB(L) RWY 09 (17 JUN 21);
- AD 2.EGGP-8-2 LOC/DME/NDB(L) RWY 09 (17 JUN 21);
- AD 2.EGGP-8-3 SRA RTR 2NM RWY 09 (17 JUN 21);
- AD 2.EGGP-8-4 RNP RWY 09 (17 JUN 21);
- AD 2.EGGP-8-5 ILS/DME/NDB(L) RWY 27 (17 JUN 21);
- AD 2.EGGP-8-6 LOC/DME/NDB(L) RWY 27 (17 JUN 21);
- AD 2.EGGP-8-7 SRA RTR 2NM RWY 27 (17 JUN 21);
- AD 2.EGGP-8-8 RNP RWY 27 (17 JUN 21);
- AD 2.EGGP-8-9 NDB(L)/DME RWY 27 (17 JUN 21).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

3.2.1 AD 2.EGGP-5-1 ATCSMAC

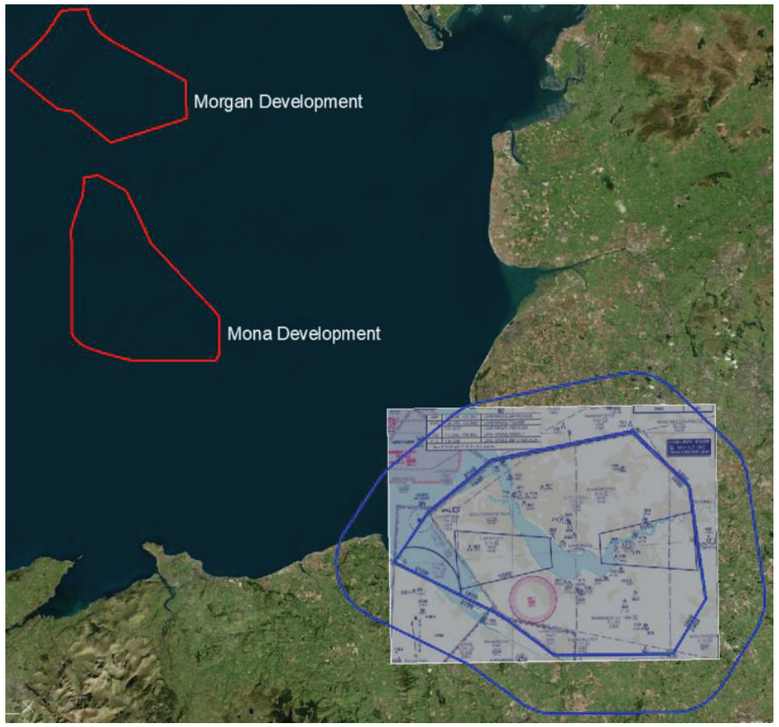

Figure 37 - Windfarms in Relation to ATCSMAC

The Windfarm developments lie outside the lateral buffer of all Surveillance Minimum Altitude Areas (SMAAs).

The windfarms would not impact Liverpool Airport's ATCSMAC.

3.2.2 AD 2.EGGP-6-1 SID POLE HILL

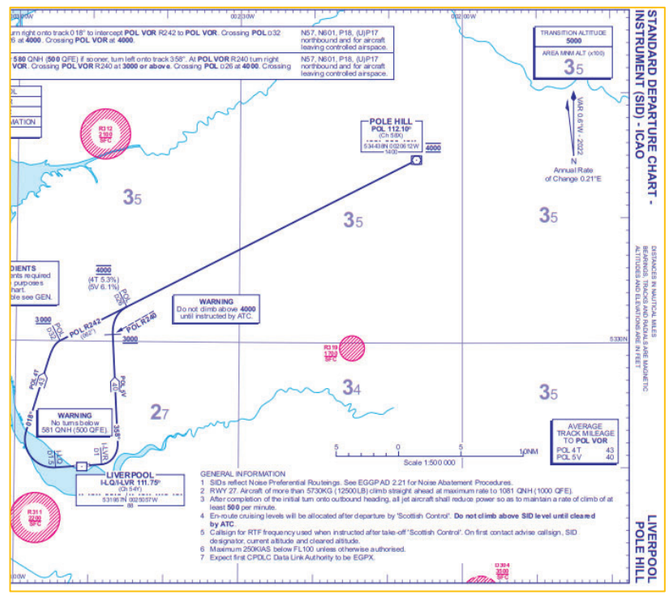

Figure 38 - SID POLE HILL 5V 4T Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 to POLE HILL.

Figure 39 - SID POL 5V RWY 09 Turn Area in Relation to Windfarms

Figure 40 - SID POL 4T RWY 27 Turn Area in Relation to Windfarms

Turn Areas

The POL 5V procedure, departing RWY 09, turns left initially before a right turn, heading north-east, away from the windfarms and would not be affected.

The POL 4T procedure, departing RWY 27, turns right and continues north-east, heading away from the windfarms and would not be affected.

The proposed windfarms would have no impact on the SID POLE HILL 5V and 4T procedures.

3.2.3 AD 2.EGGP-6-2 SID REXAM

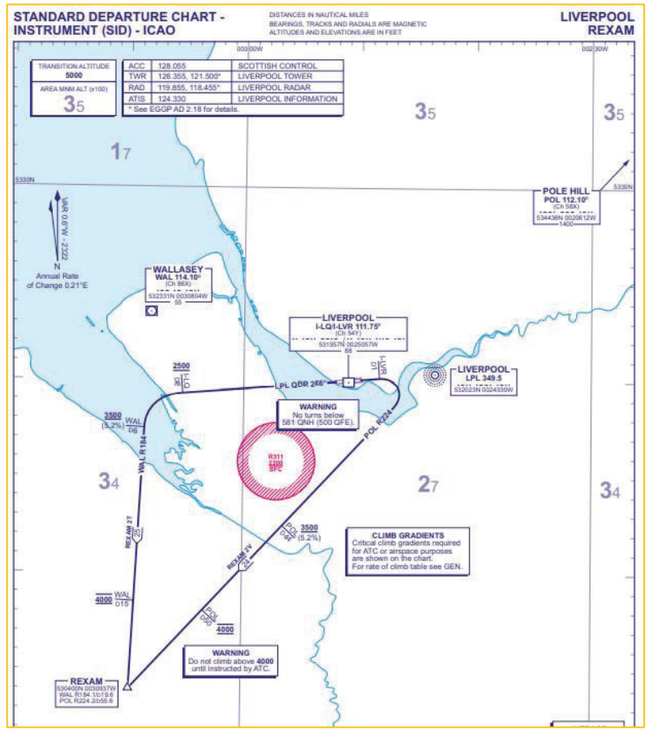

Figure 41 - SID REXAM 2V 2T Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 to REXAM.

Turn Areas

The REXAM 2V procedure, departing RWY 09, turns right and continues south-west, away from the windfarms and would not be affected.

The REXAM 2T procedure, departing RWY 27, turns left and continues south, heading away from the windfarms and would not be affected.

Figure 42 - SID REXAM 2V RWY 09 Turn Area in Relation to Windfarms

Figure 43 - SID REXAM 2T RWY 27 Turn Area in Relation to Windfarms

The proposed windfarms would have no impact on the SID REXAM 2V and 2T procedures.

3.2.4 AD 2.EGGP-6-3 SID BARTN 1T 1V

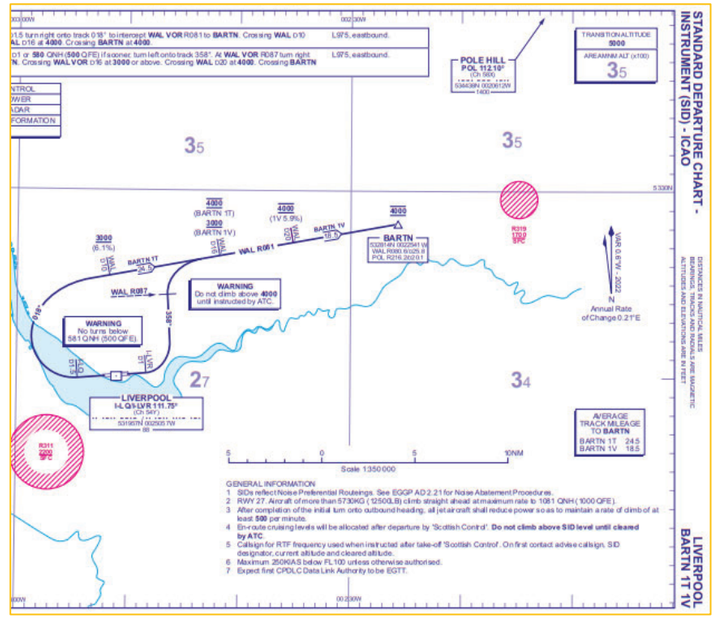

Figure 44 - SID BARTN 1T 1V Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 to BARTN.

Turn Areas

The BARTN 1V procedure, departing RWY 09, turns left and continues east, away from the windfarms and would not be affected.

The BARTN 1T procedure, departing RWY 27, turns right and continues east, away from the windfarms and would not be affected.

Figure 45 - SID BARTN 1V RWY 09 Protection Area in Relation to Windfarms

Figure 46 - SID BARTN 1T RWY 27 Protection Area in Relation to Windfarms

The proposed windfarms would have no impact on the SID BARTN 1V and 1T procedures.

3.2.5 AD 2.EGGP-6-4 SID WALLASEY/NANTI

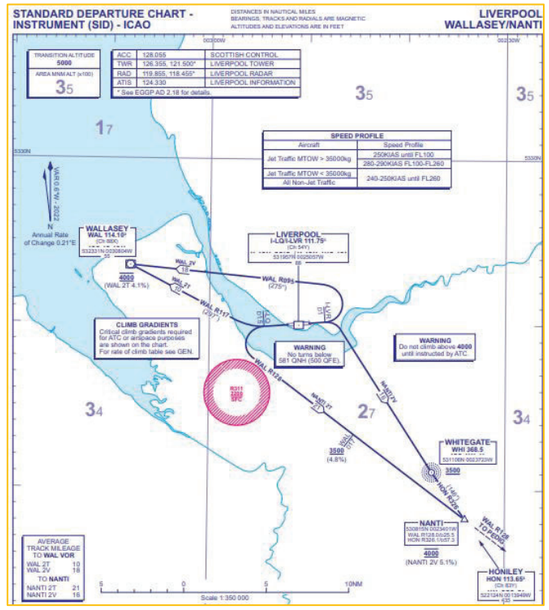

Figure 47 - SID WALLASEY 2T 2V and NANTI 2T 2V Procedure

Straight Departure Areas (SIDs)

Both Windfarms (Morgan and Mona) lie outside the Straight Protection Areas for the SIDs departing RWY 09 and 27 towards WALLASEY and NANTI.

Turn Areas for WALLASEY 2V and NANTI 2V

The WALLASEY 2V procedure, departing RWY 09, turns left and continues west towards WALLASEY VOR where aircraft climb to 4000ft and would not be affected.

The NANTI 2V procedure, departing RWY 09, turns right, away from the windfarms, continuing south-east and would not be affected.

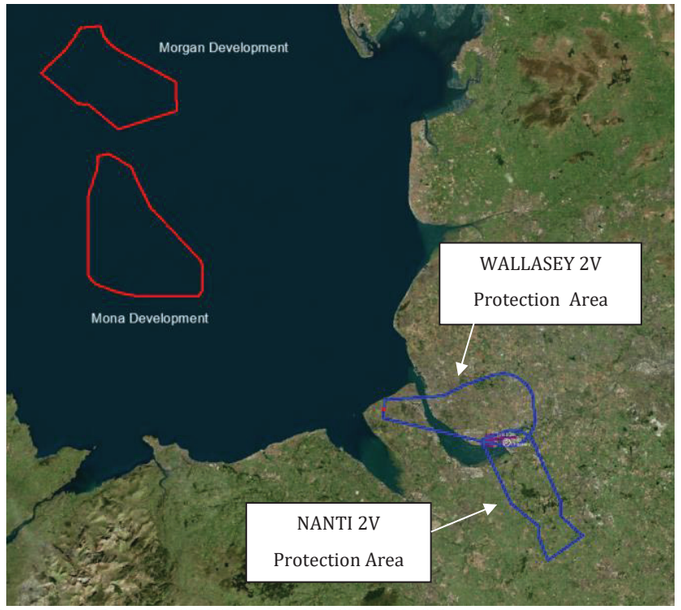

Figure 48 - SID WALLASEY 2V and NANTI 2V RWY 09 Protection Areas in Relation to Windfarms

Turn Areas for WALLASEY 2T and NANTI 2T

The WALLASEY 2T procedure, departing RWY 27, turns right and continues west towards WALLASEY VOR where aircraft climb to 4000ft and would not be affected.

The NANTI 2T procedure, departing RWY 27, turns left, away from the windfarms, continuing south-east, away from the windfarms and would not be affected.

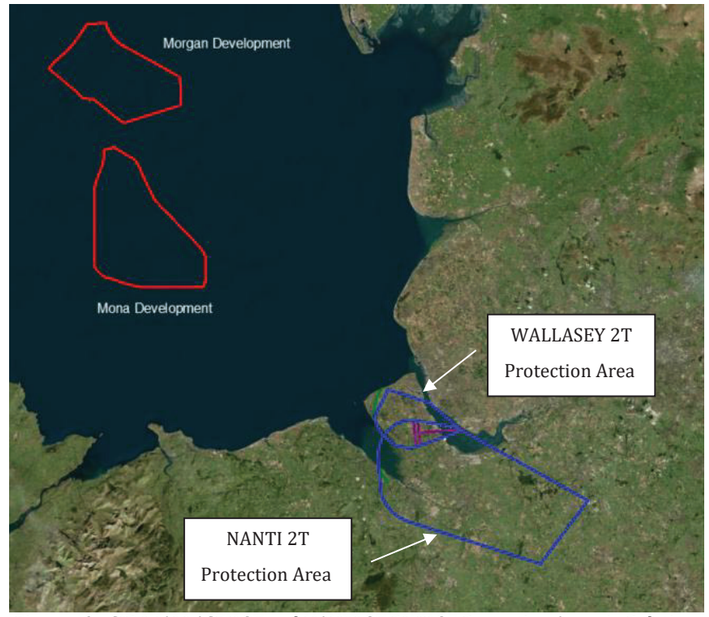

Figure 49 - SID WALLASEY 2T and NANTI 2T RWY 27 Protection Areas in Relation to Windfarms

The proposed windfarm development would have no impact on the SIDs WALLASEY and NANTI procedures.

3.2.6 AD 2.EGGP-7-1 STAR RNAV1 (DME/DME or GNSS) GASKO 1L LAKEY 1L LIBSO 1L POL 1L VEGUS 1L;

AD 2.EGGP-7-2 STAR RNAV1 (DME/DME or GNSS) BOFUM 1L PENIL 1L;

AD 2.EGGP-7-3 STAR RNAV1 (DME/DME or GNSS) ELVOS 1L LESTA 1L OKTEM 1L.

The 7-1 and 7-2 STARs terminate at TIPOD and 7-3 terminates at KEGUN both at altitudes of FL70.

Using the Windfarm elevation of 324m and MOC of 300m, the windfarms produce a MOCA of:

324m + 300m = 624m / 2048ft AMSL.

This is below the termination altitude of the STARs at 7000ft.

The Windfarm development would have no impact on the published STARs.

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3.2.7 AD 2.EGGP-8-1 ILS/DME/NDB(L) RWY 09

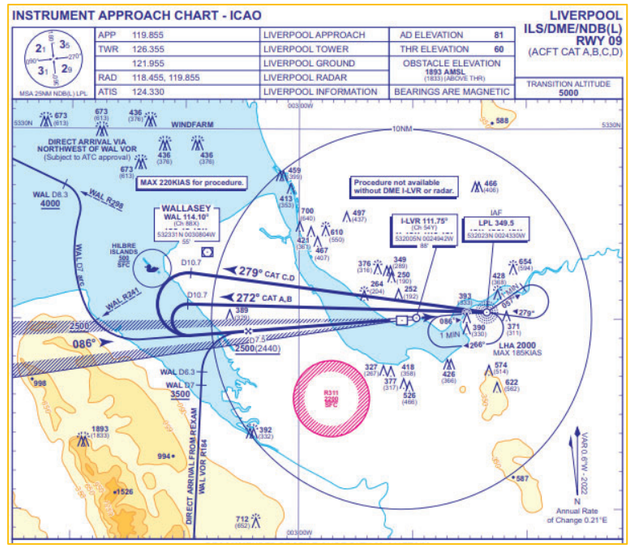

Figure 50 - ILS/DME/NDB(L) RWY 09 Procedure

The altitude for Direct arrivals procedure via WALLASEY and REXAM is published as ‘At or Above 2500ft’.

The MOCA required at the windfarms using the elevation of 324m and maximum MOC of 300m is 324 + 300m = 624m / 2048ft AMSL, which is below the arrival altitude and would have no impact on the arrival to the procedure.

Both Windfarms (Morgan and Mona) lie outside the protection areas for the ILS/DME/NDB(L) procedure, including the Missed Approach, to Runway 09 and would have no impact.

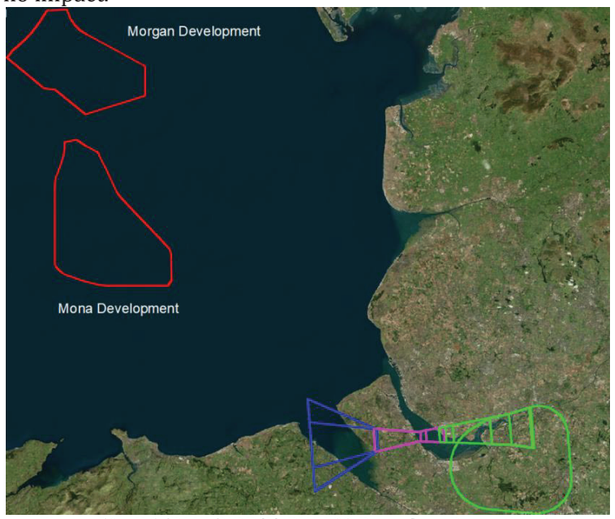

Figure 51 - ILS/DME/NDB(L) RWY 09 Procedure Protection Areas

COMMERCIAL IN CONFIDENCE

Additionally, the protection areas for both Base turns published on the chart have been constructed, including the Base turn outbound form the NDB(L) LPL Hold and the Base turn inbound to I-LVR DME for both CAT A&B and CAT C&D aircraft:

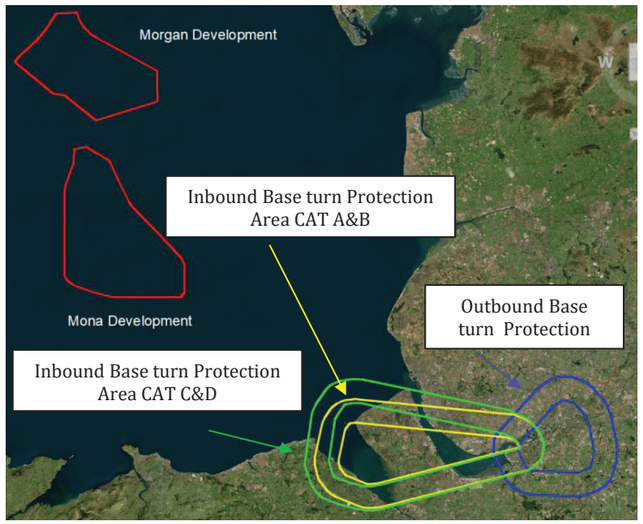

Figure 52 - ILS/DME/NDB(L) RWY 09 Base turn Protection Areas

Both Windfarms lie outside the protection area for all Base turns associated with the procedure and will have no impact.

The proposed windfarms would not impact the published ILS/DME/NDB(L) RWY 09 procedure.

3.2.8 AD 2.EGGP-8-2 LOC/DME/NDB(L) RWY 09

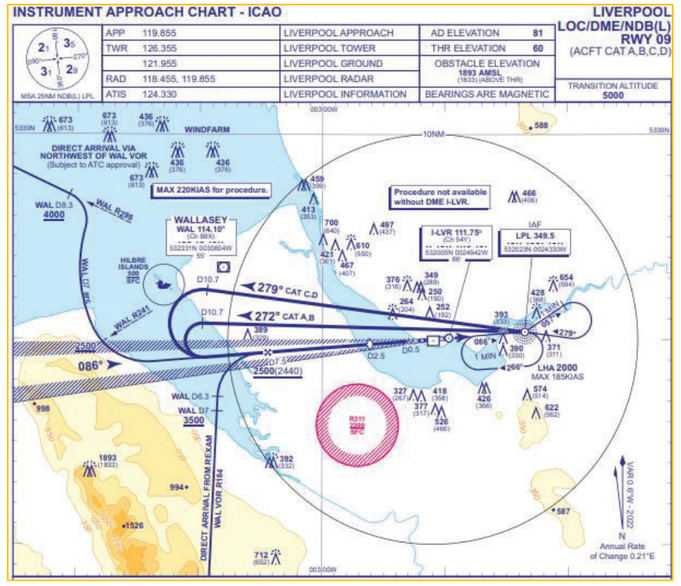

Figure 53 - LOC/DME/NDB(L) RWY 09 Procedure

The Direct arrivals altitude and Base turn protection area are common to the ILS/DME/NDB(L) RWY 09 procedure as shown in Figure 27 and Figure 28 and is not affected.

The proposed windfarms would not impact the published LOC/DME/NDB(L) RWY 09 procedure.

3.2.9 AD 2.EGGP-8-3 SRA RTR 2NM RWY 09

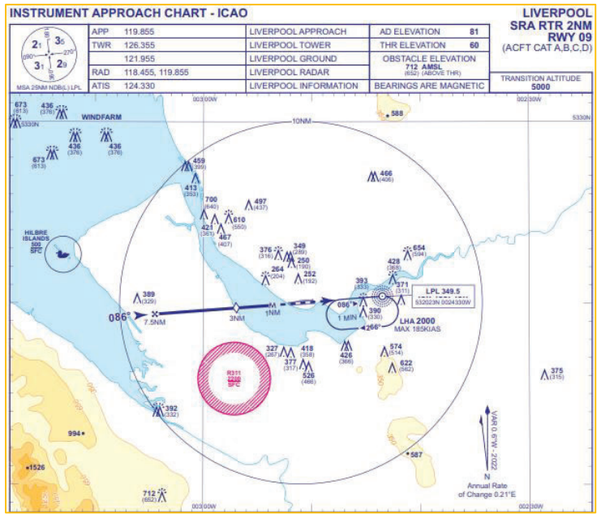

Figure 54 - SRA RTR 2NM RWY 09 Procedure

Both Windfarms lie outside the protection areas for the SRA to Runway 09.

The final approach starts at an altitude of 2500ft at the FAF. The MOCA required at the windfarms using the elevation of 324m and maximum MOC of 300m is 324 + 300m = 624m / 2048ft AMSL, which is below the altitude at the FAF, and the procedure would not be affected.

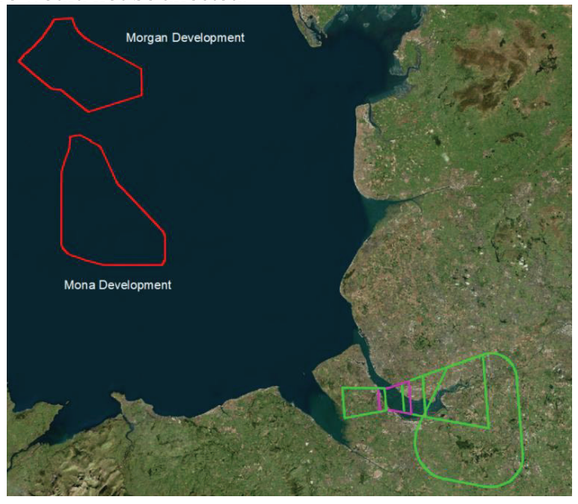

Figure 55 - SRA RTR 2NM RWY 09 Protection Areas

The proposed windfarms would not impact the published SRA RTR 2NM RWY 09 procedure.

3.2.10 AD 2.EGGP-8-4 RNP RWY 09

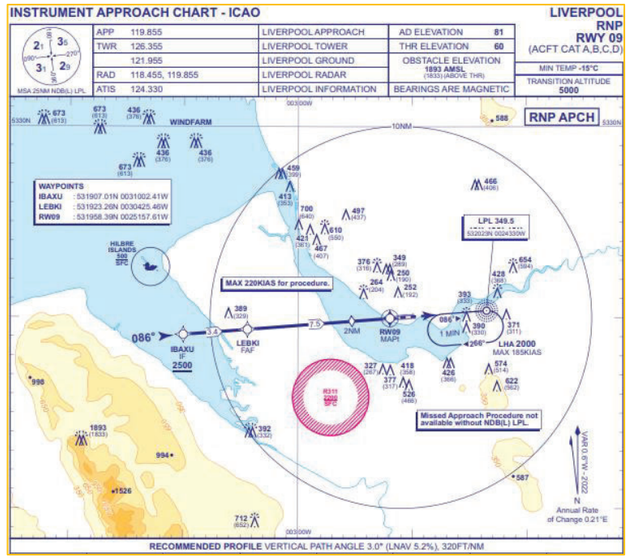

Figure 56 - RNP RWY 09 Procedure

Arrival to the RNP RWY 09 procedure is published as *'At or Above 2500ft'* and would not be affected.

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 09.

Figure 57 - RNP RWY 09 Protection Areas

The proposed windfarms would not impact the published RNP RWY 09 procedure.

3.2.11 AD 2.EGGP-8-5 ILS/DME/NDB(L) RWY 27

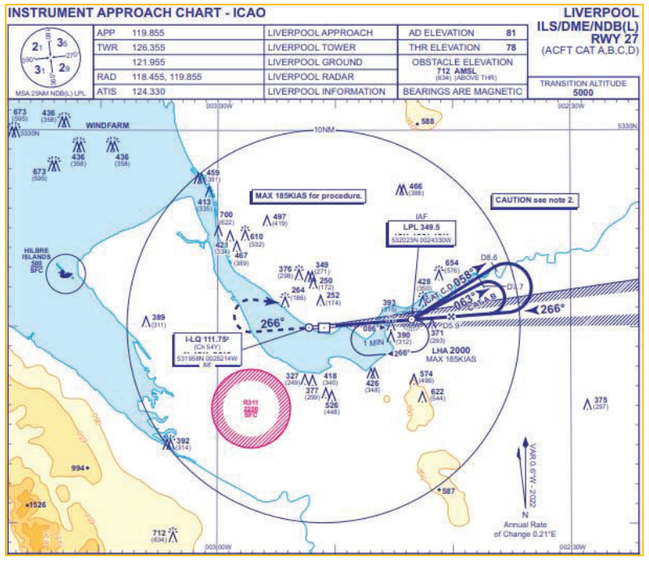

Figure 58 - ILS/DME/NDB(L) RWY 27 Procedure

Arrival at the procedure is published as *'At or Above 2500ft'* which is above the required MOCA for the windfarms.

Both windfarms lie outside the protection areas for the ILS/DME/NDB(L) Procedure to Runway 27, including the Missed Approach which climbs to the west before turning right towards NDB(L) LPL and will not be affected.

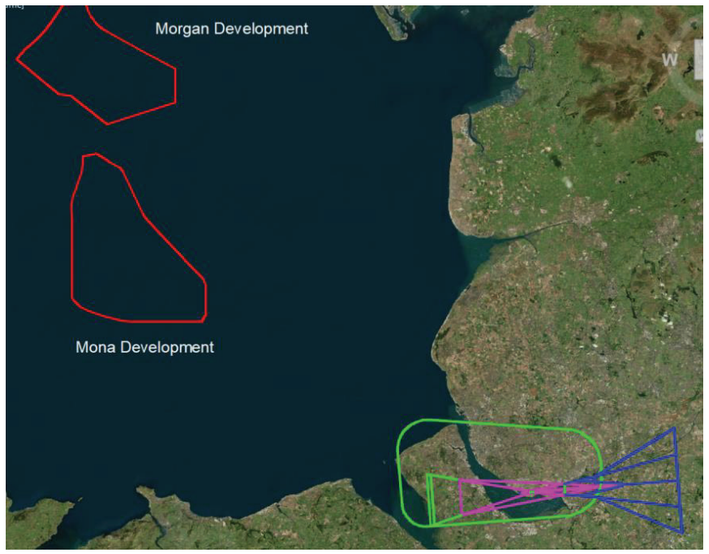

Figure 59 - ILS/DME/NDB(L) RWY 27 Protection Areas

COMMERCIAL IN CONFIDENCE

COMMERCIAL IN CONFIDENCE

Additionally, the protection areas for the Base turns published on the chart have been constructed for both CAT A&B and CAT C&D aircraft:

Figure 60 - ILS/DME/NDB(L) RWY 27 Base turn Protection Areas

The proposed windfarms would not impact the published ILS/DME/NDB(L) RWY 27 procedure.

3.2.12 AD 2.EGGP-8-6 LOC/DME/NDB(L) RWY 27

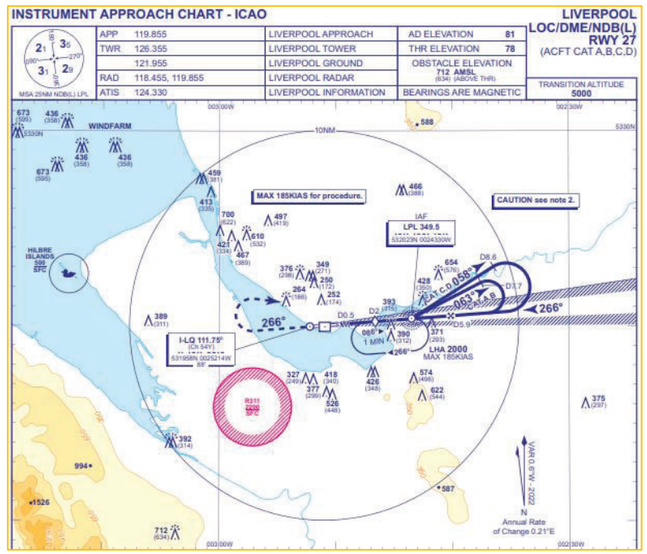

Figure 61 - LOC/DME/NDB(L) RWY 27 Procedure

COMMERCIAL IN CONFIDENCE

Arrival at the procedure is '*At or Above 2500ft*' which is above the required MOCA for the windfarms using the elevation of 324m + 300m MOC = 624m / 2048ft AMSL and would not be affected.

Both windfarms lie outside the protection areas for all aircraft categories for the published LOC/DME/NDB(L) Runway 27 procedure, specifically the Missed Approach which climbs to the west before turning right towards NDB(L) LPL.

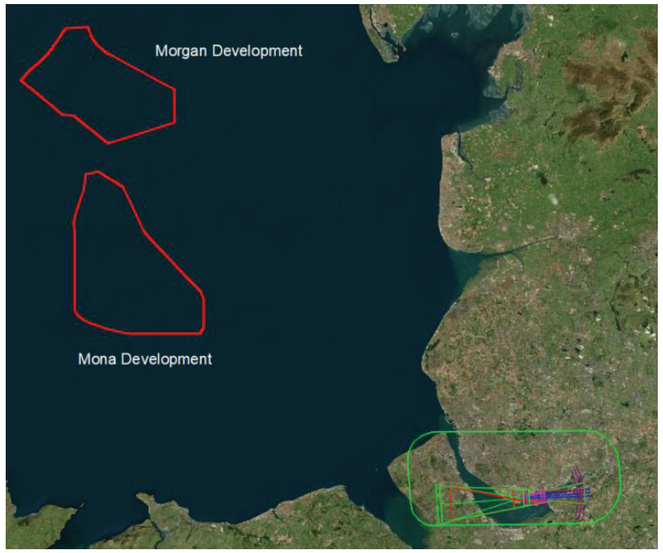

Figure 62 - LOC/DME/NDB(L) RWY 27 Protection Area

The windfarms lie outside the protection areas for the Base turn for Runway 27 as shown in Figure 36 and will not be affected.

The proposed windfarms would not impact the published LOC/DME/NDB(L) RWY 27 procedure.

3.2.13 AD 2.EGGP-8-7 SRA RTR 2NM RWY 27

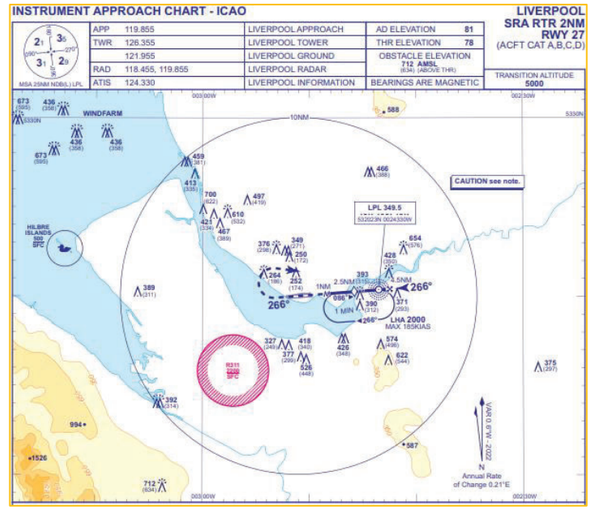

Figure 63 - SRA RTR 2NM RWY 27 Procedure

The initial and Intermediate Approach are directed by radar with no minima published on the chart.

Both windfarms lie outside the protection areas for the SRA RWY 27 and Hold Procedures for Runway 27 and will not be affected.

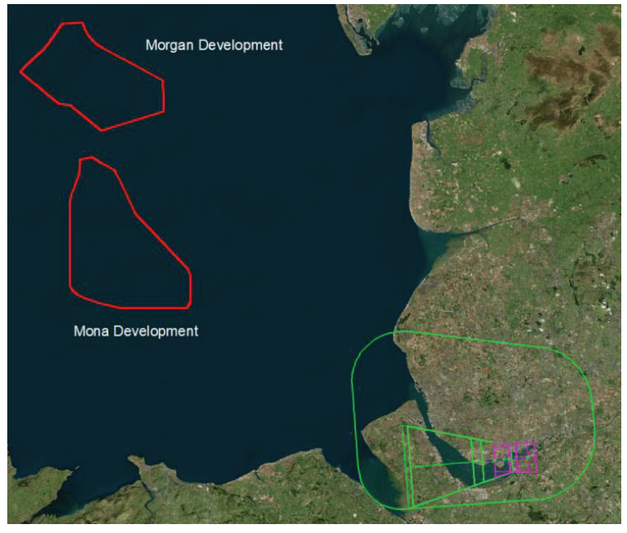

Figure 64 - SRA RTR 2NM RWY 27 Protection Area

The proposed windfarms would not impact the published SRA RTR 2NM RWY 27 procedure.

3.2.14 AD 2.EGGP-8-8 RNP RWY 27

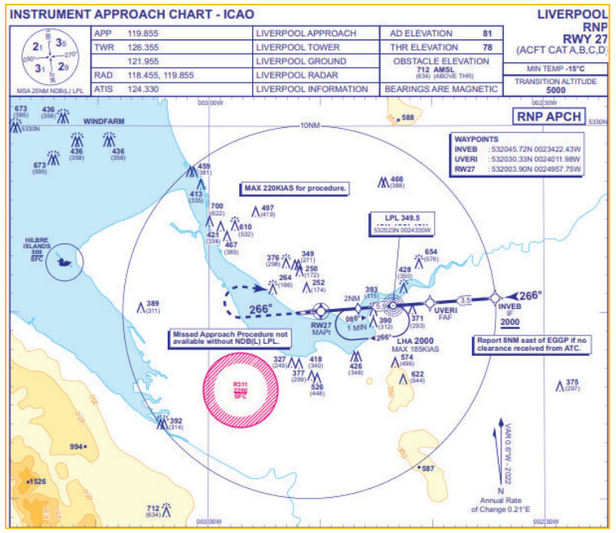

Figure 65 - RNP RWY 27 Procedure

Arrival to the RNP RWY 27 procedure is published as '*At or Above 2500ft*' and would not be affected.

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 27.

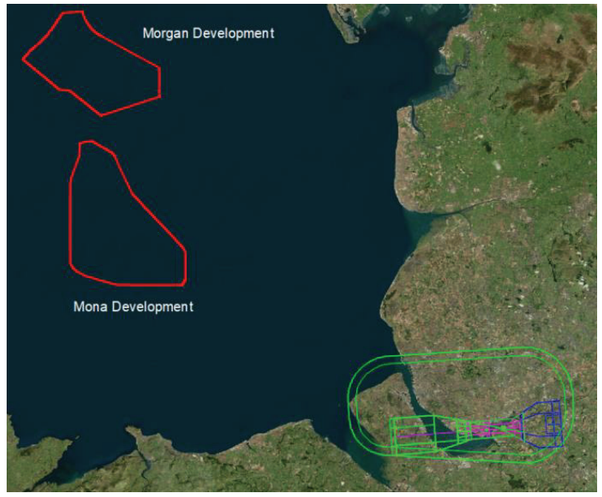

Figure 66 - RNP RWY 27 Protection Area

The Windfarm would not impact the published RNP RWY 27 procedure.

3.2.15 AD 2.EGGP-8-9 NDB(L)/DME RWY 27

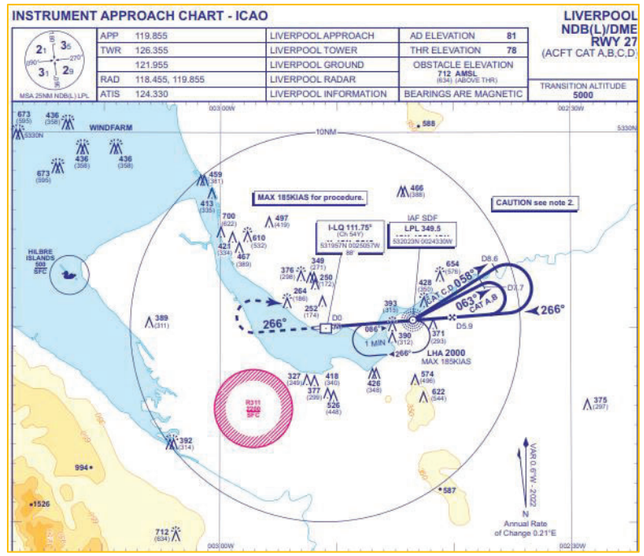

Figure 67 - NDB(L)/DME RWY 27 Procedure

Arrival to the NBD(L)/DME RWY 27 procedure is published as *'At or Above 2500ft'* and would not be affected.

Both windfarms lie outside the protection areas associated to the Procedure to Runway 27.

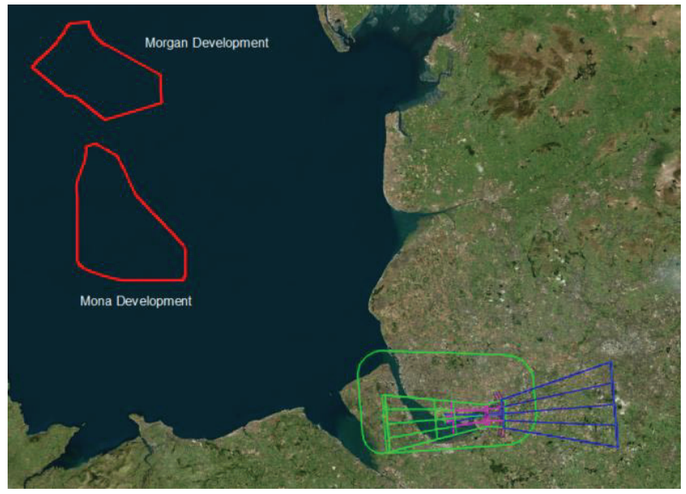

Figure 68 - NDB(L)/ DME RWY 27 Procedure

The Windfarm would not impact the published NDB(L) DME RWY 27 procedure.

3.2.16 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

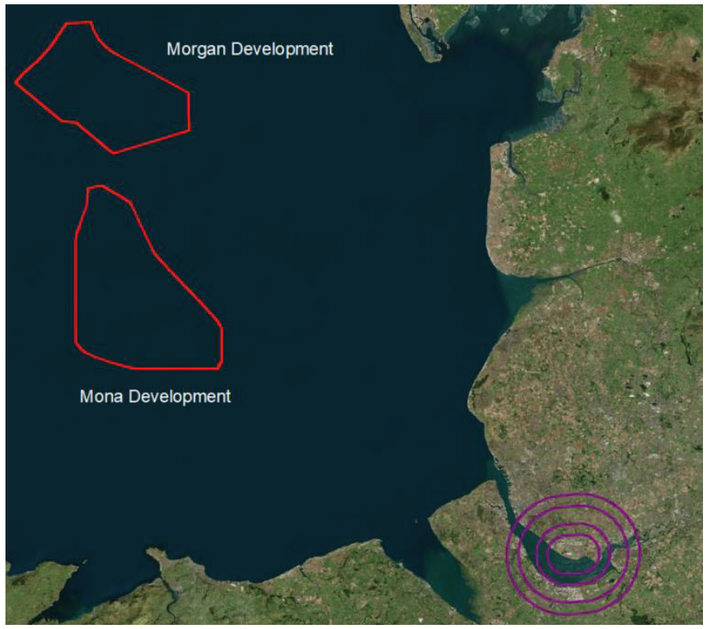

Figure 69 - Visual Circling Protection Areas

The proposed windfarms would have no impact on the Visual Circling.

3.2.17 Holding

NDB(L) LPL Hold

The NDB(L) LPL Hold has an existing Lowest Holding Altitude (LHA) of 2000ft.

With a maximum MOC of 300m the proposed Windfarm would potentially impact the hold:

324m + 300m MOC = 624m / 2048ft AMSL

Existing Lowest Holding Altitude (LHA) = 2000ft

However, further analysis has deemed that both windfarms lie outside the protection areas associated to the NDB(L) LPL Hold, including its buffers – therefore there will be no impact on the NDB(L) LPL Hold.

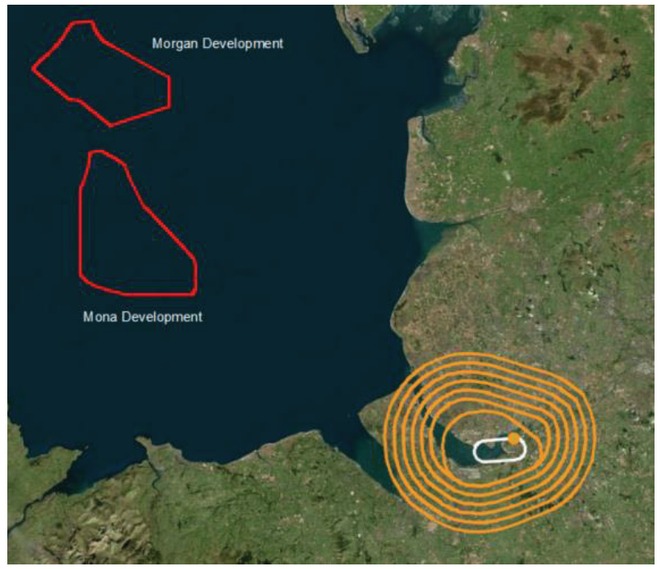

Figure 70 - NDB(L) LPL Hold and Protection Area and Buffers

The proposed windfarms would have no impact on the NDB(L) LPL Hold for Liverpool Airport.

3.2.18 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Liverpool Airport Runways.

3.2.19 Minimum Sector Altitudes (MSA)

MSA 25NM NDB(L) LPL

The windfarms lie outside the MSA 25NM NDB(L) LPL including the buffer and will have no impact.

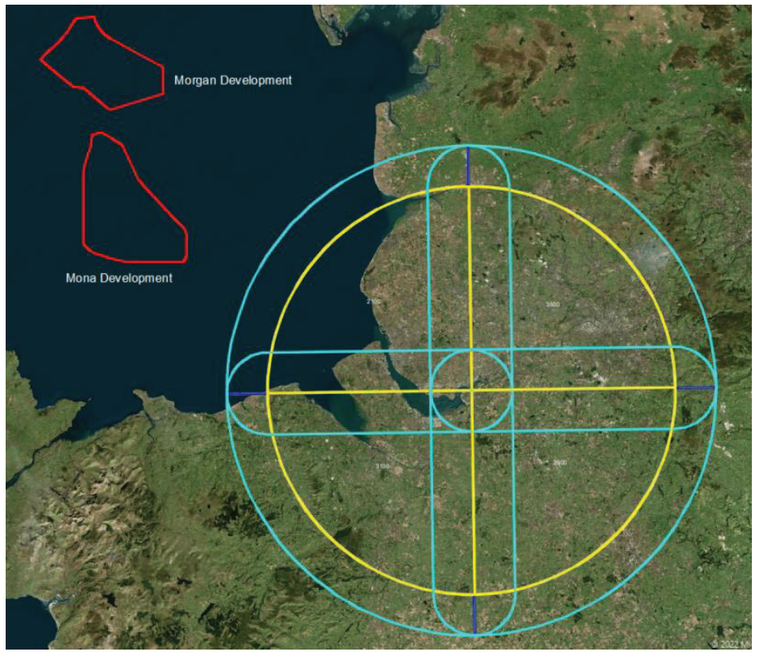

Figure 71 - MSA NDB(L) LPL Area including Buffer

The proposed windfarms would have no impact on the published NDB(L) LPL MSA.

MSA 25NM ARP

We have additionally protected for an MSA of 25NM based on the ARP as this was used for the ATCSMAC at Liverpool.

Figure 72 - MSA 25NM ARP

The proposed windfarms would have no impact on the MSA 25NM from the ARP.

4 BAE Warton Airport OLS and IFP Assessment

4.1 OLS Assessment

4.1.1 Overview

The OLS for Warton Airport has been constructed in accordance with Annex 14 and CAP 168.

4.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA
1	2	3	4	5
07	2420 M	2697 M	2420 M	2356 M
25	2341 M	2490 M	2341 M	2341 M

Figure 73 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
07	071.15°	2422 x 46 M	RWY surface: Asphalt, Grooved PCN 47/F/C/W/T	534429.78N 0025401.22W 171.0 FT	THR 30.1 FT	RWY 07 0.003% Up RWY 25 0.003% Down
25	251.18°	2422 x 46 M	RWY surface: Asphalt, Grooved PCN 47/F/C/W/T	534454.39N 0025159.51W 171.0 FT	THR 54.5 FT	RWY 07 0.003% Up RWY 25 0.003% Down

Figure 74 - Threshold Distances

Runway 07 is a CODE 4, Non-Precision Runway (**Lowest threshold, 9.18m**)

Runway 27 is a CODE 4, Precision Instrument Runway

4.1.3 OLS Construction

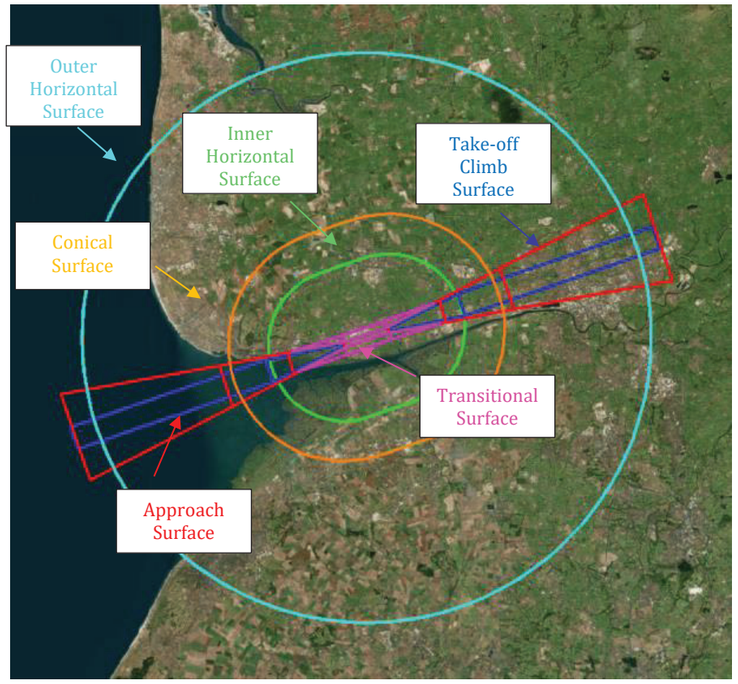

Figure 75 - OLS for Warton Airport

Figure 76 - Warton OLS in Relation to Windfarms

4.1.4 OLS Analysis

Both windfarms lie entirely outside of the boundaries of the OLS for Warton, and it is not affected by the development.

The proposed windfarms will have no impact on the OLS for Warton Airport.

4.2 IFP Assessment

Warton is a Civilian aerodrome with Military aerodrome charts.

The ATCSMAC and IFPs assessed are as follows:

Procedures from the UK Civil AIP

AIRAC 11/2022 (Effective 03 NOV 2022)

- AD 2.EGNO-5-1 ATCSMAC (17 JUN 21)

Procedures from the UK Mil AIP

AIRAC 2211 (Effective 03 Nov 22 to 01 Dec 22)

- AD 2 EGNO-1-5 ATC Surveillance MNM Altitude (16 JUN 22);
- AD 2 EGNO-1-7 SRA RWY 07 0.5NM (16 JUN 22);
- AD 2 EGNO-1-8 SRA RWY07 2NM (16 JUN 22);
- AD 2 EGNO-1-9 SRA RWY 25 0.5NM (16 JUN 22);
- AD 2 EGNO-1-10 SRA RWY 25 2NM (16 JUN 22);
- AD 2 EGNO-1-11 NDB to ILS/DME RWY 25 (16 JUN 22);
- AD 2 EGNO-1-12 TAC to ILS/DME RWY 25 (16 JUN 22);
- AD 2 EGNO-1-13 HI-TAC to ILS/DME RWY 25 (16 JUN 22);
- AD 2 EGNO-1-14 DCT ARR POL to ILS/DME RWY 25 (16 JUN 22);
- AD 2 EGNO-1-15 NDB/DME RWY 07 (16 JUN 22);
- AD 2 EGNO-1-16 NDB RWY 07 (16 JUN 22);
- AD 2 EGNO-1-17 DCT ARR WAL to NDB/DME RWY 07 (16 JUN 22);
- AD 2 EGNO-1-18 TAC RWY 07 (16 JUN 22);
- AD 2 EGNO-1-19 TAC RWY 25 (16 JUN 22);
- AD 2 EGNO-1-20 HI-TAC RWY 07 (16 JUN 22);
- AD 2 EGNO-1- 21 HI TAC RWY 25 (16 JUN 22).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

4.2.1 AD 2 EGNO-1-5 ATC Surveillance MNM Altitude

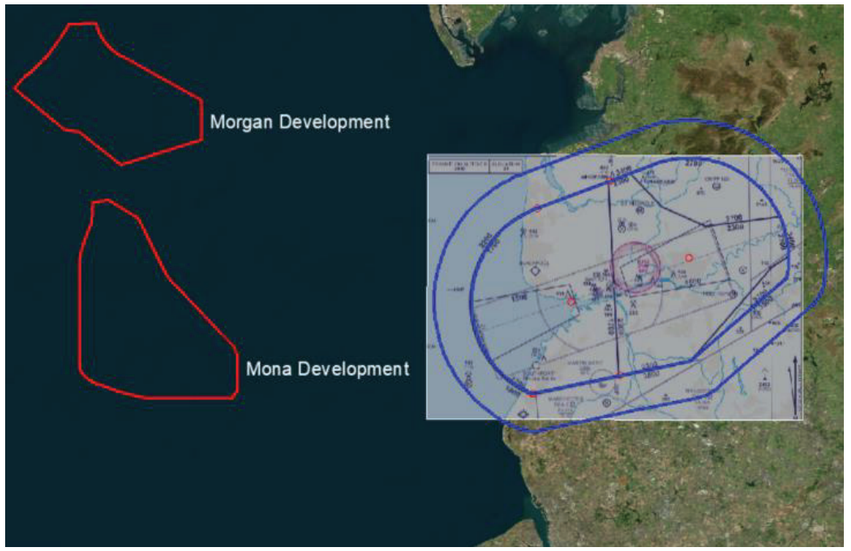

Figure 77 - Windfarms in Relation to ATCSMAC

The Civil and Military ATCSMAC are identical so only one assessment is necessary.

Both windfarms lie outside the lateral buffer of all Surveillance Minimum Altitude Areas (SMAAs).

The proposed windfarms would not impact Warton Airport's ATCSMAC.

4.2.2 AD 2 EGNO-1-7 SRA RWY 07 0.5NM

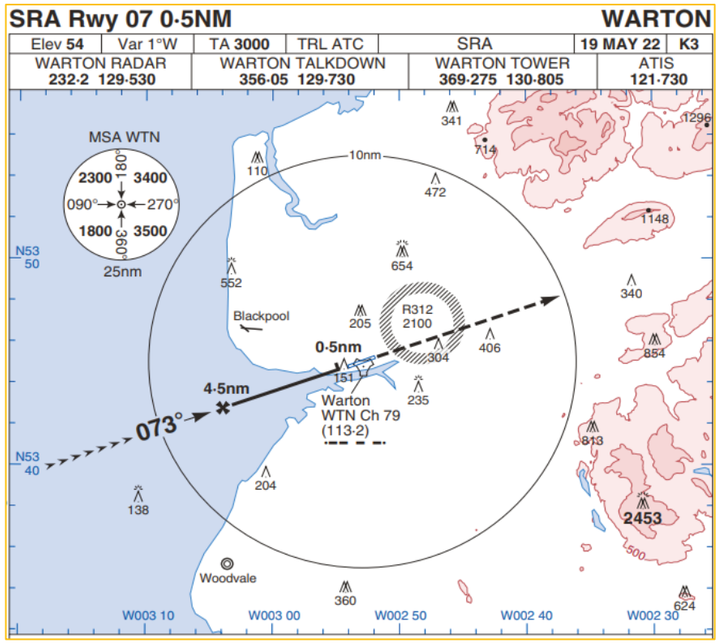

Figure 78 - SRA RWY 07 0.5NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 07 with a Missed Approach Point at 0.5NM.

The Missed Approach continues east, away from the windfarms and climbs to 3400ft, common to the MSA WTN north-east sector, and will not be affected.

Figure 79 - SRA RWY 07 0.5NM Protection Areas

Arrival to the procedure could be conducted using the ATCSMAC OR MSA to conduct radar vectoring until reaching the FAF at 1500ft.

The ATCSMAC has been considered in section 4.2.1 and the MSA WTN in section 4.2.18.

The proposed windfarms would not impact the published SRA RWY 07 0.5NM procedure.

4.2.3 AD 2 EGNO-1-8 SRA RWY07 2NM

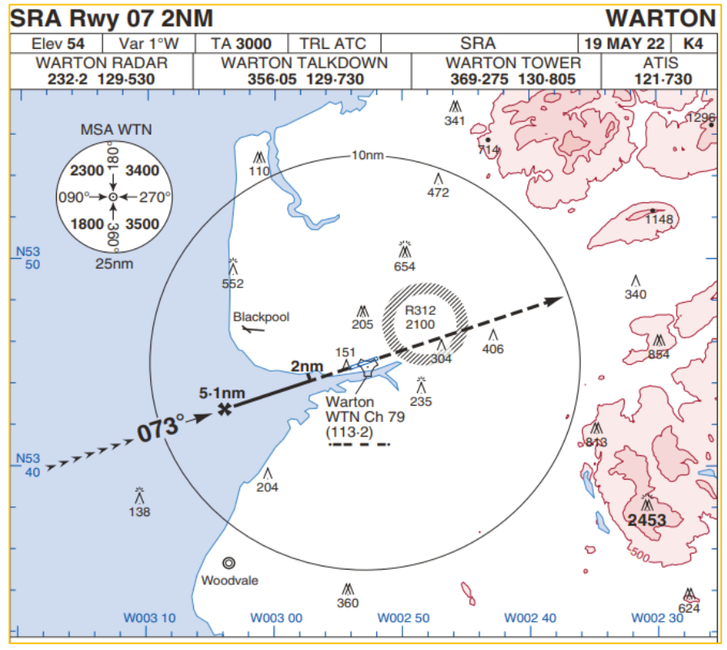

Figure 80 - SRA RWY 07 2NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 07 with a Missed Approach Point at 2NM.

The Missed Approach continues east, away from the windfarms and climbs to 3400ft, common to the MSA WTN north-east sector, and will not be affected.

Arrival to the procedure could be conducted using the ATCSMAC OR MSA to conduct radar vectoring until reaching the FAF at 1700ft.

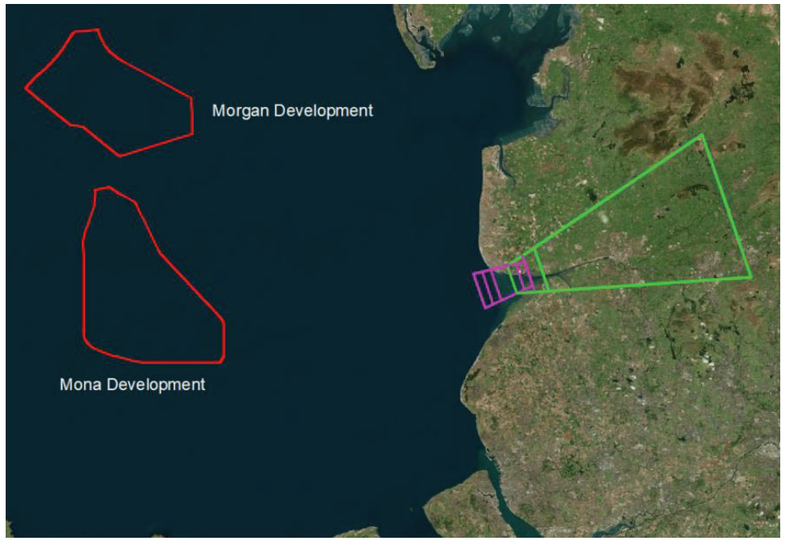

Figure 81 - SRA RWY 07 2NM Protection Areas

The proposed windfarms would not impact the published SRA RWY 07 2NM procedure.

4.2.4 AD 2 EGNO-1-9 SRA RWY 25 0.5NM

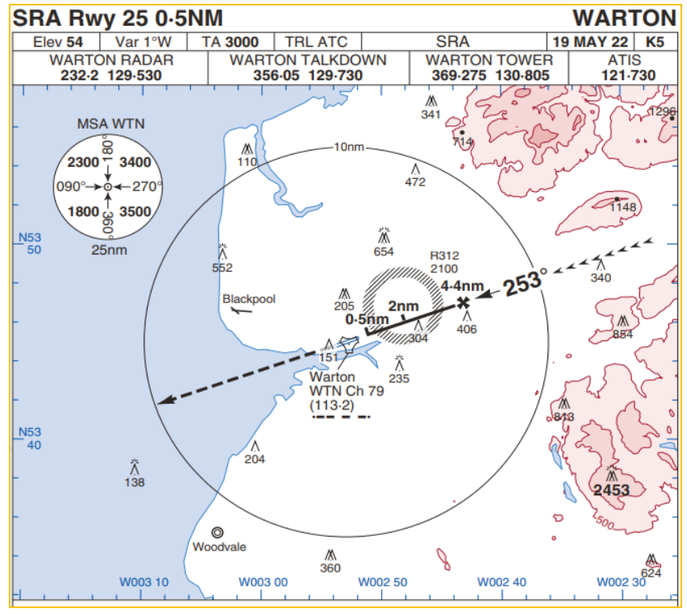

Figure 82 - SRA RWY 25 0.5NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 25 with a Missed Approach Point at 0.5NM.

The Missed Approach text is as follows:

'Climb on Rwy Tr to 2000 1950'.

Aircraft are required to climb to 2000ft QNH in the Missed Approach, ahead on the runway track, towards the vicinity of the Mona development, as shown in Figure 83.

Whilst the windfarms lie outside the protection areas for the SRA RWY 25 0.5NM procedure, they could impact the Missed Approach which requires a climb to 2000ft which is below the required MOCA required at the windfarms with an elevation of 324m AMSL and applying a MOC of 300m:

324m + 300m MOC = 624m / 2048ft AMSL

The point at which aircraft will reach the 2000ft Missed Approach altitude at the point shown in Figure 83.

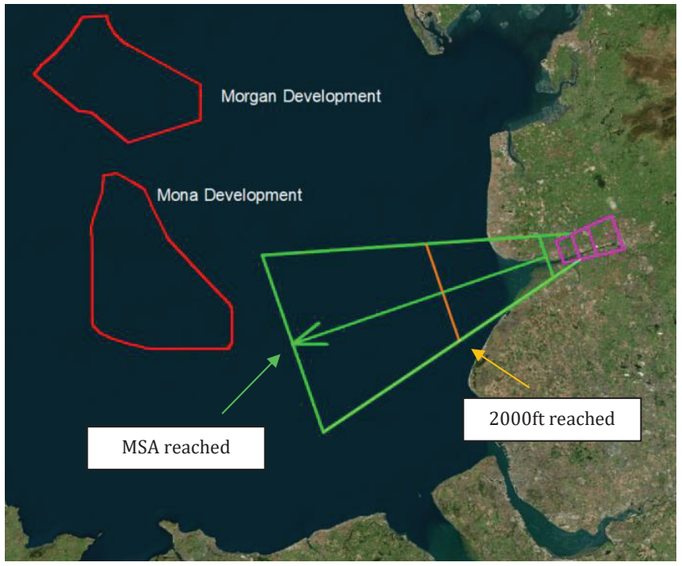

Figure 83 - SRA RWY 25 0.5NM Protection Areas

The MSA WTN 25NM boundary is shown in Figure 83 and the Mona development lies in the buffer area of the 1800ft area. This has been considered in section 4.2.20.

The proposed windfarms would not impact the published SRA RWY 25 0.5NM procedure. See Section 4.2.20 for MSA Impact that may impact arrival and Missed Approach for this procedure.

4.2.5 AD 2 EGNO-1-10 SRA RWY 25 2NM

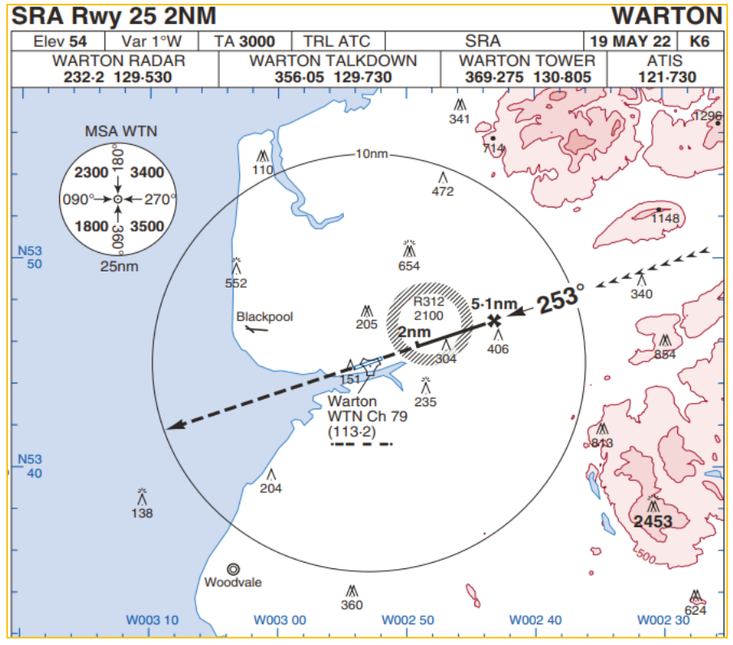

Figure 84 - SRA RWY 25 2NM Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 25 with a Missed Approach Point at 2NM.

The Missed Approach text is as follows:

'Climb on Rwy Tr to 2000 1950'.

Aircraft are required to climb to 2000ft QNH in the Missed Approach, ahead on the runway track, towards the vicinity of the Mona development as shown in Figure 85.

As with the previous procedure in section 4.2.4, whilst the windfarms lie outside the protection areas for the SRA RWY 25 2NM procedure, they could impact the Missed Approach which requires a climb to 2000ft which is below the required MOCA required at the windfarms.

The point at which aircraft will reach the 2000ft Missed Approach altitude at the point shown in Figure 85.

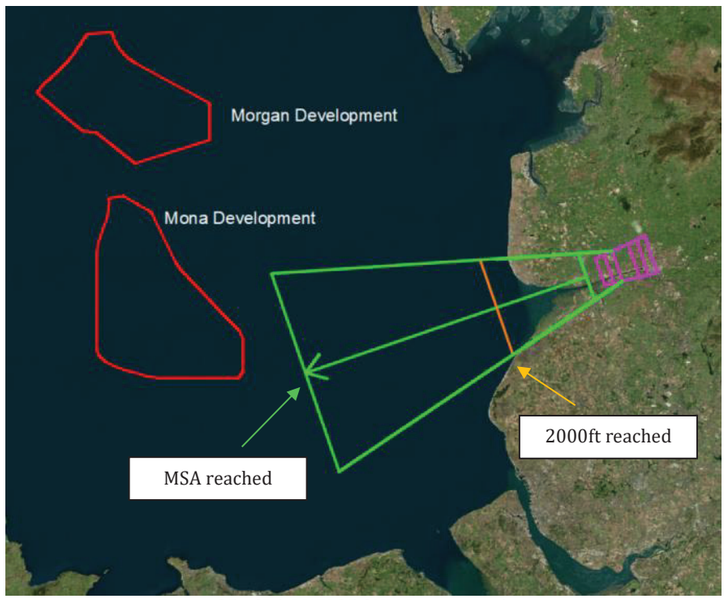

Figure 85 - SRA RWY 25 2NM Protection Area

The proposed windfarms would not impact the published SRA RWY 25 2NM procedure. **See Section 4.2.20 for MSA Impact that may impact arrival and Missed Approach for this procedure.**

4.2.6 AD 2 EGNO-1-11 NDB to ILS/DME RWY 25

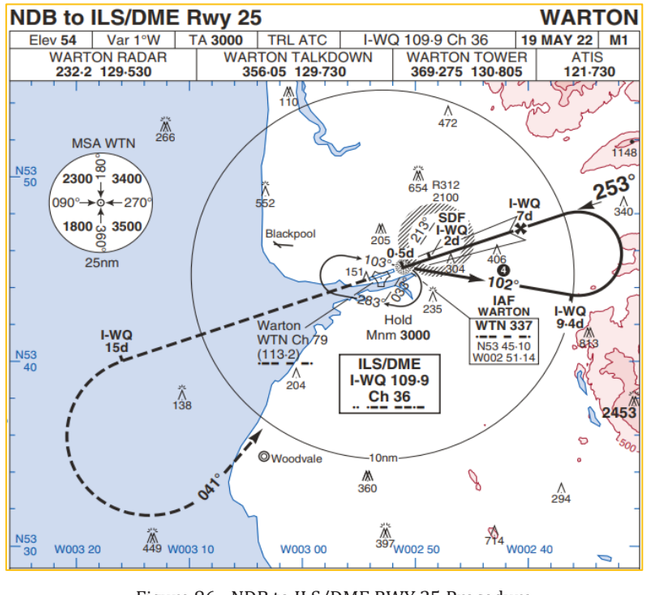

Figure 86 - NDB to ILS/DME RWY 25 Procedure

COMMERCIAL IN CONFIDENCE

Both windfarms lie outside the protection areas for the NDB to ILS/DME RWY procedure to runway 25 and will have no impact.

This includes the Missed Approach which climbs to 3000ft and turns left, away from the windfarms.

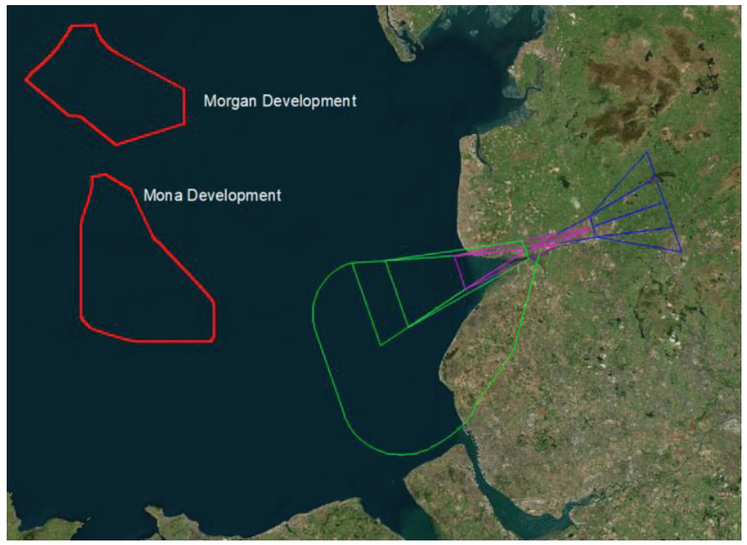

Figure 87 - NDB to ILS/DME RWY 25 Protection Areas

Additionally, the reversal procedure from NDB WTN, published on the approach chart has been constructed:

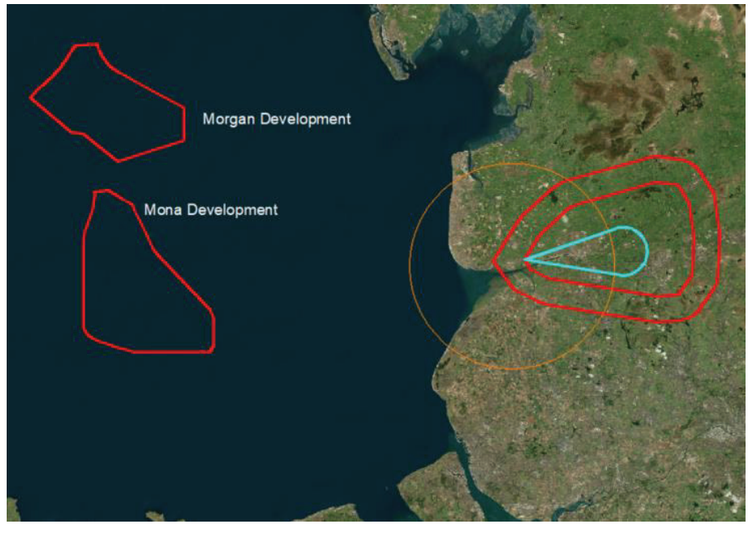

Figure 88 - NDB to ILS/DME RWY 25 Base turn Protection Area

Both windfarms lie outside the protection area for the Base turn and will not impact the reversal procedure.

The Hold from NDB WTN has been considered in section 4.2.18.

The proposed windfarms will not impact the published NDB to ILS/DME RWY 25 procedure.

4.2.7 AD 2 EGNO-1-12 TAC to ILS/DME RWY 25

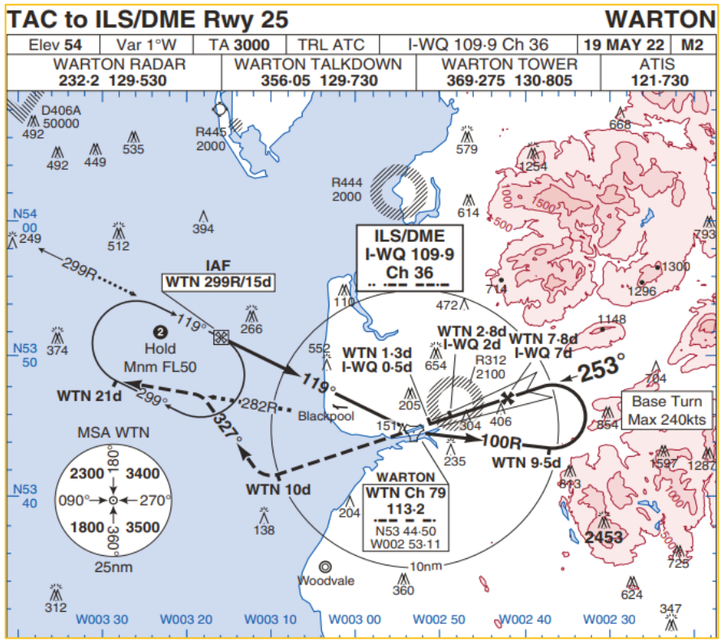

Figure 89 - TAC to ILS/DME RWY 25

Both windfarms lie outside the protection area for the TACAN approach to ILS/DME to RUNWAY 25, including the Missed Approach area and will have no impact to the procedure.

Aircraft will be at 5000ft at the IAF at the NDB WTN Hold which is above the MOCA required at the windfarms. The procedure then heads west, away from the windfarms.

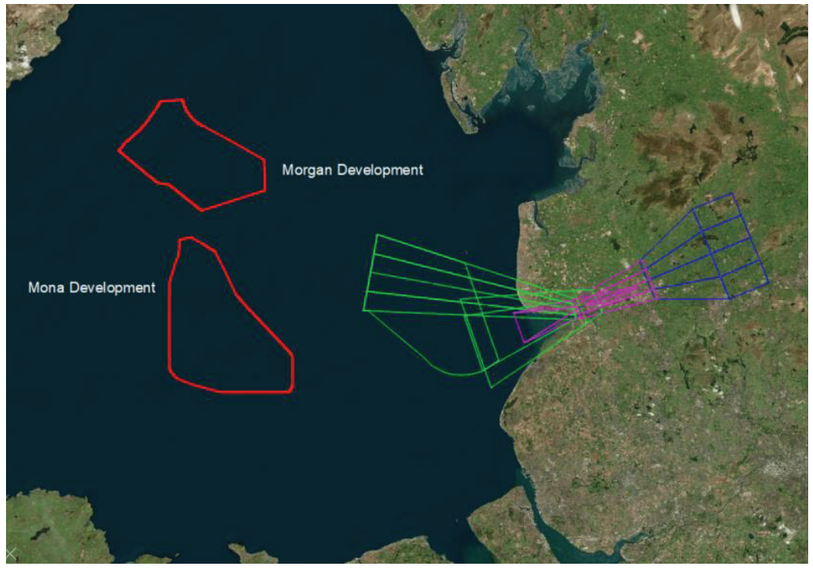

Figure 90 - TAC to ILS/DME RWY 25 Protection Areas

Additionally, the procedure features a reversal Base turn. The minimum altitude within the Base turn is 2560ft which is above the MOCA required at the windfarms which will have no impact to the procedure.

The proposed windfarms will not impact the published TAC to ILS/DME RWY 25 procedure.

4.2.8 AD 2 EGNO-1-13 HI-TAC to ILS/DME RWY 25

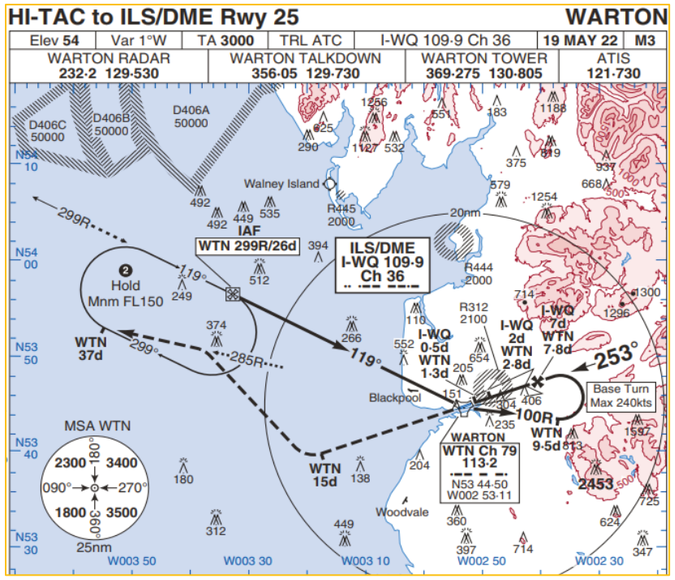

Figure 91 – HI-TAC to ILS/DME RWY 25

Both windfarms lie outside the protection areas for the ILS as considered in section 4.2.7 and will have no impact.

However, both windfarms lie within the protection area of the Final Missed Approach area associated with the HI-TAC to ILS/DME RWY 25 and could impact the procedure:

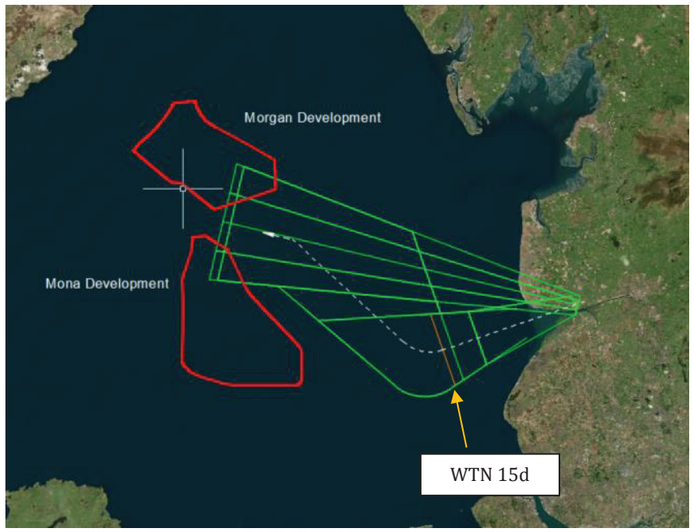

Figure 92 - HI-TAC to ILS/DME, Final Missed Approach Protection Areas

This Missed Approach Text is as follows:

Climb on Rwy Tr to 2060 2000. At WTN 15d right onto 285R oubd, climbing to FL150 and join high WTN hold at 285R/37d.

Aircraft are required to climb to 2060ft before turning at WTN 15d which is shown in figure 92 and are, at this point, already above the MOCA required at the windfarms.

Using the MOC for the Missed Approach of 50m and Windfarm elevation of 324m, aircraft should be at a minimum altitude of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

The High WTN Hold has a minimum altitude of FL150 and will not be affected and is considered in section 4.2.18.

The proposed windfarms will not impact the published HI-TAC to ILS/DME RWY 25 procedure.

4.2.9 AD 2 EGNO-1-14 DCT ARR POL to ILS/DME RWY 25

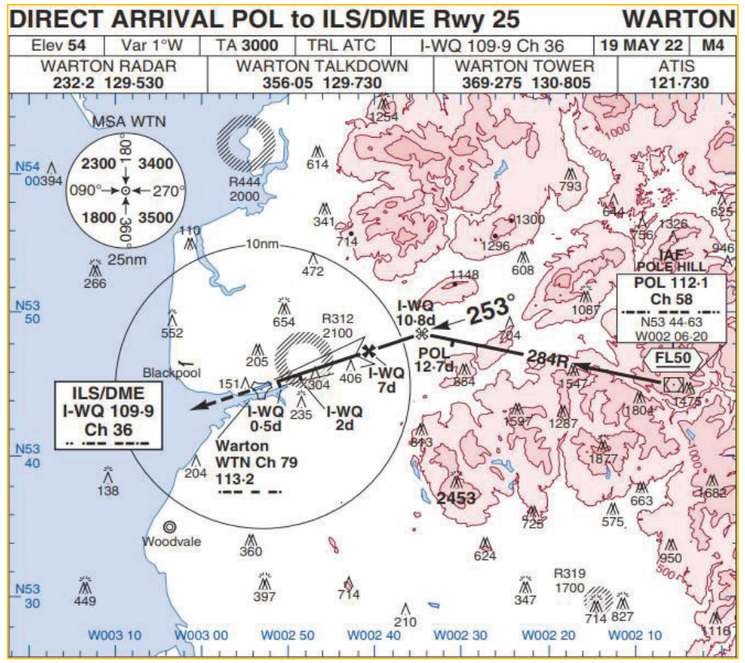

Figure 93 - DIRECT ARRIVAL POL to ILS/DME RWY 25 Procedure

Both windfarms lie outside the protection areas associated with the Direct Arrival procedure from POL VOR to the ILS/DME for runway 25.

Figure 94 - DIRECT ARRIVAL from POL to ILS/DME RWY 25 Protection Areas

The DME/ILS procedure protection areas has already been assessed along with the Missed Approach in section 4.2.7 and will not be affected.

The proposed windfarms will not impact the published DIRECT ARRIVAL POL to ILS/DME RWY 25 procedure.

4.2.10 AD 2 EGNO-1-15 NDB/DME RWY 07

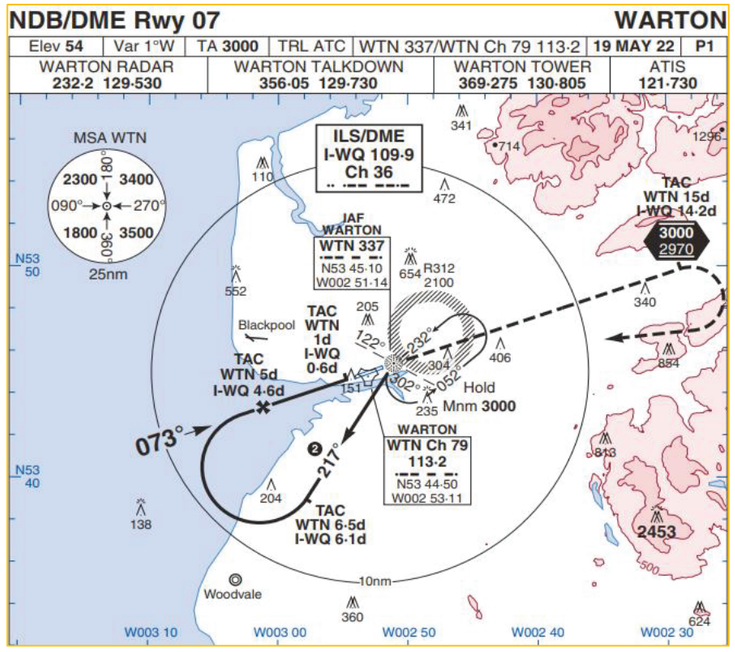

Figure 95 - NDB/DME RWY 07 Procedure

Both windfarms lie outside the protection areas for the NDB/DME procedure to runway 07, including the Missed Approach which heads east, away from the windfarms and will have no impact.

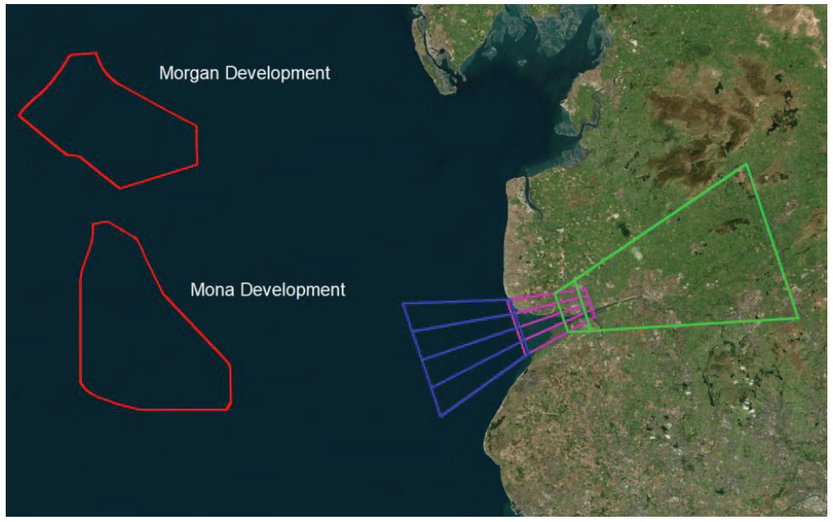

Figure 96 - NDB/DME RWY 07 Protection Areas

The procedure reversals published on the approach chart allows aircraft to descend to 1530ft at the FAF. The protection area for the Base turn has been constructed:

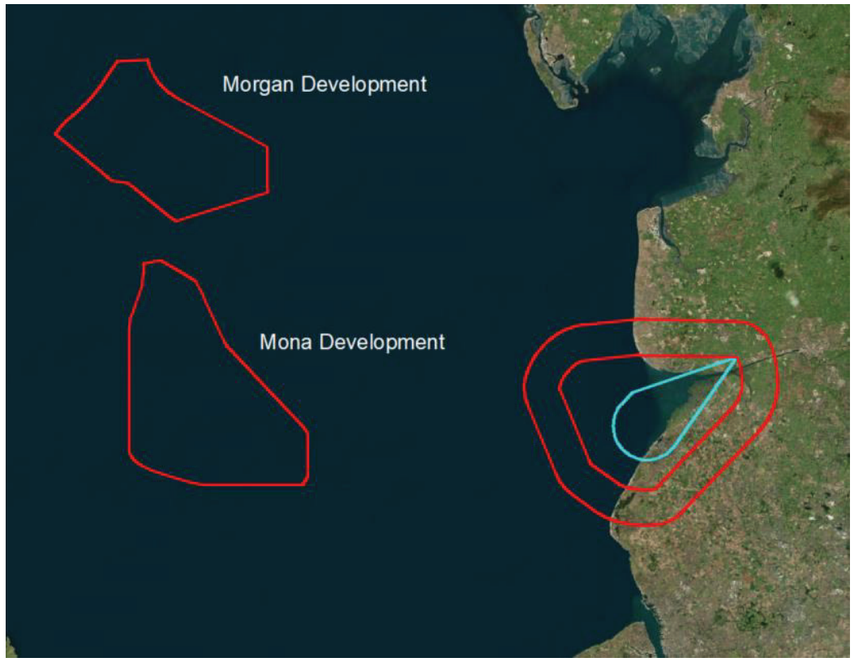

Figure 97 – NDB/DME RWY 25 TAC WTN Base turn Protection Areas

Both windfarms lie outside the protection area for the procedure reversal published on the NDB/DME RWY 25 chart. The NDB WTN Hold has been considered in section 4.2.18.

The proposed windfarms will not impact the published NDB/DME RWY 25 procedure.

4.2.11 AD 2 EGNO-1-16 NDB RWY 07

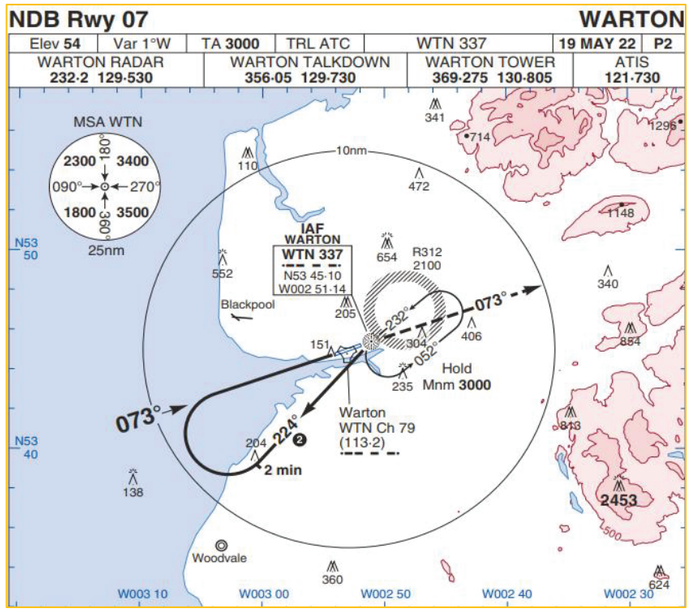

Figure 98 - NDB RWY 07 Procedure

Both windfarms lie outside the protection areas for the NDB procedure to runway 07 and will have no impact.

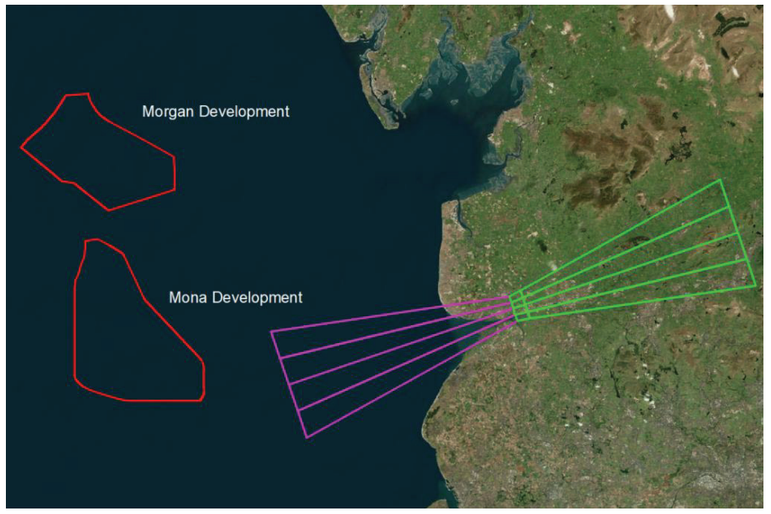

Figure 99 - NDB RWY 07 Protection Areas

The procedure reversals published on the approach chart allows aircraft to descend to 1730ft in the Base turn. The protection area for the base turn has been constructed:

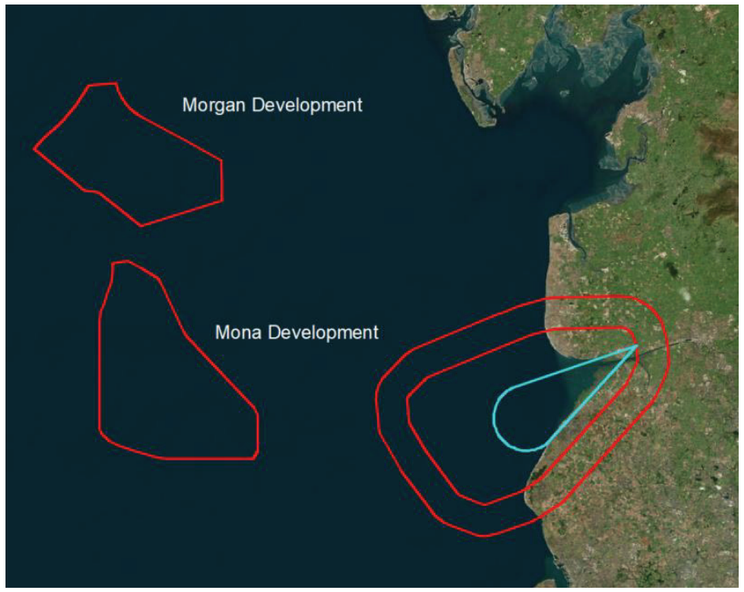

Figure 100 - NDB RWY 07 TAC WTN Base turn Protection Area

Both windfarms lie outside the protection area for the procedure reversal published on the NDB RWY 25 chart.

The proposed windfarms will not impact the published NDB RWY 25 procedure.

4.2.12 AD 2 EGNO-1-17 DCT ARR WAL to NDB/DME RWY 07

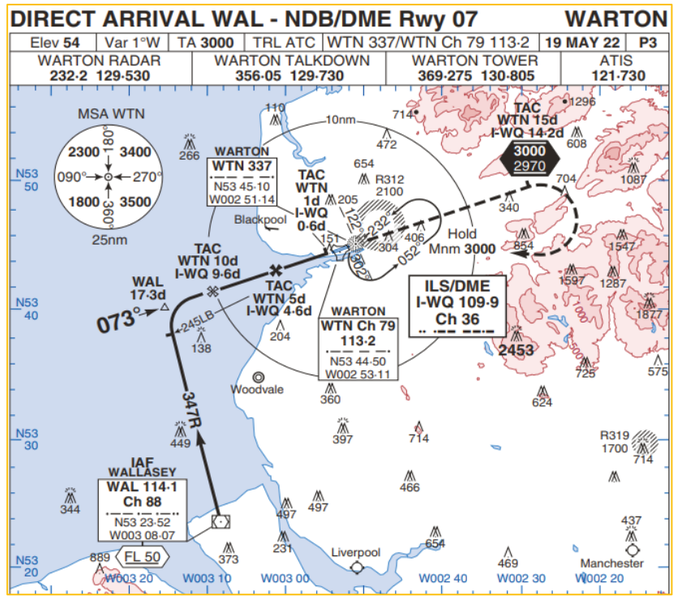

Figure 101 - DIRECT ARRIVAL WAL - NDB/DME RWY 07 Procedure

Both windfarms lie outside the protection areas for the DIRECT ARRIVAL from WAL VOR to the NDB/DME procedure to runway 07, which has already been assessed in section 4.2.10 and will have no impact.

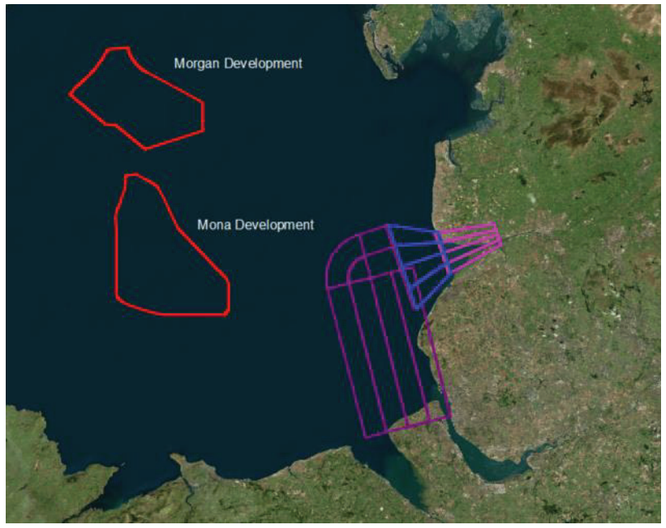

Figure 102 - DIRECT ARRIVAL WAL to NDB/DME RWY 07 Protection Areas

The proposed windfarms will not impact the published DIRECT ARRIVAL WAL to NDB/DME RWY 07 procedure.

4.2.13 AD 2 EGNO-1-18 TAC RWY 07

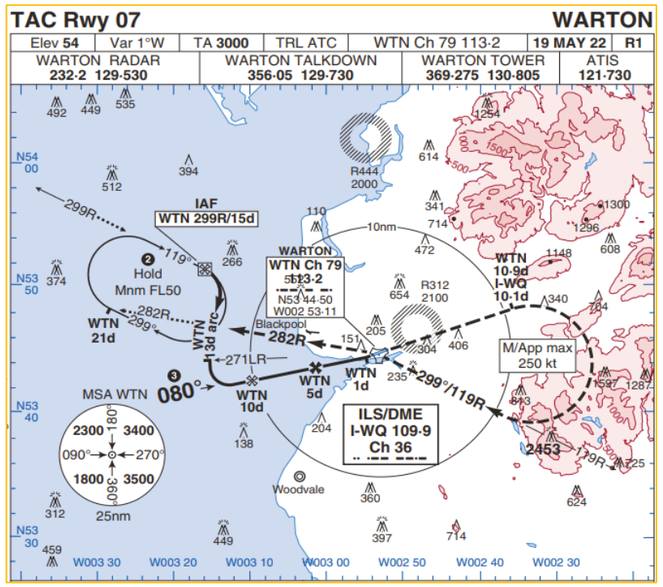

Figure 103 - TAC RWY 07 PROCEDURE

The windfarms lie outside of the protection areas for the TAC approach procedure, including the Missed Approach, to runway 07 and will have no impact.

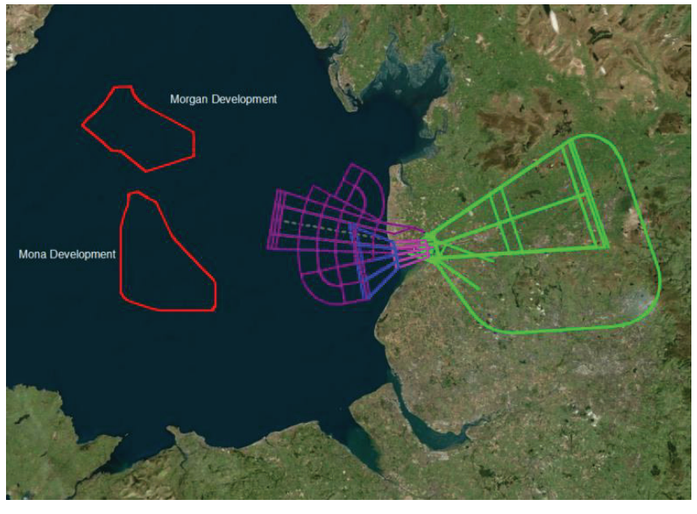

Figure 104 - TAC RWY 07 Protection Areas

Arrival to the procedure is via the IAF at the WTN Hold at a minimum altitude of FL50 and will not be affected.

The proposed windfarms will not impact the published TAC RWY 07 procedure.

4.2.14 AD 2 EGNO-1-19 TAC RWY 25

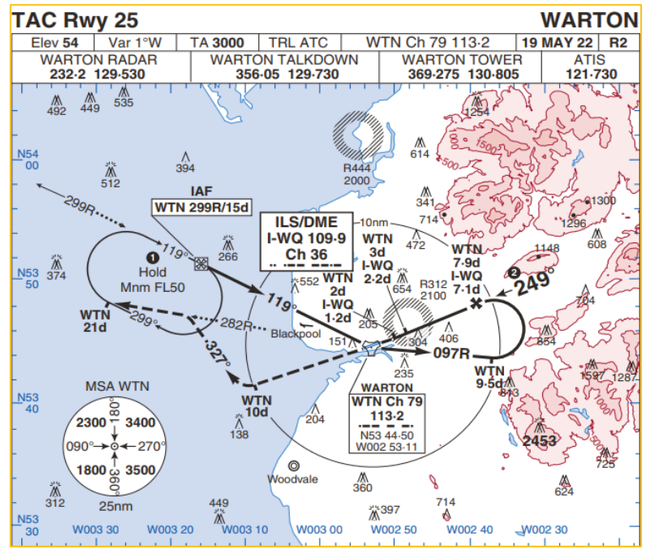

Figure 105 - TAC RWY 25 Procedure

The windfarms lie outside of the protection areas for the TAC approach procedure, including the Missed Approach, to runway 25 and will have no impact.

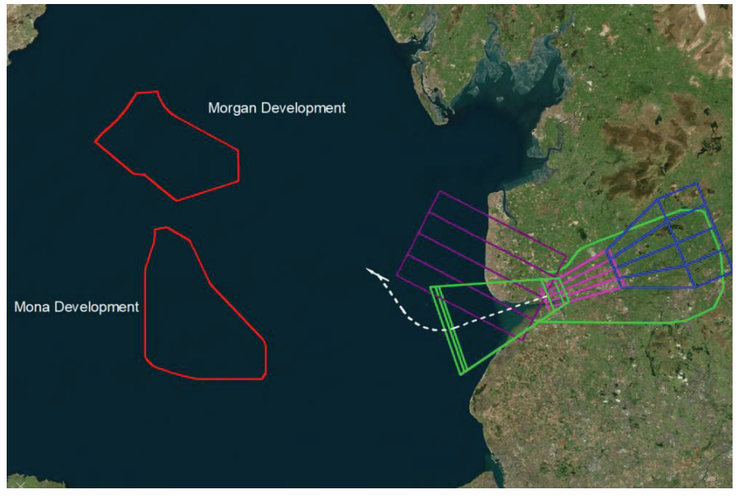

Figure 106 - TAC RWY 25 Protection Areas

Arrival to the procedure is via the IAF at the WTN Hold at a minimum altitude of FL50 and will not be affected.

The proposed windfarms will not impact the published TAC RWY 25 procedure.

4.2.15 AD 2 EGNO-1-20 HI-TAC RWY 07

The TAC approach procedure to runway 07 has been assessed in section 4.2.13 and will not be affected by the windfarms.

Arrival to the procedure via the IAF at WTN Hold is at FL150 is above the MOCA required at the windfarms.

The proposed windfarms will not impact the published HI-TAC RWY 07 procedure.

4.2.16 AD 2 EGNO-1- 21 HI TAC RWY 25

The TAC approach procedure to runway 25 has been assessed in section 4.2.14 and will not be affected by the windfarms.

Arrival to the procedure via the IAF at WTN Hold at FL150 and is above the MOCA required at the windfarms.

The proposed windfarms will not impact the published HI-TAC RWY 25 procedure.

4.2.17 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C, D and E).

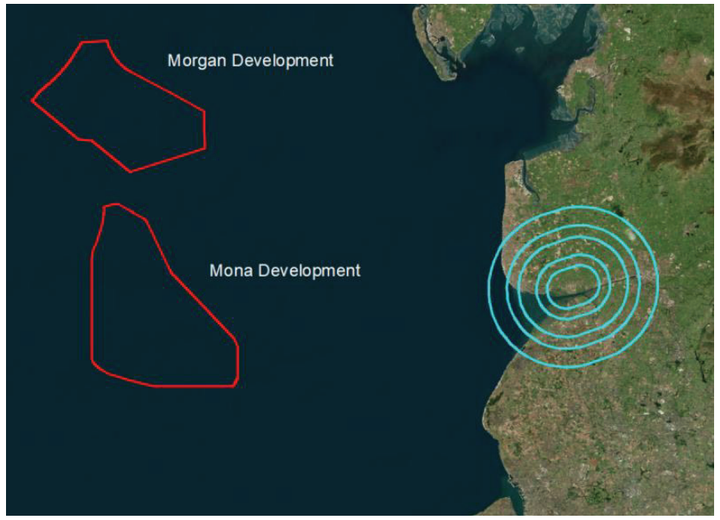

Figure 107 - Visual Circling

The proposed windfarms would have no impact on the Visual Circling at Warton.

4.2.18 Holding

NDB WTN Hold (All Entries)

The NDB WTN Hold has a published minimum altitude of 3000ft.

With a maximum MOC of 300m, the windfarms would not impact the hold:

- 324m + 300m MOC = 624m / 2048ft AMSL
- Published minimum altitude = 3000ft

WTN IAF Hold

The WTN IAF Hold has a published minimum altitude of FL50.

With a maximum MOC of 300m, the windfarms would not impact the hold:

- 324m + 300m MOC = 624m / 2048ft AMSL
- Published minimum altitude = 5000ft

High WTN Hold

The High WTN Hold has a published minimum altitude of FL150.

With s maximum MOC of 300m, the windfarms would not impact the hold:

- 324m + 300m MOC = 624m / 2048ft AMSL
- Published minimum altitude = 15,000ft

The proposed windfarms would have no impact on any of the holds for Warton Airport.

4.2.19 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Warton Airport Runways.

4.2.20 Minimum Sector Altitudes (MSA)

WTN TAC MSA 25NM

The Mona Windfarm lies within the buffer protection area of the south-western quarter of the MSA 25NM , which published MSA is 1800ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

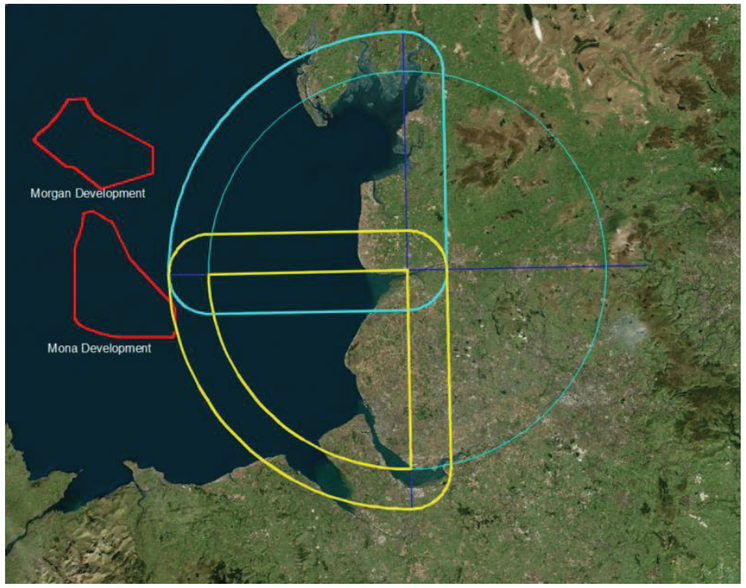

Figure 108 - WTN TAC MSA 25NM

The windfarms would produce a MOCA of 324m + 300m = 624m / 2048ft AMSL for the north-western quadrants.

This is above the SW quadrant published MSA which has a MOCA of 1800ft which will need to be increased to 2100ft to clear the wind turbines.

The proposed windfarms would cause an impact on the published WTN TAC MSA.

WTN NDB MSA 25NM

This report also considers an MSA based on the WTN NDB due to the ATCSMAC being based on the NDB.

Both windfarms lie outside the WTN NDB MSA, including the buffer protection area.

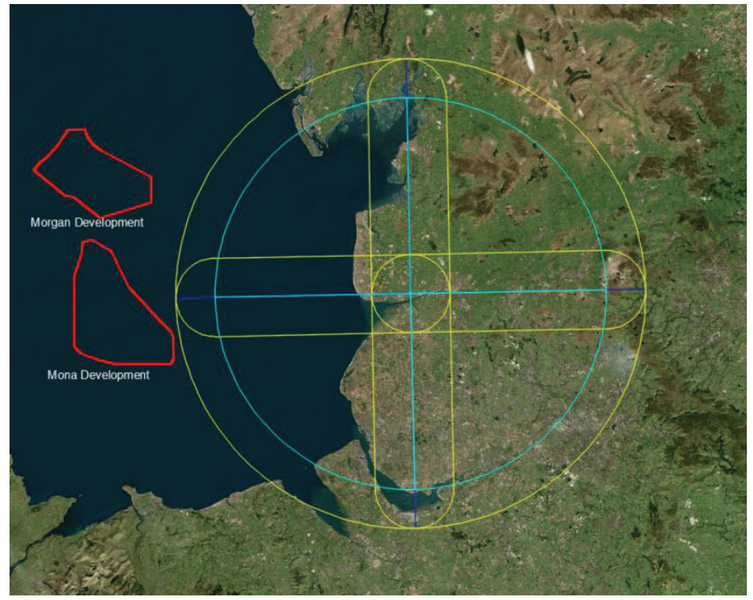

Figure 109 - WTN NDB MSA 25NM

The proposed windfarms would have no impact on the WTN NDB MSA 25NM.

Although there is no impact to the WTN NDB MSA, it is likely this would be raised to remain consistent with the WTN TAC MSA.

5 Isle of Man Ronaldsway Airport OLS and IFP Assessment

5.1 OLS Assessment

5.1.1 Overview

The OLS for Warton Airport has been constructed in accordance with Annex 14 and CAP 168.

5.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA	Remarks
1	2	3	4	5	6
08	1877 M	2815 M	1877 M	1586 M	
26	1909 M	2057 M	1909 M	1613 M	
08	1754 M	2631 M	1754 M		Full width departures
08	1495 M	2242 M	1495 M		Take-off from intersection of Taxiway Bravo
26	1759 M	1907 M	1759 M		Full width departures
26	1470 M	1618 M	1470 M		Take-off from intersection of Taxiway Kilo
03	1199 M	1199 M	1199 M	1105 M	
21	1105 M	1199 M	1105 M	1105 M	

Figure 110 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
03	027.96°	1199 x 46 M	RWY surface: Asphalt PCN 28/F/B/X/T	540442.70N 0043751.73W 181.0 FT	THR 23.7 FT	
21	207.97°	1199 x 46 M	RWY surface: Asphalt PCN 28/F/B/X/T	540514.27N 0043723.22W 181.0 FT	THR 52.5 FT	
08	077.96°	1837 x 46 M	RWY surface: Asphalt PCN 48/F/C/X/T	540454.97N 0043804.49W 181.0 FT	THR 30.1 FT	
26	257.98°	1837 x 46 M	RWY surface: Asphalt PCN 48/F/C/X/T	540505.25N 0043642.55W 181.0 FT	THR 33.4 FT	

Figure 111 - Threshold Details

Runways 08 and 26 have ILS approaches and both runways are more than 1800m in length. Runways 03 and 21 are less than 1199m in length.

Runway 08 is a CODE 4, Precision Instrument Runway

Runway 26 is a CODE 4, Precision Instrument Runway

Runway 03 is a CODE 2, Non-Precision Runway (**Lowest threshold, 7.22m**)

Runway 21 is a CODE 2, Non-Precision Runway

5.1.3 OLS Construction

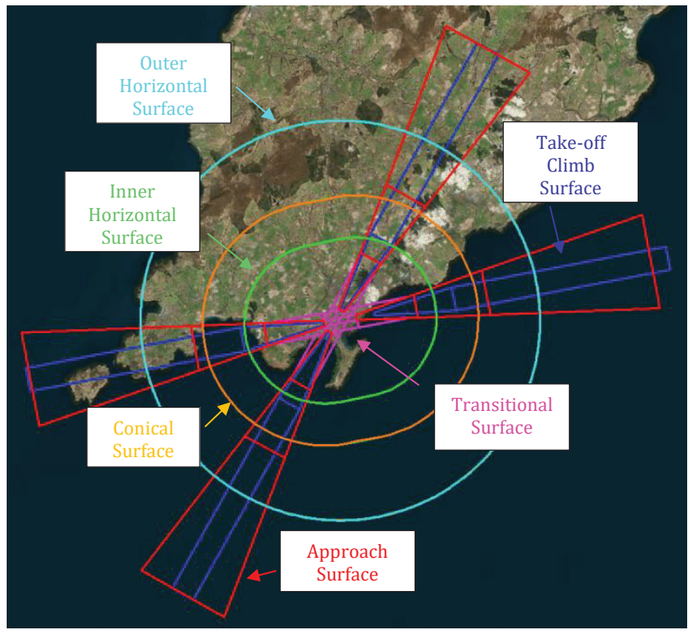

Figure 112 - OLS for Isle of Man Airport

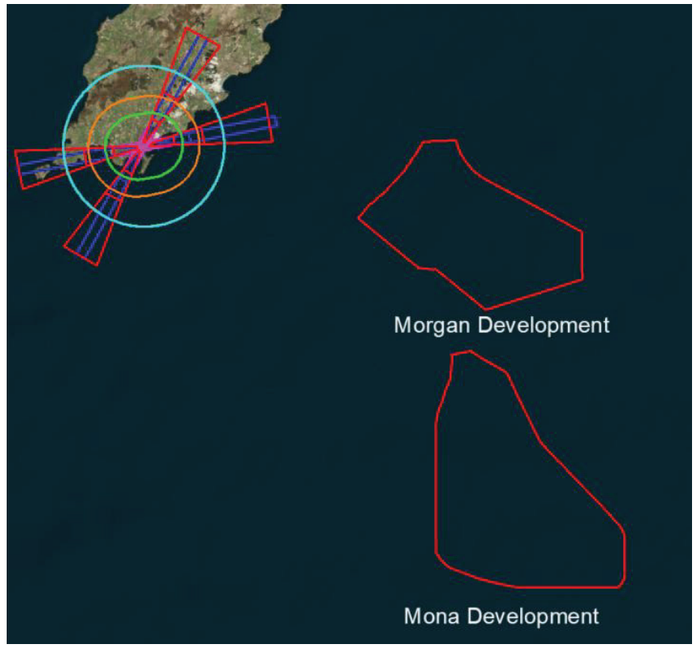

Figure 113 - Isle of Man OLS in Relation to Windfarms

5.1.4 OLS Analysis

The OLS for Isle of Man Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for Isle of Man Airport.

5.2 IFP Assessment

The ATCSMAC and IFPs assessed are as follows:

<u>AIRAC 11/2022 (Effective 03 NOV 2022)</u>

- AD 2.EGNS-5-1 ATCSMAC (24 MAR 22);
- AD 2.EGNS-8-1 SRA RTR 2NM RWY 03 (28 FEB 19);
- AD 2.EGNS-8-2 OFFSET ILS/DME RWY 08 (28 FEB 19);
- AD 2.EGNS-8-3 OFFSET LOC/DME RWY 08 (28 FEB 19);
- AD 2.EGNS-8-4 SRA RTR 2NM RWY 08 (28 FEB 19);
- AD 2.EGNS-8-5VOR/DME RWY 08 (28 FEB 19);
- AD 2.EGNS-8-6 NDB(L)/DME RWY 08 (28 FEB 19);
- AD 2.EGNS-8-7 ILS/DME RWY 26 (28 FEB 19);
- AD 2.EGNS-8-8 LOC/DME RWY 26 (28 FEB 19);
- AD 2.EGNS-8-9 SRA RTR 2NM RWY 26 (28 FEB 19);
- AD 2.EGNS-8-10 NDB(L)/DME RWY 26 (28 FEB 19).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

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5.2.1 AD 2.EGNS-5-1 ATCSMAC

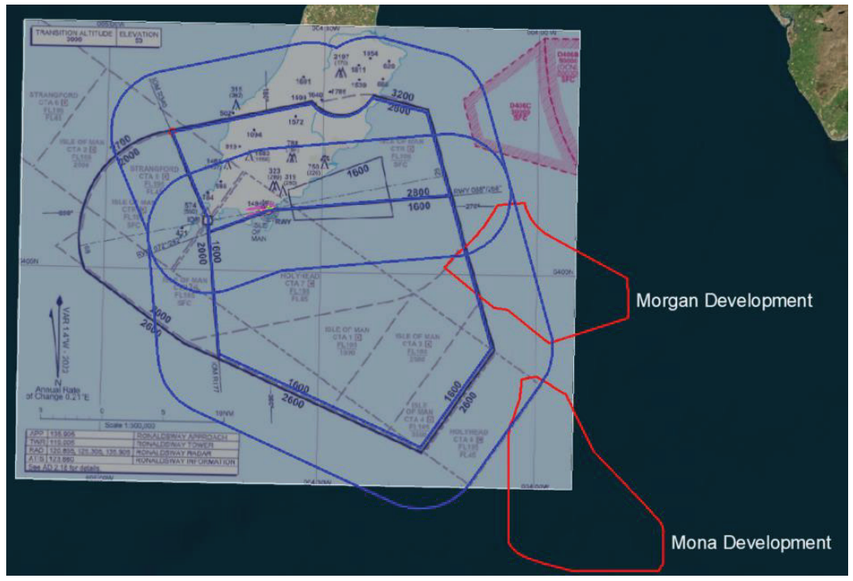

Figure 114 - Windfarms in Relation to ATCSMAC

Both windfarm developments lie within the lateral confines of the SMAA (Surveillance Minimum Altitude Area) which has a 5NM buffer applied. The area has a MOCA (Minimum Obstacle Clearance Altitude) of 1600ft.

The Morgan Windfarm development also lies in the buffer area of the 2800ft area.

Using the development elevation of 324m AMSL, the development produces an OCA of 324m + 300m MOC (Minimum Obstacle Clearance) = 624m / 2048ft AMSL.

The developments would have an impact on the Isle of Man's ATCSMAC and would require the 1600ft area to be raised to 2100ft.

5.2.2 SRA RTR 2NM RWY 03

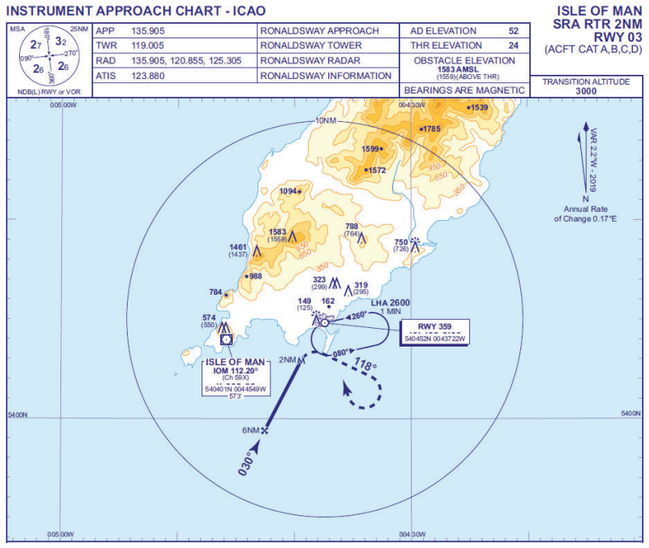

Figure 115 - SRA RWY03

The Mona windfarm lies outside the protection areas associated to the SRA to Runway 03 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

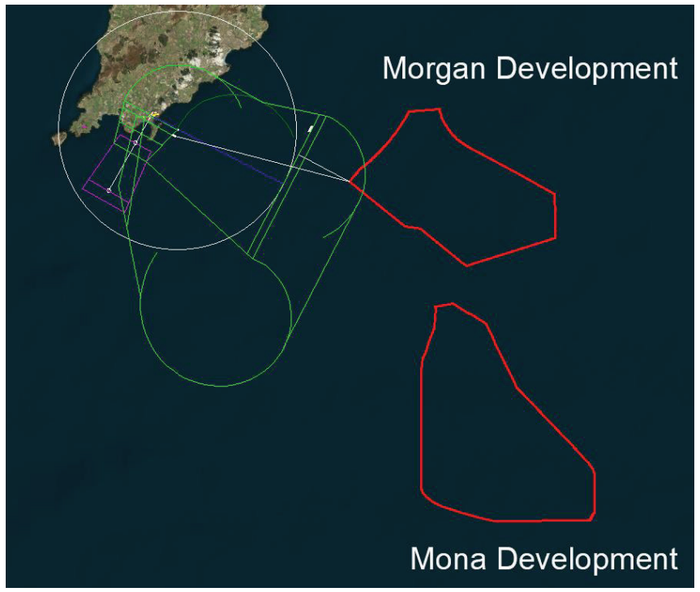

Figure 116 - Morgan and Mona Windfarm vs SRA RWY 03 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, from the MAPt climbing right turn onto track 118° then when passing 2000 right turn to NDB(L) RWY at 3000 or as directed.

The procedure OCA is 680ft and therefore aircraft would not be allowed to turn lower than that.

The shortest distance from the 680ft TIA to the Morgan Windfarm is 24817.29m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 680ft + 0.025*24817.29m = 827.69m / 2715ft at the obstacle.

Additionally, the shortest distance from the second 2000ft TIA to the Morgan Windfarm has been measured to be 7814.42m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*7814.42m = 804.96m / 2640ft at the obstacle.

Both calculations provide sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

The proposed windfarms will not have an impact on the SRA RWY 03 Procedure.

5.2.3 OFFSET ILS/DME RWY 08

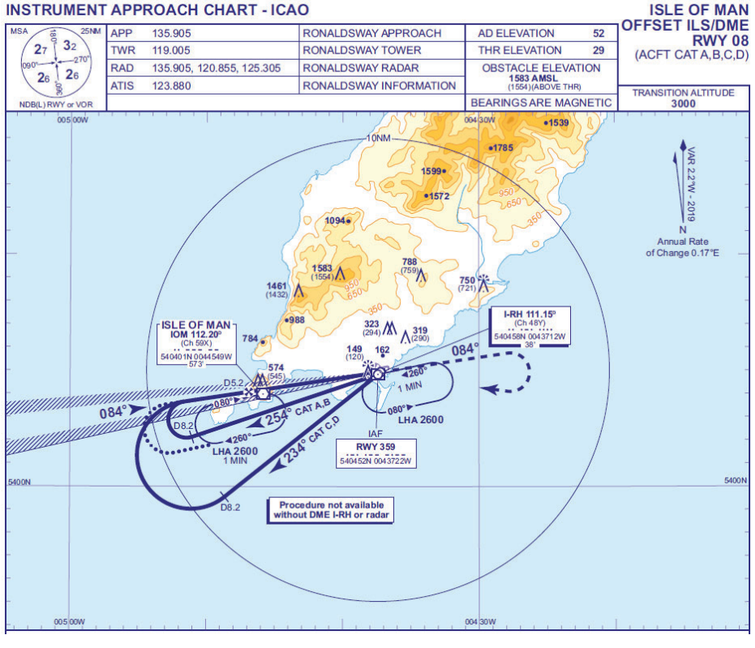

Figure 117 - OFFSET ILS/DME RWY08

The Mona windfarm lies outside the protection areas associated to the Offset ILS to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the ILS OAS but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

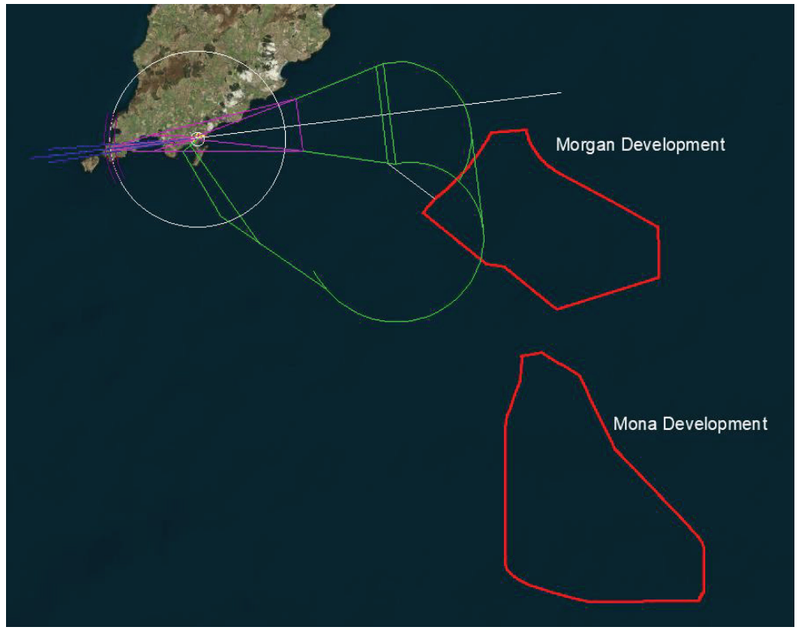

Figure 118 - Morgan and Mona Windfarm vs OFFSET ILS/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead to 2000 then right turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 6969.58m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*6969.58m = 783.83m / 2571ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have been constructed:

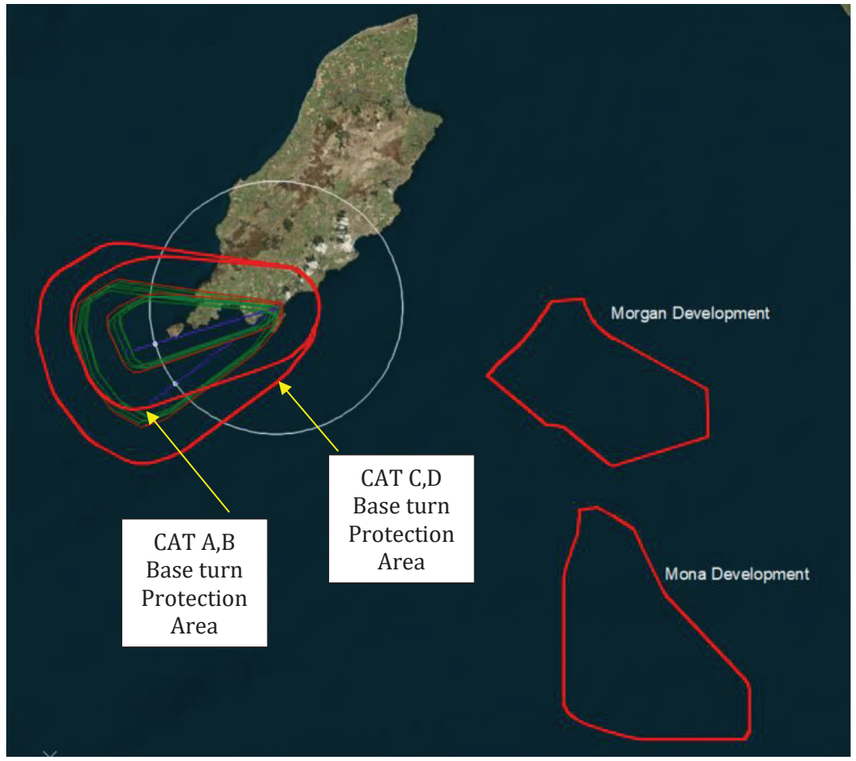

Figure 119 - Windfarms vs OFFSET ILS/DME RWY 08 Base turns

Figure 120 - Windfarms vs OFFSET ILS/DME RWY 08 Extended Holding

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the OFFSET ILS/DME RWY 08 Procedure.

5.2.4 OFFSET LOC/DME RWY 08

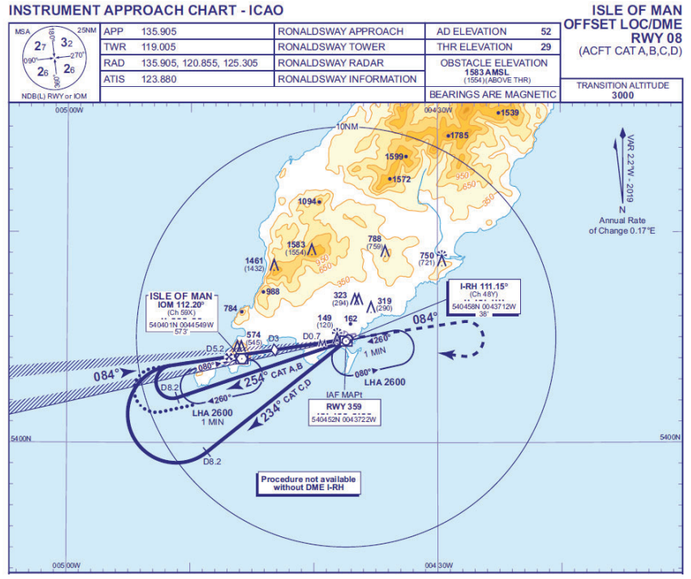

Figure 121 - OFFSET LOC/DME RWY 08

The Mona windfarm lies outside the protection areas associated to the Offset LOC to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

Figure 122 - Morgan and Mona Windfarm vs OFFSET LOC/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead to 2000 then right turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 8645.55m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*8645.55m = 825.73m / 2709ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have already been assessed in Section 5.2.3 and are not impacted.

The proposed windfarms will not have an impact on the OFFSET LOC/DME RWY 08 Procedure.

5.2.5 SRA RTR 2NM RWY 08

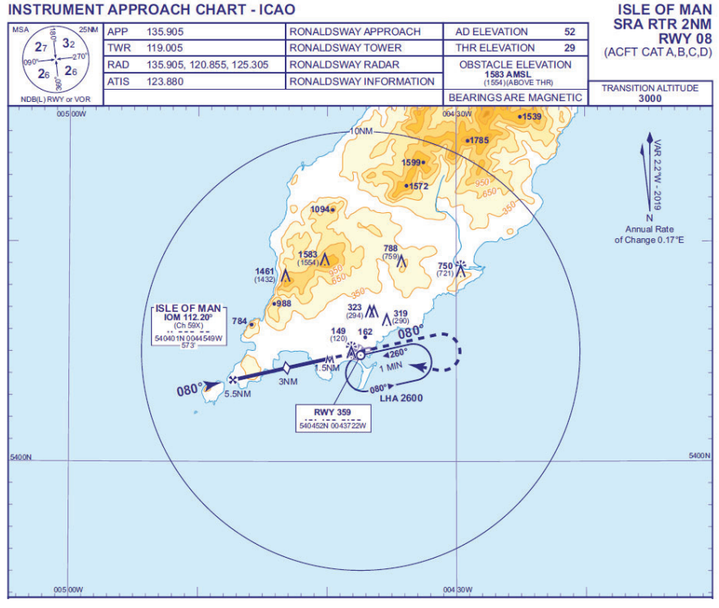

Figure 123 - SRA RWY08

The Mona windfarm lies outside the protection areas associated to the SRA to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

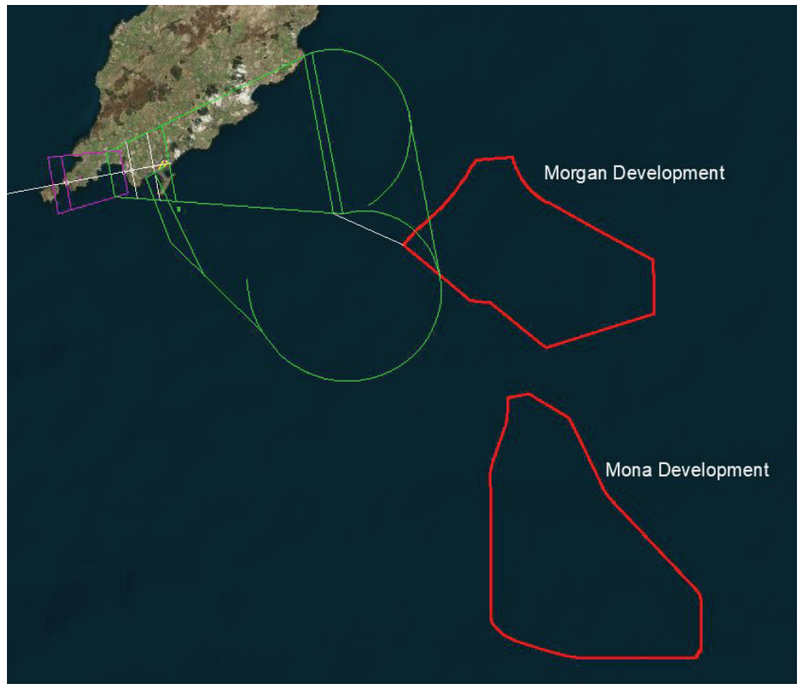

Figure 124 - Morgan and Mona Windfarm vs SRA RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead 2000 then right turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm is 8476.58m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*8476.58m = 821.51m / 2695ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

The proposed windfarms will not have an impact on the SRA RWY 08 Procedure.

5.2.6 VOR/DME RWY 08

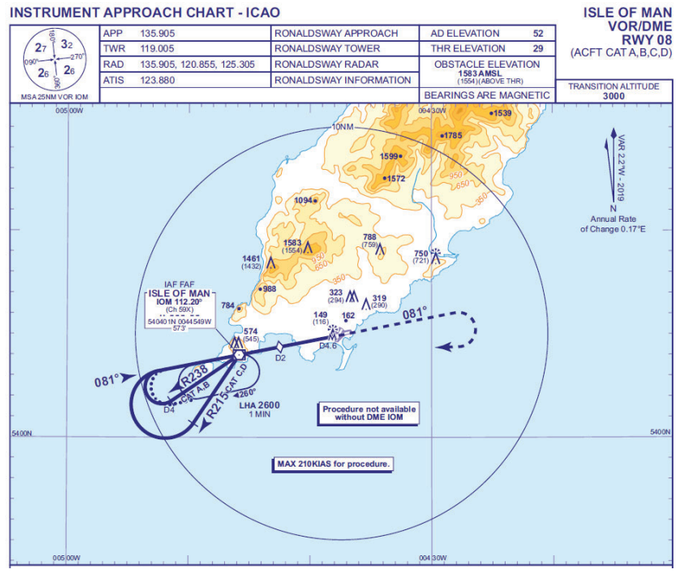

Figure 125 - VOR/DME RWY08

The Mona windfarm lies outside the protection areas associated to the VOR/DME to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

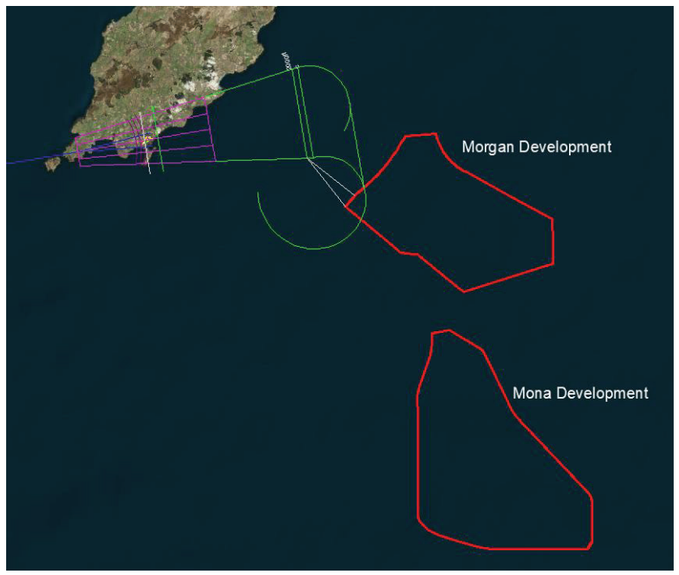

Figure 126 - Morgan and Mona Windfarm vs VOR/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially on IOM VOR R081 to 2000 then turn right to VOR IOM at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 8081.75m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*8081.75m = 811.64m / 2662ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have been constructed:

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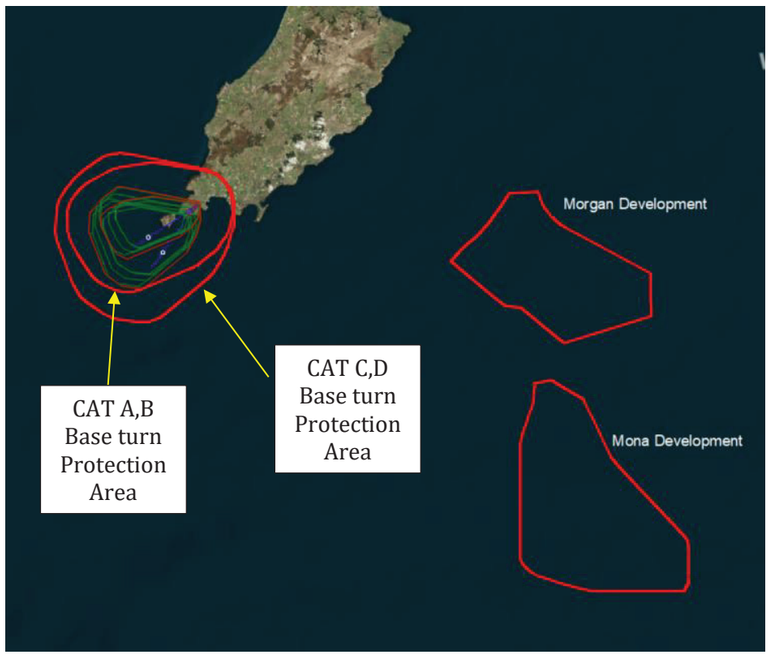

Figure 127 - Windfarms vs VOR/DME RWY 08 Base turns

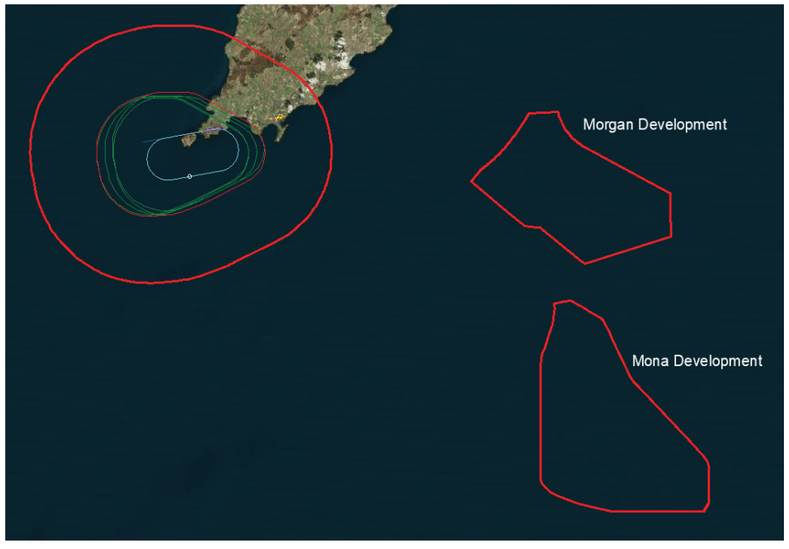

Figure 128 - Windfarms vs VOR/DME RWY 08 Extended Holding

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the VOR/DME RWY 08 Procedure.

5.2.7 NDB(L)/DME RWY 08

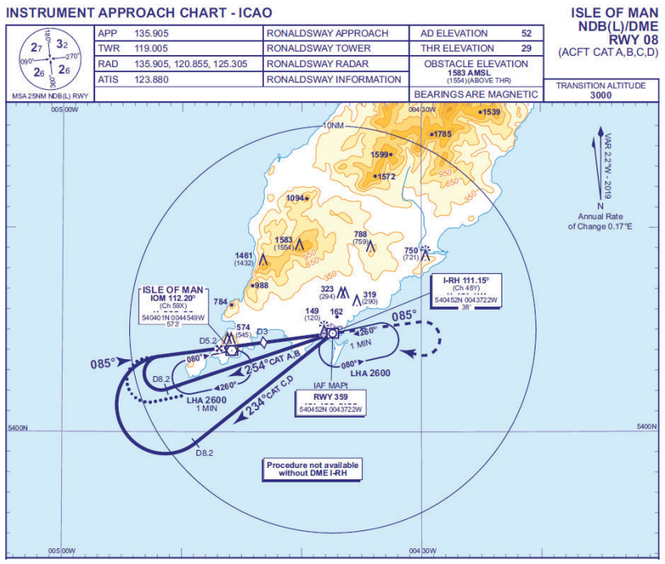

Figure 129 - NDB(L)/DME RWY08

The Mona windfarm lies outside the protection areas associated to the NDB(L)/DME to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

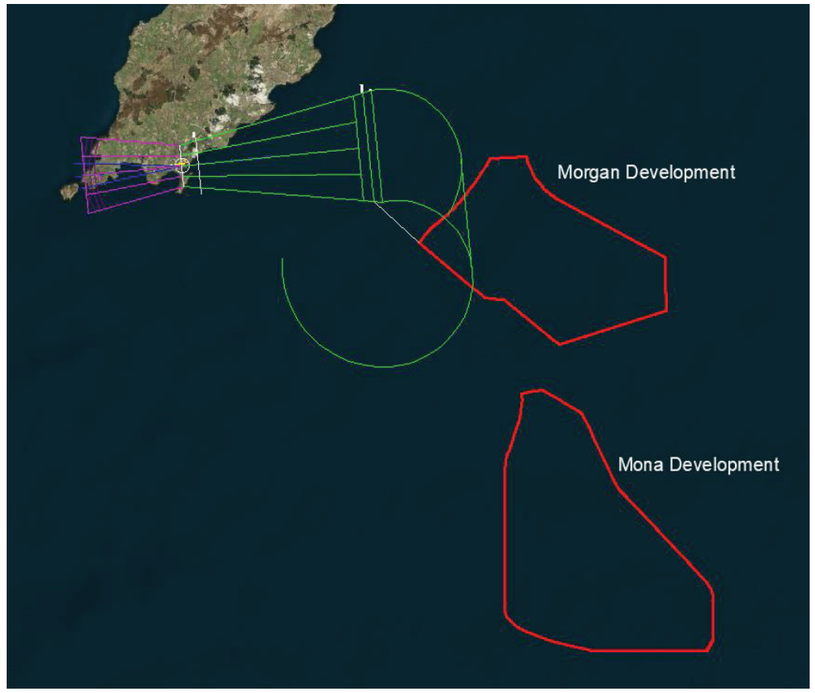

Figure 130 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 08 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially on NDB(L) RWY QDM 085° to 2000 then turn right to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 6859.47m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*6859.47m = 781.08m / 2562ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IOM VOR have been constructed:

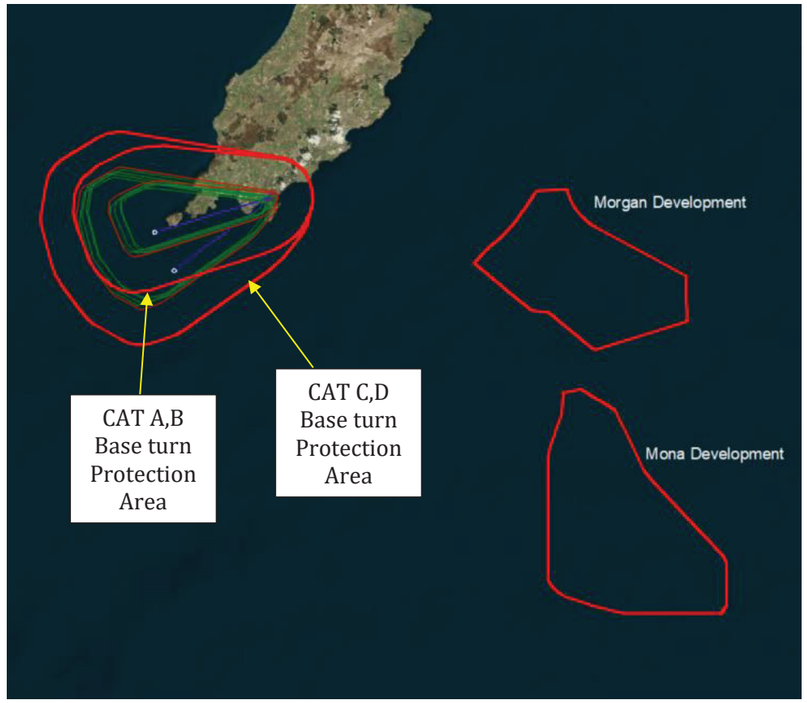

Figure 131 - Windfarms vs NDB(L)/DME RWY 08 Base turns

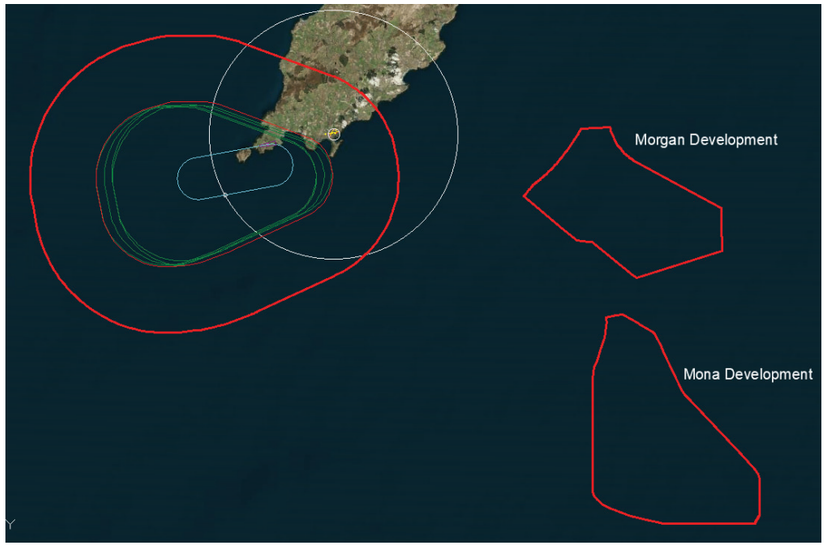

Figure 132 - Windfarms vs NDB(L)/DME RWY 08 Extended Holding

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 08 Procedure.

5.2.8 ILS/DME RWY 26

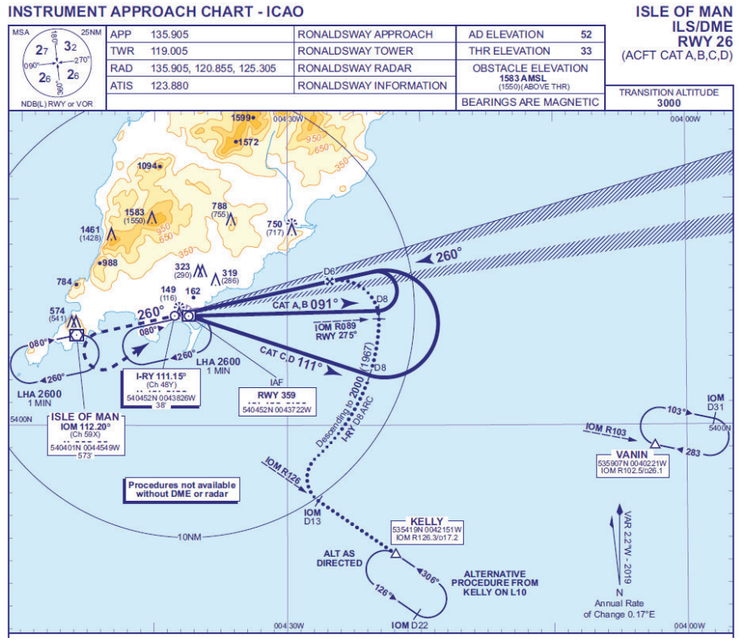

Figure 133 - ILS/DME RWY26

Both windfarms (Morgan and Mona) lie outside the final approach and missed approach protection areas associated to the ILS/DME Procedure to Runway 26.

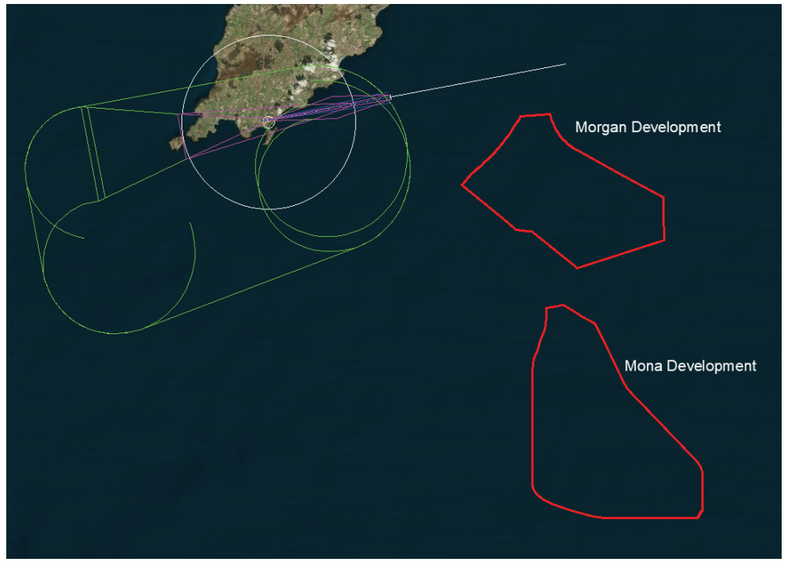

Figure 134 - Morgan and Mona Windfarm vs ILS/DME RWY 26 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns) from NDB(L) RWY have been constructed:

Figure 135 - Windfarms vs ILS/DME RWY 26 Base turn CAT A,B

Figure 136 - Windfarms vs ILS/DME RWY 26 Base turn CAT C,D

As can be observed in the above figures, both windfarms are outside the protection areas for the CAT A, B base turn and therefore they will not impact such reversal.

However, the Morgan Windfarm is within the secondary protection areas of the CAT C,D base turn. The highest secondary MOC required over the obstacles would be 9.91% of the full Initial Approach MOC (300m); 0.091*300 = 27.3m. Therefore, aircraft should be at a minimum of 324m + 27.3m = 351.3m / 1153ft to safely clear the obstacle. As the minimum altitude within the base turn is 2000ft, this provides sufficient margin to clear the obstacle safely.

Alternative Procedure from KELLY on L10

The chart features a note specifying *'Arrival not below 3000 or MSA whichever is the higher'.*

Obstacles would need to be higher than 3000ft – 300m (614.4m) to potentially impact any arrival. As the maximum turbine elevation is 324m, arrivals will not be impacted.

However, the KELLY arrival features a DME arc from I-RY of 8NM, where aircraft can start descending to 2000ft when stablished on the arc.

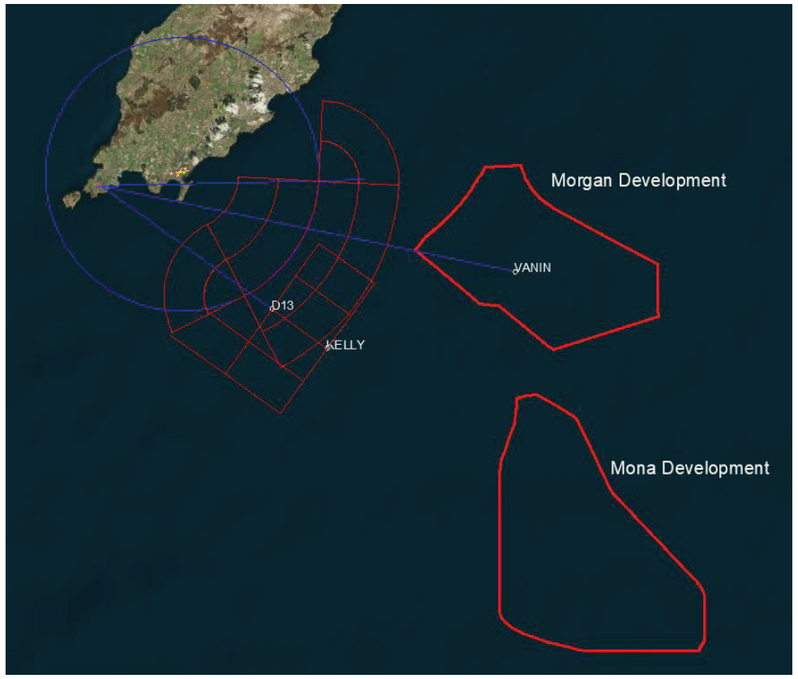

Figure 137 - Windfarms vs Direct Arrivals from KELLY

As both windfarms are outside the protection areas for the Direct Arrivals from KELLY, they will not impact the arrival.

Alternative Procedure from VOR IOM

FROM OVERHEAD VOR IOM: Descend as required to 3000 inbound to NDB(L) RWY on QDM 080°, then continue as for full procedure.

As the Direct Arrival from VOR IOM is fully above 3000ft before continuing as per the already assessed procedure, obstacles lower than 614.4m would not cause any impact.

The proposed windfarms will not have an impact on the ILS/DME RWY 26 Procedure.

5.2.9 LOC/DME RWY 26

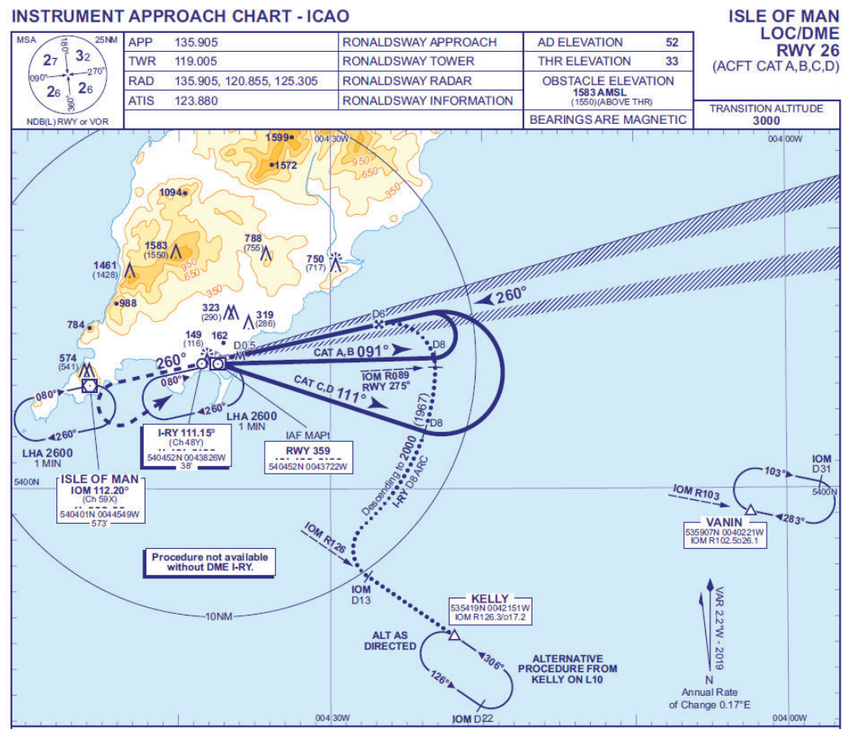

Figure 138 - LOC/DME RWY26

Both windfarms (Morgan and Mona) lie outside the final approach and missed approach protection areas associated to the LOC/DME Procedure to Runway 26.

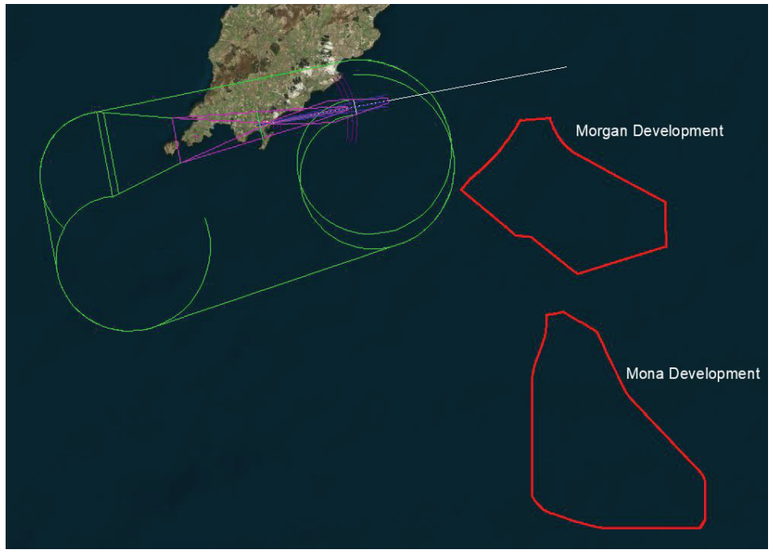

Figure 139 - Morgan and Mona Windfarm vs LOC/DME RWY 26 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns) and the Direct Arrivals from IOM VOR and KELLY have already been assessed in Section 5.2.8 and are not impacted.

The proposed windfarms will not have an impact on the LOC/DME RWY 26 Procedure.

5.2.10 SRA RTR 2NM RWY 26

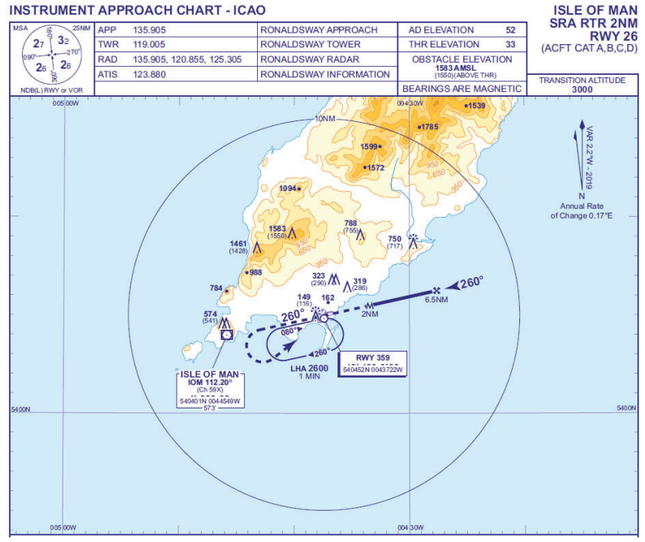

Figure 140 - SRA RTR 2NM RWY26

The Mona windfarm lies outside the protection areas associated to the SRA to Runway 08 and therefore will not impact the procedure.

The Morgan windfarm lies within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

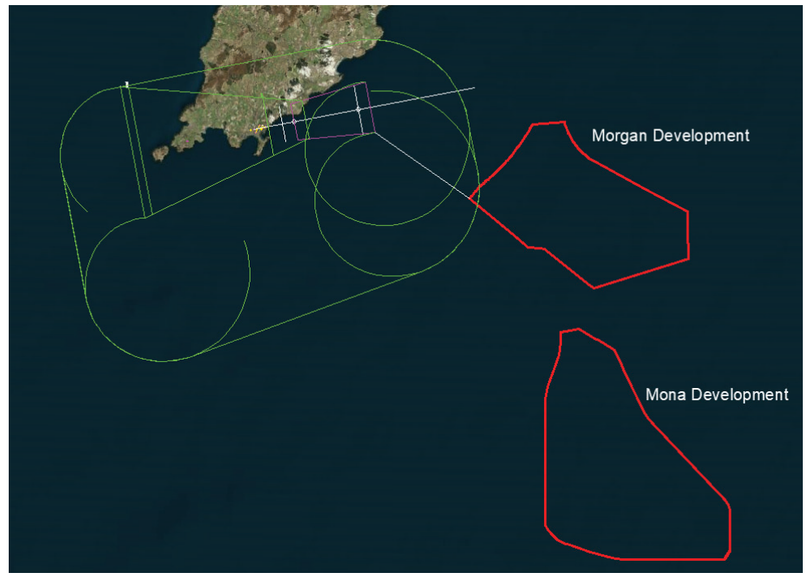

Figure 141 - Morgan and Mona Windfarm vs SRA RWY 26 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially straight ahead 2000 then turn left to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm is 14634.86m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*14634.86m = 975.47m / 3200ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

The proposed windfarms will not have an impact on the SRA RWY 26 Procedure.

5.2.11 NDB(L)/DME RWY 26

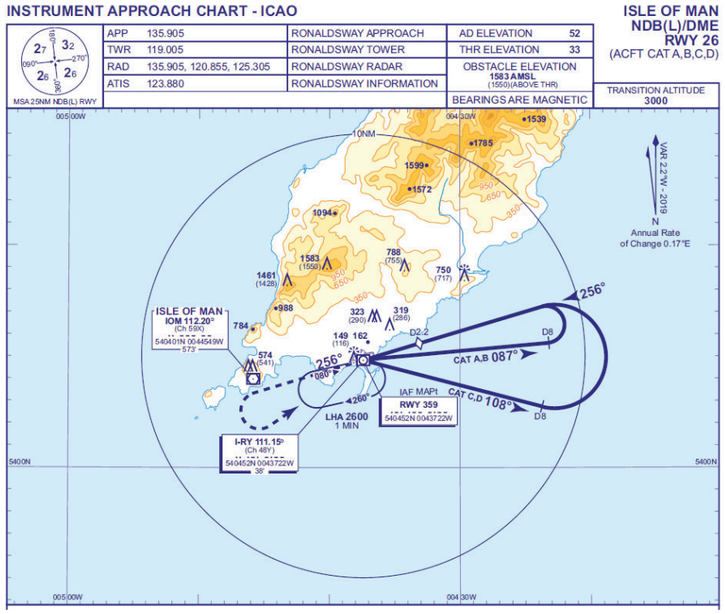

Figure 142 - NDB(L)/DME RWY 26

<u>DME I-RY Operative</u>

The Mona windfarm lies outside the protection areas associated to the NDB(L)/DME to Runway 26 and therefore will not impact the procedure.

The Morgan windfarm lies outside the Final Approach Areas but within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

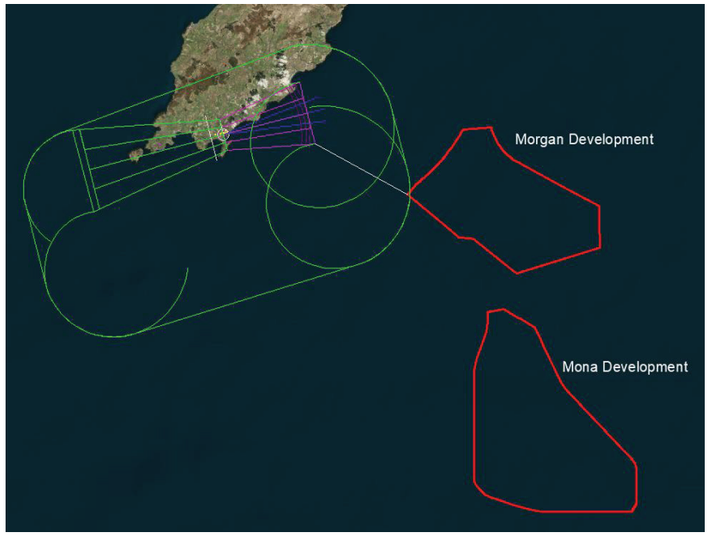

Figure 143 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 26 Protection Areas

The Missed Approach text is as follows:

Continuous climb to 3000, initially on NDB(L) RWY QDM 256° to 2000 then left turn to NDB(L) RWY at 3000 or as directed.

The shortest distance from the 2000ft TIA to the Morgan Windfarm has been measured to be 15257.82m. With a 2.5% Missed Approach Climb Gradient, aircraft would be at 2000ft + 0.025*15257.82m = 991.04m / 3251ft at the obstacle.

This provides sufficient clearance as the MOC for the Final Missed Approach is 50m and therefore aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle.

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns) have been constructed:

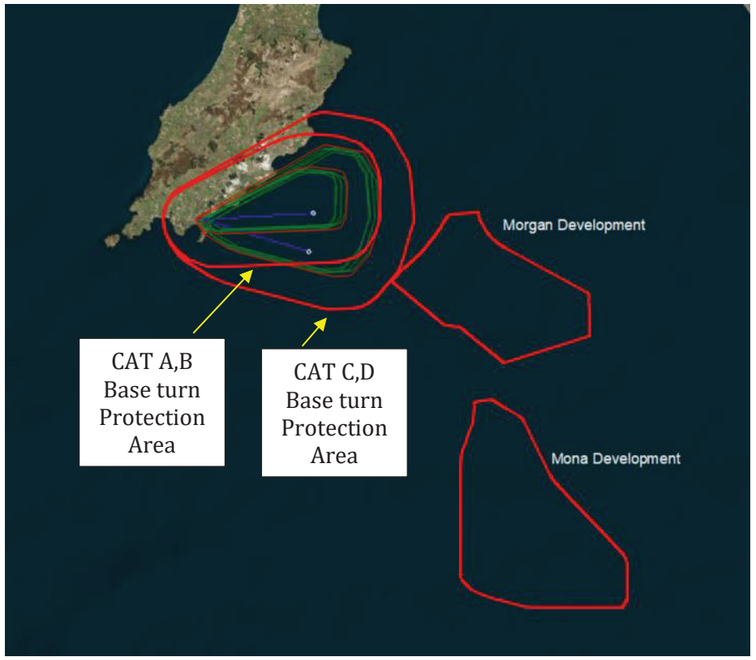

Figure 144 - Windfarms vs NDB(L)/DME RWY 26 Base turns

As both windfarms are outside the protection areas for the base turn and the extended holding, they will not impact the reversals.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 26 (With DME I-RY Operative) Procedure.

DME I-RY Inoperative

The Mona windfarm lies outside the protection areas associated to the NDB(L)/DME to Runway 26 and therefore will not impact the procedure.

The Morgan windfarm lies within the Final Approach Areas and within the protection areas associated to the Final Missed Approach and could potentially impact the procedure:

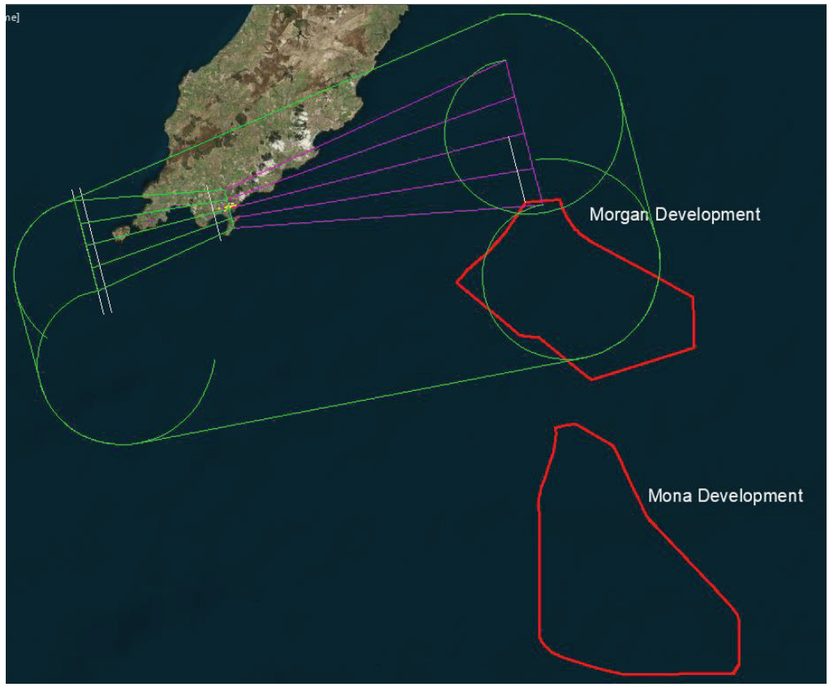

Figure 145 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 26 (NO DME) Protection Areas

When DME I-RY is inoperative or cannot be used for aircraft flying the NDB(L)/DME RWY 26 Approach, there is no defined FAF (Final Approach Fix) and therefore the final approach areas extend to the edge of the Base turn primary protection area. Therefore, we will analyse base turns in the first instance.

CAT A,B

The CAT A,B procedure reversal published on the approach chart has been constructed:

Figure 146 - Windfarms vs NDB(L)/DME RWY 26 Base turn CAT A,B (NO DME; 3 MIN)

As can be observed in the above figure, both windfarms are outside the protection areas for the CAT A, B base turn and therefore will not impact the reversal.

The final approach areas have been extended to the edge of the primary area for the CAT A,B base turn:

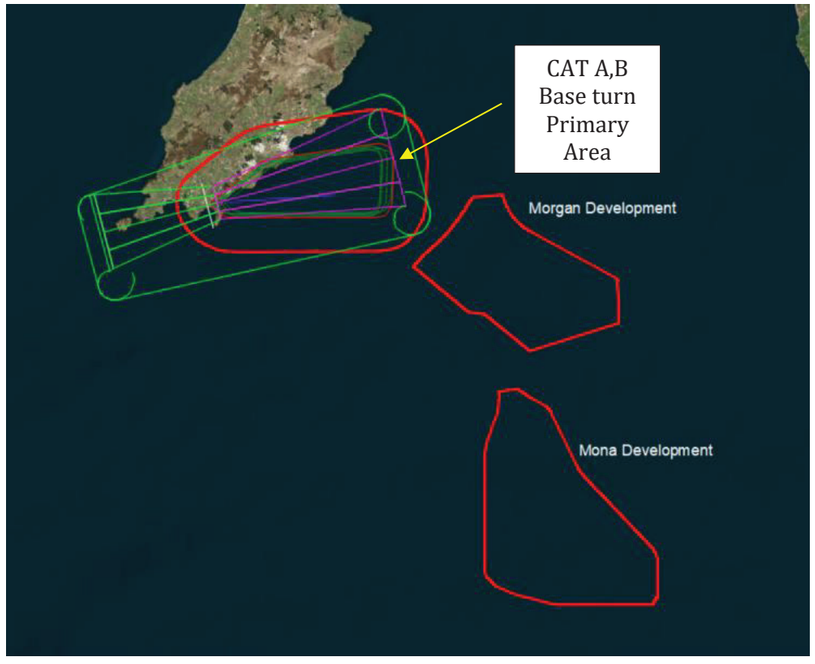

Figure 147 - Windfarms vs NDB(L)/DME RWY 26 (NO DME) CAT A,B

As can be observed in the above figure, both windfarms are outside the protection areas for the CAT A, B final and missed approach, therefore they will not impact the Procedure.

CAT C,D

The CAT C,D procedure reversal published on the approach chart has been constructed:

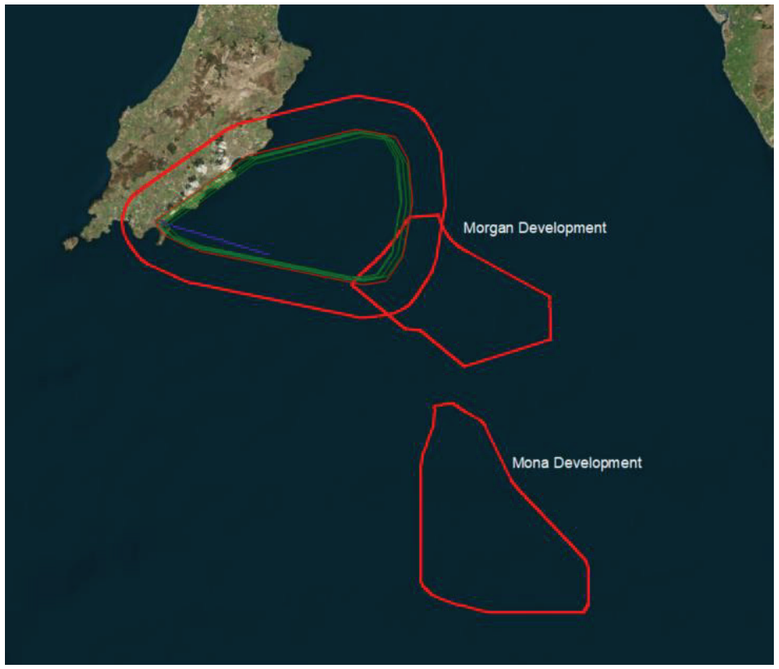

Figure 148 - Windfarms vs NDB(L)/DME RWY 26 Base turn CAT C,D (NO DME; 2.5 MIN)

As can be observed in the above figure, the Mona windfarm is outside the protection areas for the CAT C, D base turn and therefore it will not impact such reversal.

However, the Morgan Windfarm is within the primary protection areas of the CAT C, D base turn. The MOC required over the obstacles would be 100% of the full Initial Approach MOC (300m). Therefore, aircraft should be at a minimum of 324m + 300m = 624m / 2048ft AMSL to safely clear the obstacle. As the minimum altitude within the base turn is 2000ft, this does not provide sufficient margin to clear the obstacle safely.

The minimum altitude within the base turn would require increasing to 2100ft, which could have knock-on effects on the procedure if this leads to a change in the Final Approach Altitude.

The final approach areas have been extended to the edge of the primary area for the CAT C, D base turn:

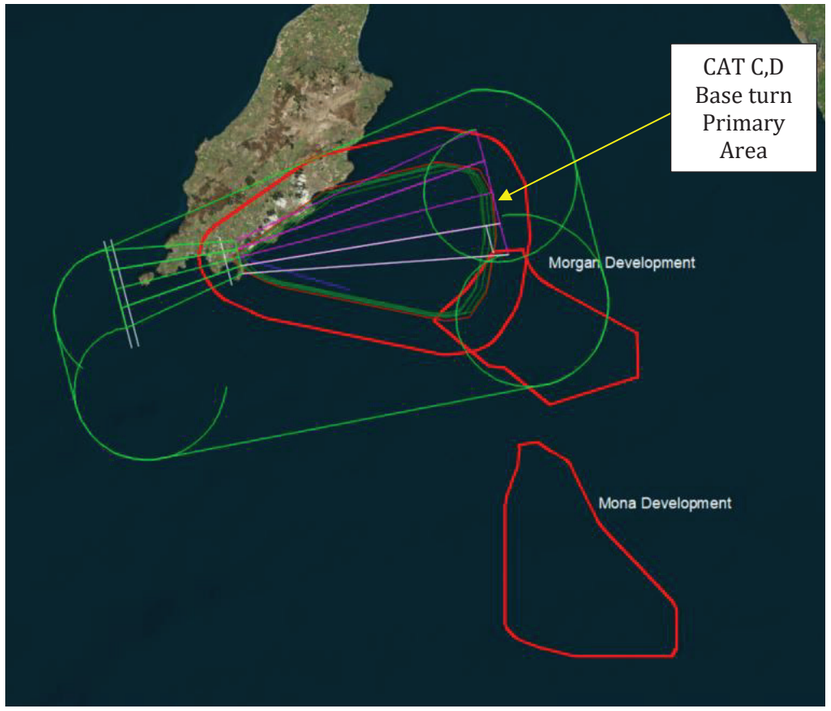

Figure 149 - Windfarms vs NDB(L)/DME RWY 26 (NO DME) CAT C, D

As can be observed in the above figure, the Mona windfarm is outside the protection areas for the CAT C, D final and missed approach, therefore it will not impact the Procedure.

However, the Morgan Windfarm is within the secondary protection areas of the CAT C,D Final Approach.

The highest secondary MOC required over the obstacles would be 12.17% of the full Final Approach MOC with no FAF (90m); 0.1217*90 = 10.96m. Therefore, aircraft should be at a minimum of 324m + 10.96m = 334.96m / 1099ft to safely clear the obstacle. As the procedure OCA is 810ft, this does not provide sufficient margin to clear the obstacle safely.

The NO DME OCA for CAT C and D would require increasing to 1100ft, which could have knock-on effects on other items of the procedure such as the VM(C) OCA shown on this procedure chart.

The Missed Approach text is as follows:

Continuous climb to 3000, initially on NDB(L) RWY QDM 256° to 2000 then left turn to NDB(L) RWY at 3000 or as directed.

The Morgan Windfarm is within the TIA and would require a 50m MOC. Therefore, aircraft should be at a minimum of 324m + 50m = 374m / 1228ft to safely clear the obstacle. This is achieved as the turning altitude is 2000ft.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 26 (With DME I-RY Operative) Procedure for aircraft Categories A and B.

The proposed windfarms will have an impact on the NDB(L)/DME RWY 26 (With DME I-RY Operative) Procedure for aircraft Categories C and D, specifically an impact on the MOCA for the base turn and on the Procedure OCA.

5.2.12 Visual Circling

The proposed windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

Figure 150 – Visual Circling

The proposed windfarms would have no impact on the Visual Circling.

5.2.13 Holding

NDB(L) RWY Hold

The NDB(L) RWY Hold has an existing Lowest Holding Altitude (LHA) of 2600ft.

With a maximum MOC of 300m the proposed turbines would not impact the hold:

- 324m + 300m MOC = 624m / 2048ft
- Existing Lowest Holding Altitude (LHA) = 2600ft

VOR IOM Hold

The VOR IOM Hold has an existing Lowest Holding Altitude (LHA) of 2600ft.

With a maximum MOC of 300m the proposed turbines would not impact the hold:

- 324m + 300m MOC = 624m / 2048ft
- Existing Lowest Holding Altitude (LHA) = 2600ft

VANIN & KELLY Holds

The VANIN and KELLY Holds do not have an existing Lowest Holding Altitude (LHA) Published.

However, they are part of the arrival, and the following note is present on the charts: *'Arrival not below 3000 or MSA whichever is the higher'.*

With a maximum MOC of 300m the proposed turbines would not impact the holds:

- 324m + 300m MOC = 624m / 2048ft
- Derived Lowest Holding Altitude (LHA) by Chart Notes = Higher between 3000ft and MSA.

The proposed windfarms would have no impact on any of the holds for Isle of Man Airport.

5.2.14 Visual Segment Surface (VSS)

The proposed windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Isle of Man Airport Runways.

5.2.15 Minimum Sector Altitudes

MSA 25NM NDB(L) RWY

Both the Mona and Morgan Windfarms lie within the south-eastern quarter of the MSA 25NM NDB(L) RWY, which published MSA is 2600ft. Additionally, the Morgan Windfarm lies within the north-eastern quarter of the MSA 25NM NDB(L) RWY, which published MSA is 3200ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

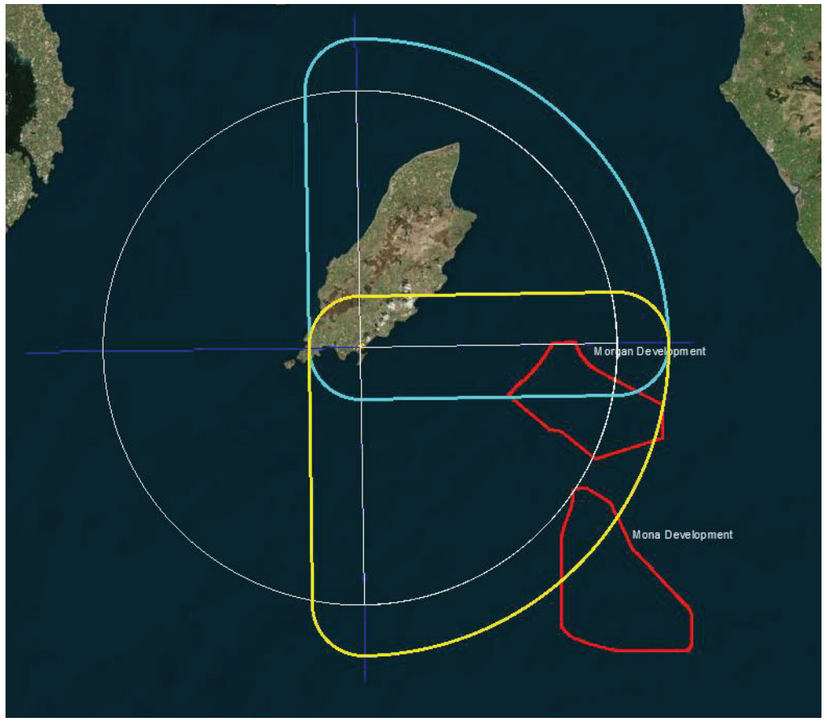

Figure 151 – NDB(L) RWY vs Windfarms

The proposed windfarms would produce a MOCA of 324m + 300m = 624m / 2048ft AMSL for the north-eastern and south-eastern quadrants.

This is below the NE quadrant published MSA which has a MOCA of 3200ft, and below the SE quadrant published MSA which has a MOCA of 2600ft.

The proposed windfarms would have no impact on the published NDB(L) RWY MSA.

MSA 25NM VOR IOM

Both the Mona and Morgan Windfarms lie within the south-eastern quarter of the MSA 25NM VOR IOM, which published MSA is 2600ft. Additionally, the Morgan Windfarm lies within the north-eastern quarter of the MSA 25NM VOR IOM, which published MSA is 3200ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

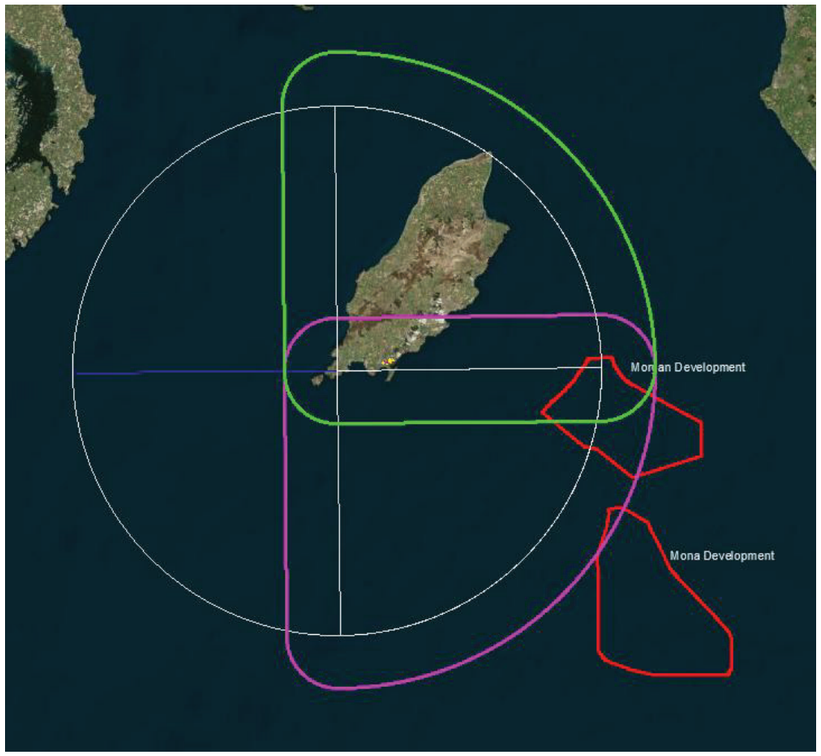

Figure 152 – VOR IOM vs Windfarms

The proposed windfarms would produce a MOCA of 324m + 300m = 624m / 2048ft AMSL for the north-eastern and south-eastern quadrants.

This is below the NE quadrant published MSA which has a MOCA of 3200ft, and below the SE quadrant published MSA which has a MOCA of 2600ft.

The proposed windfarms would have no impact on the published VOR IOM MSA.

MSA 25NM ARP

We have additionally protected for an MSA based on the ARP owing to the fact the minimum levels shown outside the ATCSMAC are based on the ARP as per note 4 in the ATCSMAC chart:

"4. Minimum Sector Altitudes are based on obstacles and spot heights within 25NM of the Aerodrome Reference Point"

Both the Mona and Morgan Windfarms lie within the south-eastern quarter of the MSA 25NM ARP, which published MSA is 2600ft. Additionally, the Morgan Windfarm lies within the north-eastern quarter of the MSA 25NM ARP, which published MSA is 3200ft.

The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

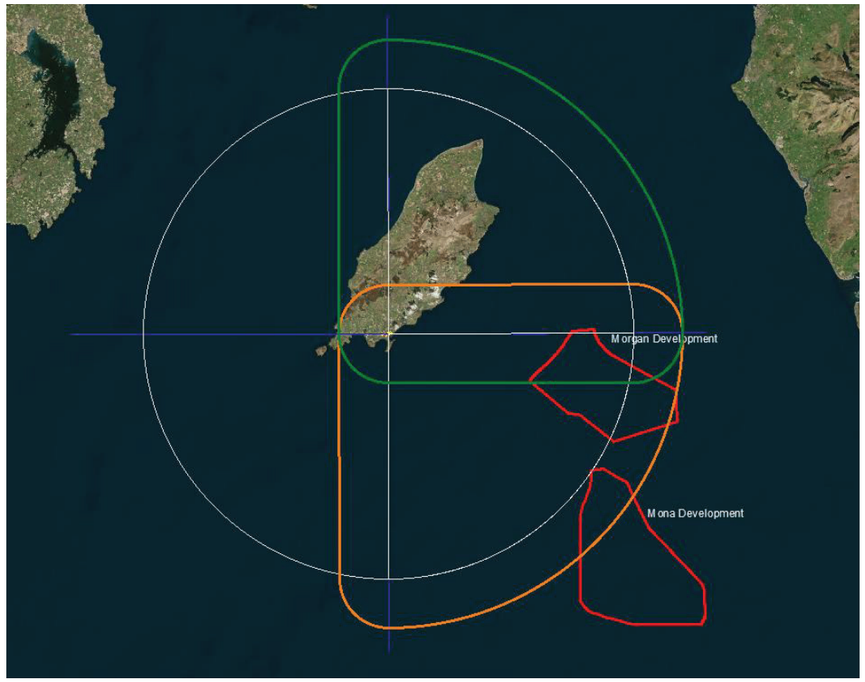

Figure 153 –ARP MSA vs Windfarms

The proposed windfarms would produce a MOCA of 324m + 300m = 624m / 2048ft AMSL for the north-eastern and south-eastern quadrants.

This is below the NE quadrant published MSA which has a MOCA of 3200ft, and below the SE quadrant published MSA which has a MOCA of 2600ft.

The proposed windfarms would have no impact on the published ARP MSA.

6 RAF Valley Airport OLS and IFP Assessment

6.1 OLS Assessment

6.1.1 Overview

The OLS for RAF Valley Airport has been constructed in accordance with Annex 14 and CAP 168.

6.1.2 Runway Data Used

The following declared distances and threshold details are published in the in the Mil AIP:

Runway	TORA (m)	TODA (m)	ASDA (m)	LDA (m)	Remarks
1	2	3	4	5	6
13	2,290	2,295	2,290	2,290	TORA = Thr 13 to Thr 31 TODA = Thr 13 to 5nm past Thr 31 ASDA = Thr 13 to Thr 31 LDA = Thr 13 to Thr 31
31	2,290	2,295	2,290	2,290	TORA = Thr 31 to Thr 13 TODA = Thr 31 to Arrestor ASDA = Thr 31 to Thr 13 LDA = Thr 31 to Thr 13
01	1,572	1,600	1,572	1,572	TORA = Thr 01 to Thr 19 TODA = Thr 01 to Arrestor ASDA = Thr 01 to Thr 19 LDA = Thr 01 to Thr 19
19	1,572	1,585	1,572	1,572	TORA = Thr 19 to Thr 01 TODA = Thr 19 to Arrestor ASDA = Thr 19 to Thr 01 LDA = Thr 19 to Thr 01

Figure 154 - Declared Distances

Designations Runway Number	True and MAG bearing	Dimensions of Runway (m)	Strength (PCN) and surface of Runway and stopway	Threshold co-ordinates
1	2	3	4	5
13	130°24'41" GEO 132°16'41" MAG	2290 x 45	32·5/F/A/W/T Asphalt 41·6/R/C/W/T Concrete	N53 15 13·65 W004 32 46·89
31RH	310°25'56" GEO 312°17'56" MAG	2290 x 45	32·5/F/A/W/T Asphalt 41·6/R/C/W/T Concrete	N53 14 25·61 W004 31 12·86
01	006°18'43" GEO 008°10'43" MAG	1572 x 45	PCN 10 Asphalt/Concrete	N53 14 36·63 W004 32 25·61
19 RH	186°18'51" GEO 188°10'51" MAG	1572 x 45	PCN 10 Asphalt/Concrete	N53 15 27·16 W004 32 16·29

Figure 155 - Threshold Details

Runway 13 is a CODE 4, Precision Instrument Runway

Runway 31 is a CODE 4, Precision Instrument Runway (**Lowest threshold, 7.04m**)

Runway 01 is a CODE 3, Non-Precision Runway

Runway 19 is a CODE 3, Non-Precision Runway

6.1.3 OLS Construction

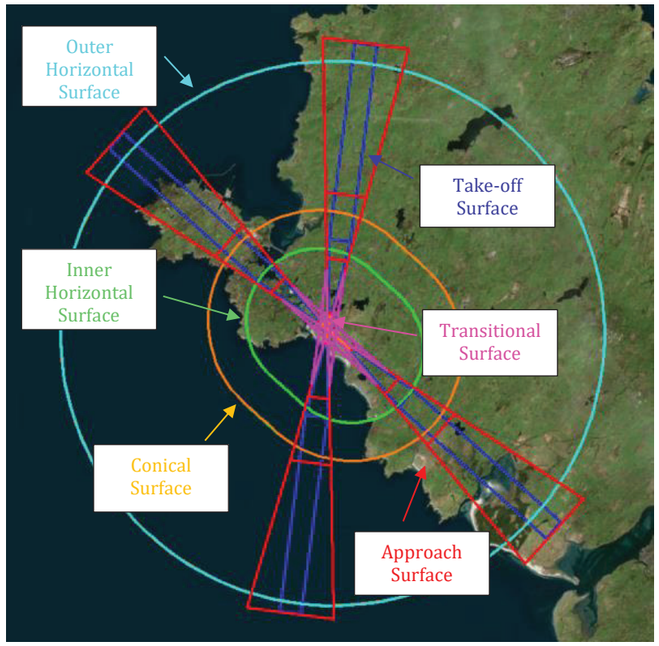

Figure 156 - OLS for RAF Valley Airfield

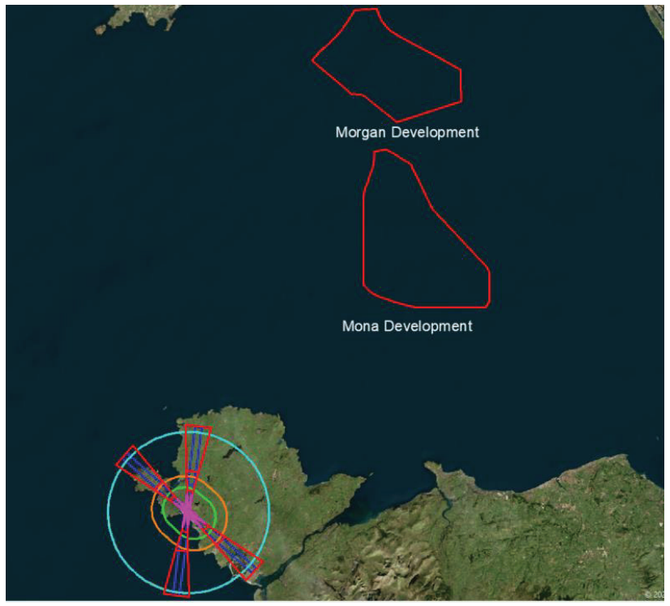

Figure 157 - RAF Valley OLS in Relation to Windfarms

6.1.4 OLS Analysis

The OLS for RAF Valley lies entirely outside of the boundaries of both Windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for RAF Valley Airfield.

6.2 IFP Assessment

The IFPs assessed are as follows:

<u>AIRAC 2211 (Effective 03 NOV to 01 DEC 22)</u>

- AD 2 EGOV-1-13 EAST MID;
- AD 2 EGOV-1-14 SOUTH MID;
- AD 2 EGOV-1-16 TAC to PAR RWY 13 (Point X-Ray Hold);
- AD 2 EGOV-1-17 TAC to PAR RWY 19 (Point X-Ray Hold);
- AD 2 EGOV-1-18 TAC to PAR RWY 31 (Point Alpha Hold);
- AD 2 EGOV-1-19 PAR RWY 13;
- AD 2 EGOV-1-20 PAR RWY 19;
- AD 2 EGOV-1-21 PAR RWY 31;
- AD 2 EGOV-1-22 SRA RWY 01;
- AD 2 EGOV-1-23 SRA RWY 13;
- AD 2 EGOV-1-24 SRA RWY 19;
- AD 2 EGOV-1-25 SRA RWY 31;
- AD 2 EGOV-1-26 ATCSMAC;
- AD 2 EGOV-1-27 TAC to ILS/DME RWY 13 (Point X-Ray Hold);
- AD 2 EGOV-1-28 TAC RWY 01 (Point Alpha Hold);
- AD 2 EGOV-1-29 TAC RWY 13 (Point X-Ray Hold);
- AD 2 EGOV-1-30 TAC RWY 19 (Point X-Ray Hold);
- AD 2 EGOV-1-31 TAC RWY 31 (Point Alpha Hold).

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surfaces (VSS)
- Minimum Sector Altitudes (MSA)

6.2.1 AD 2 EGOV-1-26 ATCSMAC

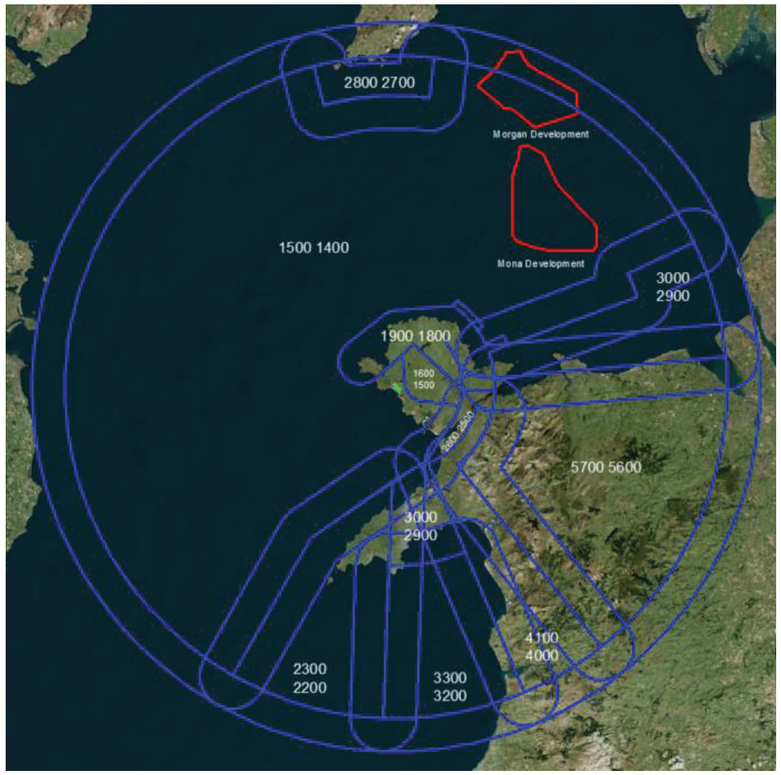

Figure 158 - Windfarms in Relation to ATCSMAC

Both windfarm developments lie within the lateral confines of the Outside SMAA (Surveillance Minimum Altitude Area) which has a 5NM buffer applied. The area has a MOCA (Minimum Obstacle Clearance Altitude) of 1500ft.

Using the development elevation of 324m AMSL, the development produces an OCA of 324m + 300m MOC (Minimum Obstacle Clearance) = 624m / 2048ft AMSL.

Current, Published OCA/OCH derived from existing controlling obstacle:
OCA = 1435ft, rounding to **1500ft**

OCH = 1399ft, rounding to **1400ft.**

Required MOCA using development elevation of 324m AMSL:

324m + 300m (MOC) = 624m / 2048ft AMSL

Airfield elevation at Valley = 36ft

COMMERCIAL IN CONFIDENCE

Civil Procedures

OCA = 2048ft, rounding to **2100ft**

OCH = 2048ft – 36ft = 2012ft

Military Procedures

QFE = 2048ft – 36ft = 2012ft, rounding to **2100ft**

QNH = 2100ft + 36ft = 2136ft, rounding to **2200ft**

The developments would have an impact on RAF Valley's ATCSMAC and would require the 1500ft QNH/1400ft QFE area to be raised to 2200ft QNH/2100ft QFE.

6.2.2 AD 2 EGOV-1-13 EAST MID

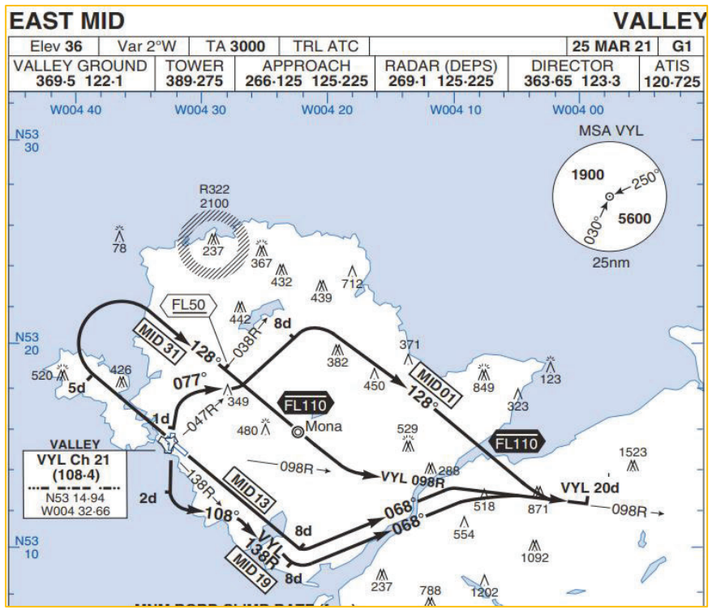

Figure 159 - East MID Procedure

Straight Departure

Both windfarms lie outside the Straight Departure protection areas for the MIDs departing to the east from Runways 01, 13, 19 and 31.

Turn Areas

The MID 01 procedure turns right and continues away from the windfarms and would have no impact.

The MID 13 procedure departs to the south-east and continues away from the windfarms and would be unaffected.

The MID 19 procedure departs to the south and continues away from the windfarms and would be unaffected.

The MID 31 procedure departs to the north-west but then turns right, away from the windfarms and would be unaffected.

The proposed windfarms would have no impact on the EAST MID procedures.

6.2.3 AD 2 EGOV-1-14 SOUTH MID

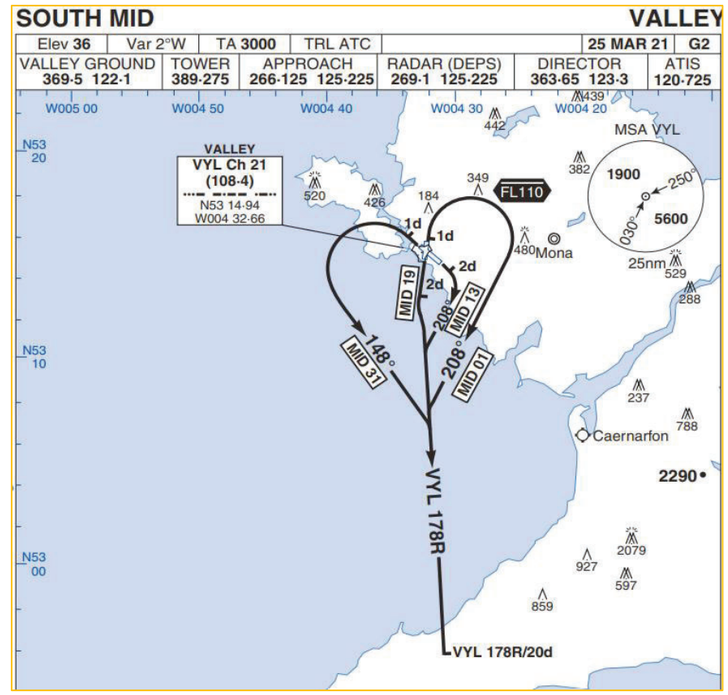

Figure 160 - SOUTH MID Procedure

Straight Departure

Both windfarms lie outside the Straight Departure protection areas for the MIDs departing to the south from Runways 01, 13, 19 and 31.

Turn Area

The MID 01 and 13 procedures turn right and head south, away from the windfarms and would not be affected.

The MID 19 and 31 procedures turn left and head south, away from the windfarms and would not be affected.

The proposed windfarms would have no impact on the SOUTH MID procedures.

6.2.4 AD 2 EGOV-1-16 TAC to PAR RWY 13 (Point X-Ray Hold)

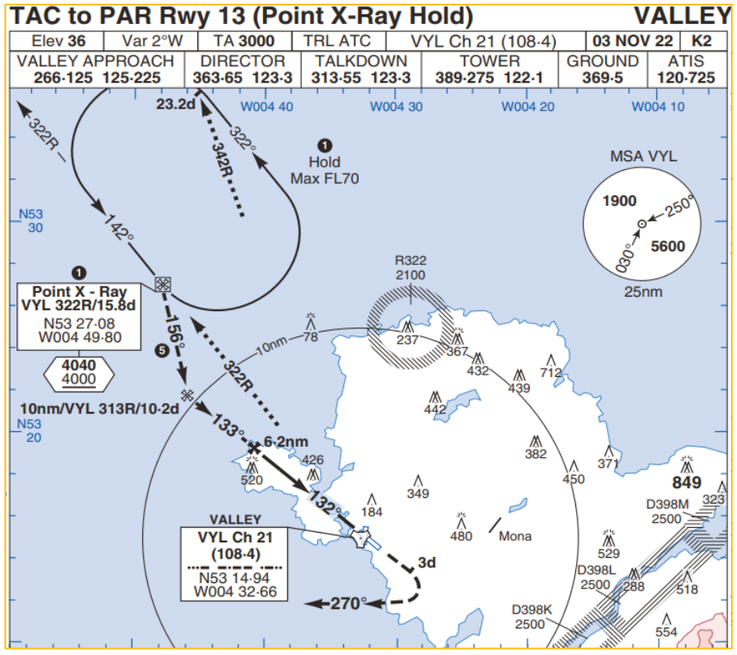

Figure 161 - TAC to PAR RWY 13 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to PAR Procedure to Runway 13 where the initial approach tracks south from the IAF at Point X-Ray Hold before reaching the IF at 2040ft.

The procedure then turns away from the windfarms after the Missed Approach and would not be affected.

POINT X-RAY Hold has been considered in section 6.2.20.

Figure 162 - TAC to PAR RWY 13 Protection Areas

The proposed windfarms would have no impact on the TAC to PAR RWY 13 procedure.

6.2.5 AD 2 EGOV-1-17 TAC to PAR RWY 19 (Point X-Ray Hold)

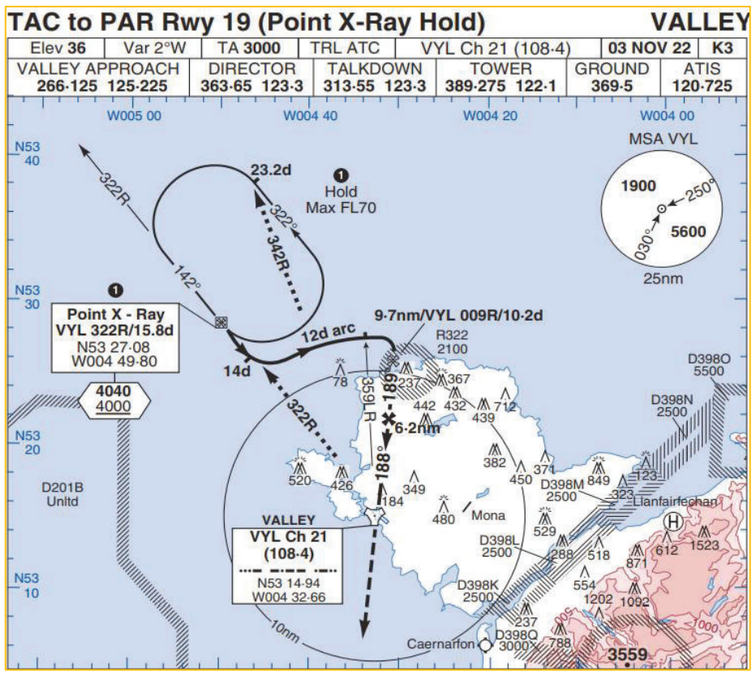

Figure 163 - TAC to PAR RWY 19 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to PAR Procedure to Runway 19 where the initial approach tracks east from the IAF at Point X-Ray Hold before reaching the IF at 2040ft.

The procedure then turns south, away from the windfarms and would not be affected.

COMMERCIAL IN CONFIDENCE

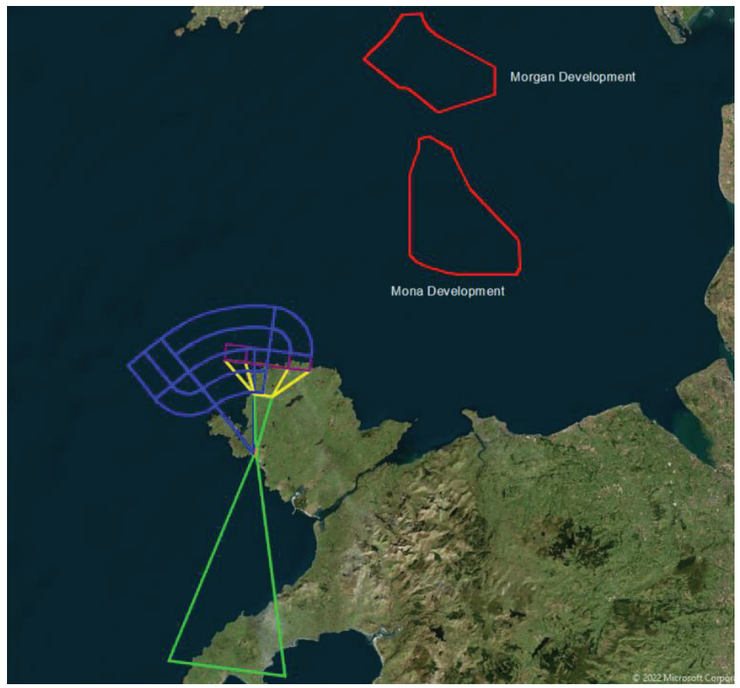

Figure 164 - TAC to PAR RWY 19 Protection Areas

The proposed windfarms would have no impact on the TAC to PAR RWY 19 procedure.

6.2.6 AD 2 EGOV-1-18 TAC to PAR RWY 31 (Point Alpha Hold)

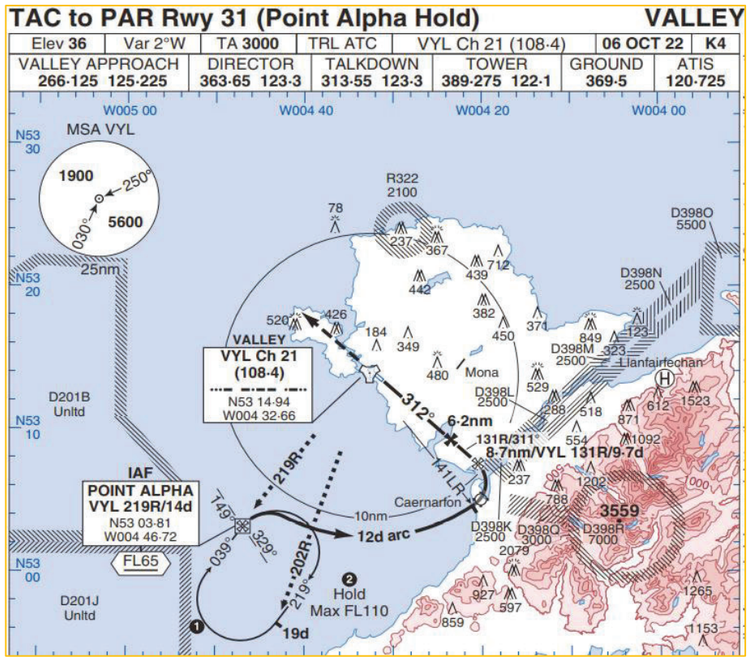

Figure 165 - TAC to PAR RWY 31 (POINT ALPHA Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to PAR Procedure to Runway 31 where the initial approach tracks east initially from the IAF at Point Alpha Hold before reaching the IF at 2530ft which is above the 2048ft MOCA required at the windfarms.

The procedure tracks away from the windfarms after the Missed Approach, away from the windfarms and climbing to 2530ft and would not be affected.

POINT ALPHA Hold has been considered in section 6.2.20.

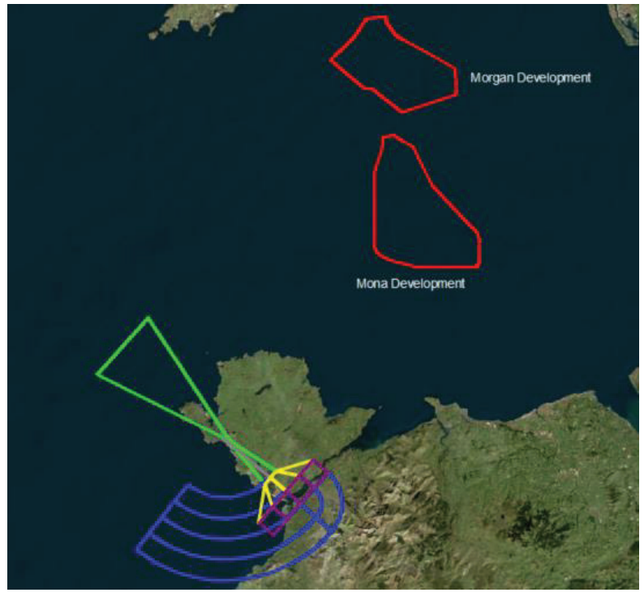

Figure 166 - TAC to PAR RWY 31 Protection Areas

The proposed windfarms would have no impact on the TAC to PAR RWY 31 procedure.

6.2.7 AD 2 EGOV-1-19 PAR RWY 13

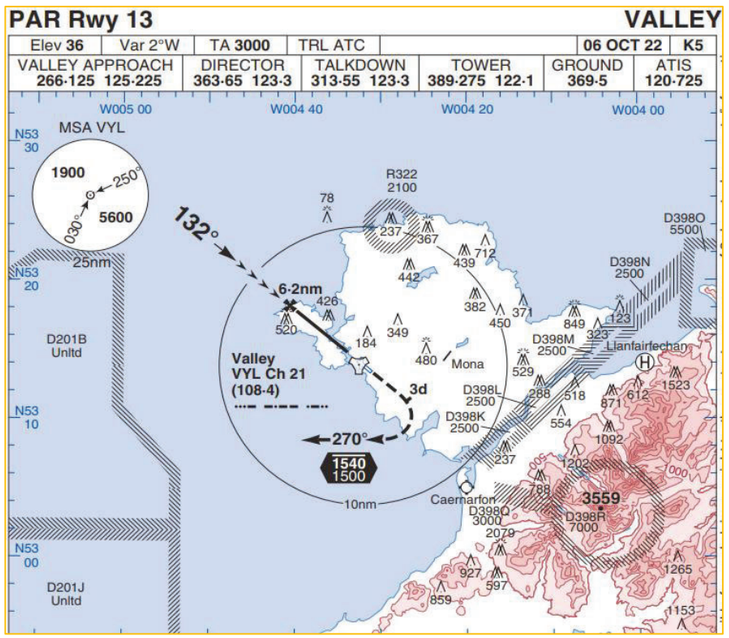

Figure 167 - PAR RWY 13 Procedure

Both windfarms are outside the protection area for the PAR procedure to Runway 13, including the Missed Approach which turns away from the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2040ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the NW sector MSA VYL which has been assessed separately in section 6.2.22.

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Figure 168 - PAR RWY 13 Protection Areas

The proposed windfarms would have no impact on the PAR RWY 13 procedure.

6.2.8 AD 2 EGOV-1-20 PAR RWY 19

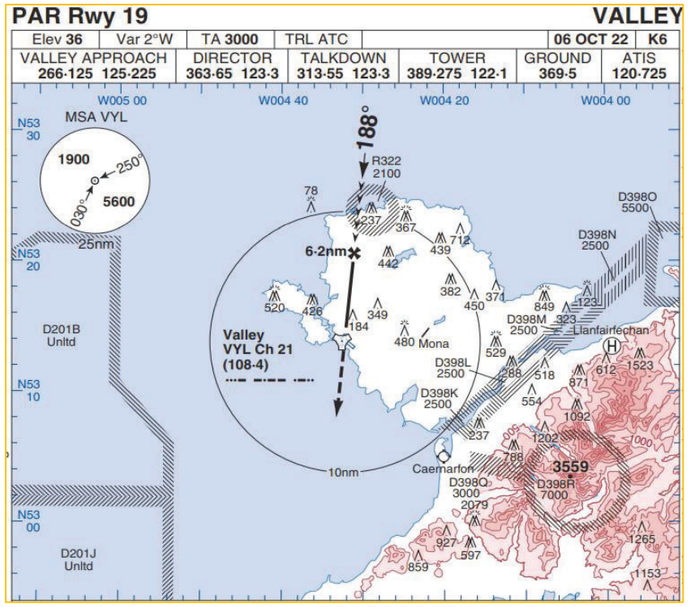

Figure 169 - PAR RWY 19 Procedure

Both windfarms are outside the protection area for the PAR procedure to Runway 19, including the Missed Approach which tracks south, away from the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2040ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the NW MSA VYL which has been assessed separately in section 6.2.22.

Figure 170 - PAR RWY 19 Protection Areas

The proposed windfarms would have no impact on the PAR RWY 19 procedure.

6.2.9 AD 2 EGOV-1-21 PAR RWY 31

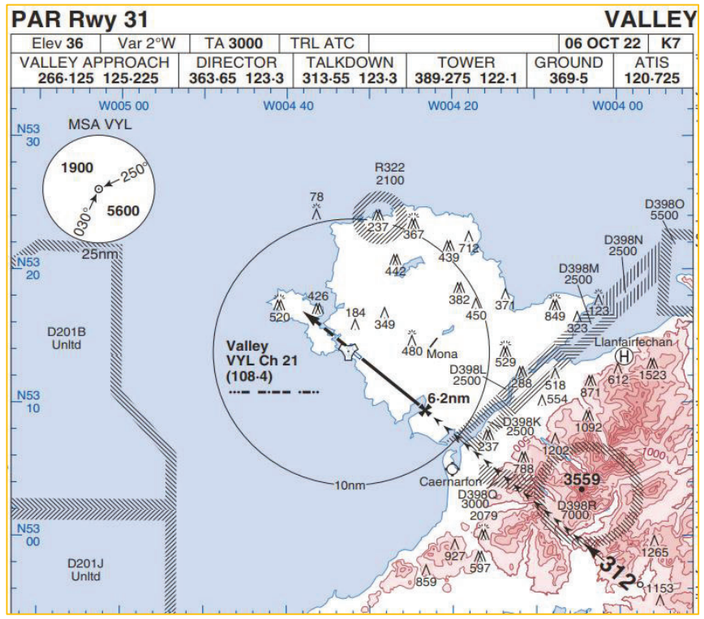

Figure 171 - PAR RWY 31 Procedure

Both windfarms lie outside the protection areas for the PAR procedure to runway 31, including the Missed Approach which tracks west, away from the windfarms and climbs to 2530ft which is above the MOCA required at the windfarms.

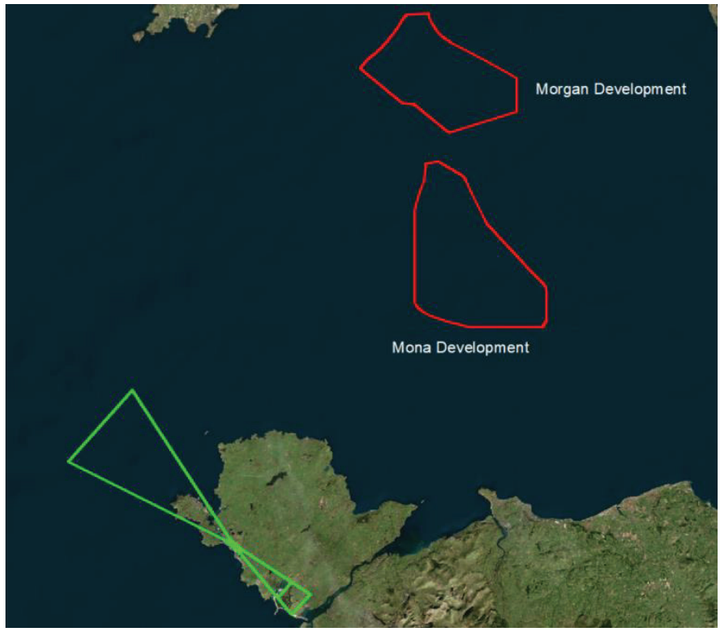

Figure 172 - PAR RWY 31 Protection Areas

The proposed windfarms would have no impact on the PAR RWY 31 procedure.

6.2.10 AD 2 EGOV-1-22 SRA RWY 01

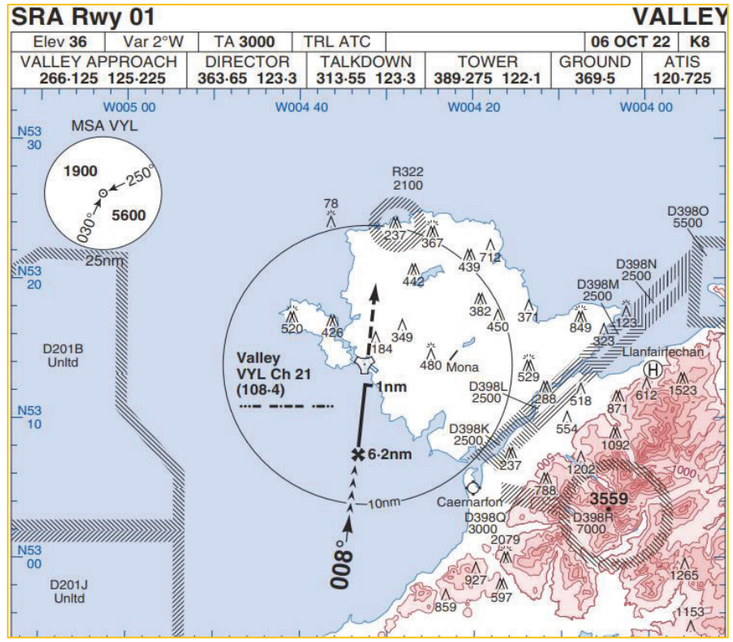

Figure 173 - SRA RWY 01 Procedure

Both windfarms lie outside the protection area for the PAR procedure to runway 01.

This includes the Missed Approach which tracks north, towards the vicinity of the windfarms where aircraft are required to climb to 2520ft which is above the MOCA required at the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2020ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the MSA VYL which has been assessed separately in section 6.2.22.

Figure 174 - SRA RWY 01 Protection Areas

The proposed windfarms would have no impact on the SRA RWY 01 procedure.

6.2.11 AD 2 EGOV-1-23 SRA RWY 13

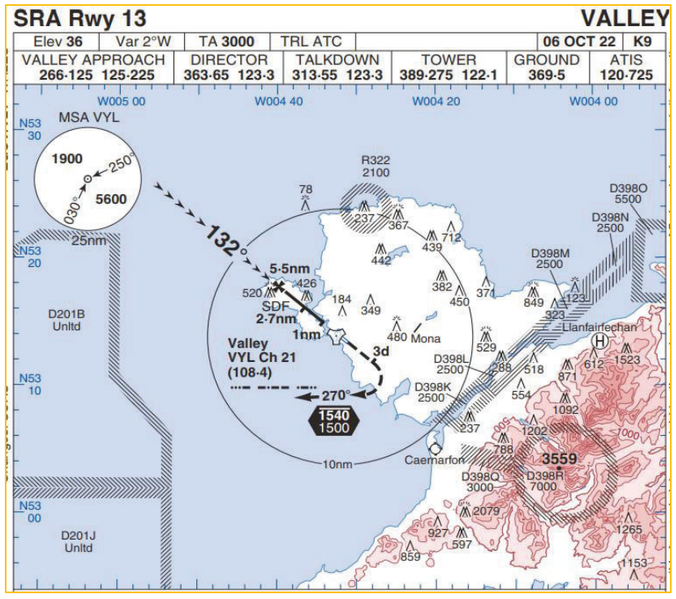

Figure 175 - SRA RWY 13 Procedure

Both windfarms are outside the protection area for the SRA procedure to Runway 13, including the Missed Approach which tracks south-east before turning right, away from the windfarms.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 1840ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the MSA VYL which has been assessed separately in section 6.2.22.

Figure 176 - SRA RWY 13 Protection Areas

The proposed windfarms would have no impact on the SRA RWY 13 procedure.

6.2.12 AD 2 EGOV-1-24 SRA RWY 19

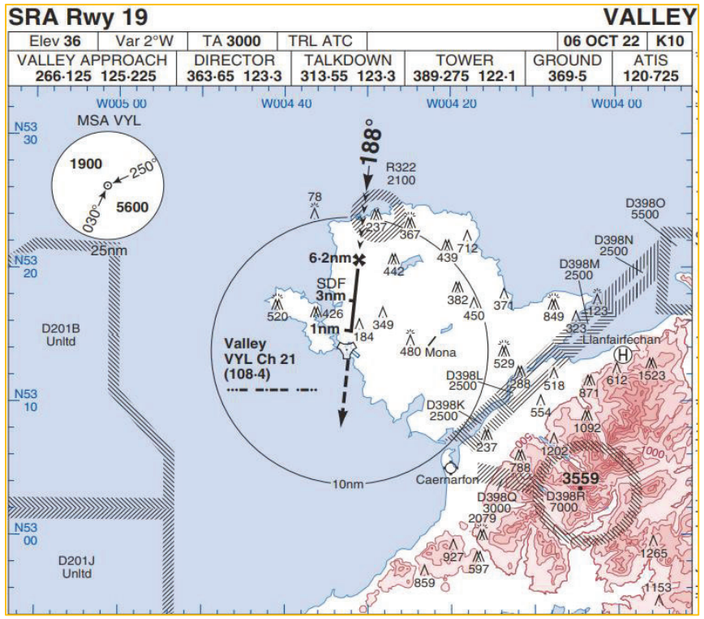

Figure 177 - SRA RWY 19 Procedure

Both windfarms are outside the protection area for the SRA procedure to Runway 19, including the Missed Approach which tracks south, away from the windfarms and requires aircraft to climb to 2540ft.

However, arrival to the procedure could be conducted using the ATCSMAC or MSA VYL to conduct radar vectoring until reaching the FAF at 2040ft.

Both windfarms lie within the ATCSMAC 1400ft/1500ft area which has been assessed separately in section 6.2.1.

Additionally, the Mona development lies within the 1900ft buffer area of the MSA VYL which has been assessed separately in section 6.2.22.

Figure 178 - SRA RWY 19 Protection Areas

The proposed windfarms would have no impact on the SRA RWY 19 procedure.

6.2.13 AD 2 EGOV-1-25 SRA RWY 31

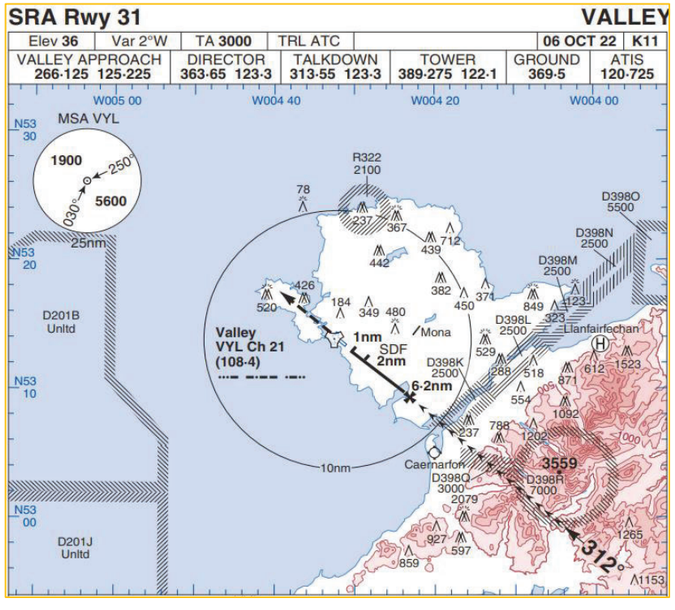

Figure 179 - SRA RWY 31 Procedure

Both windfarms lie outside the protection areas for the SRA procedure to runway 31, including the Missed Approach which tracks west, away from the windfarms and climbs to 2530ft which is above the MOCA required at the windfarms.

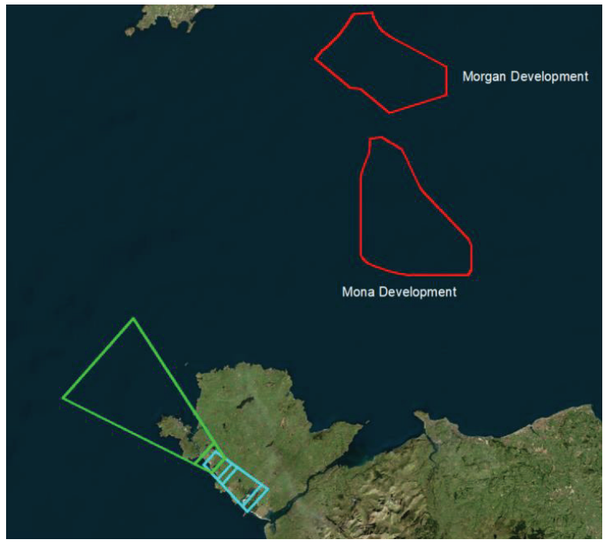

Figure 180 - SRA RWY 31 Protection Areas

Arrival to the procedure from the east lies in the 5600ft south-east sector of the MSA which would offer protection from the windfarms which lie in the 1900ft NW sector.

The proposed windfarms would have no impact on the SRA RWY 31 procedure.

6.2.14 AD 2 EGOV-1-27 TAC to ILS/DME RWY 13 (Point X-Ray Hold)

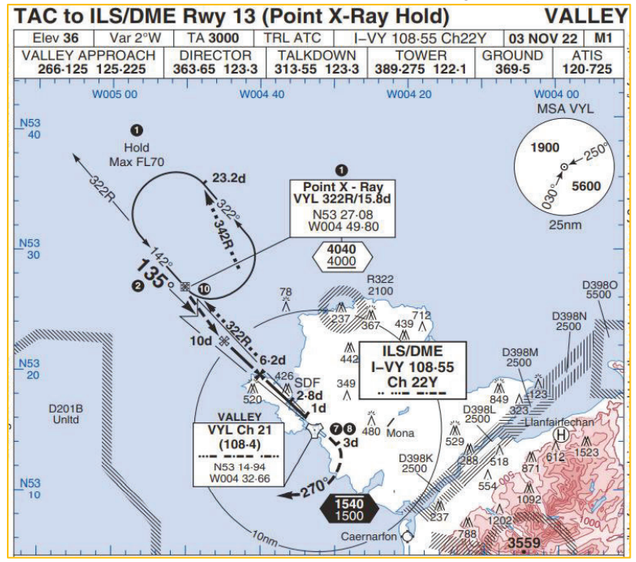

Figure 181 - TAC to ILS/DME RWY 13 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC to ILS/DME procedure to runway 13 which arrives from the Hold at Point X-Ray.

The Missed Approach continues ahead on the runway track and turns right, away from the windfarms and will not be affected.

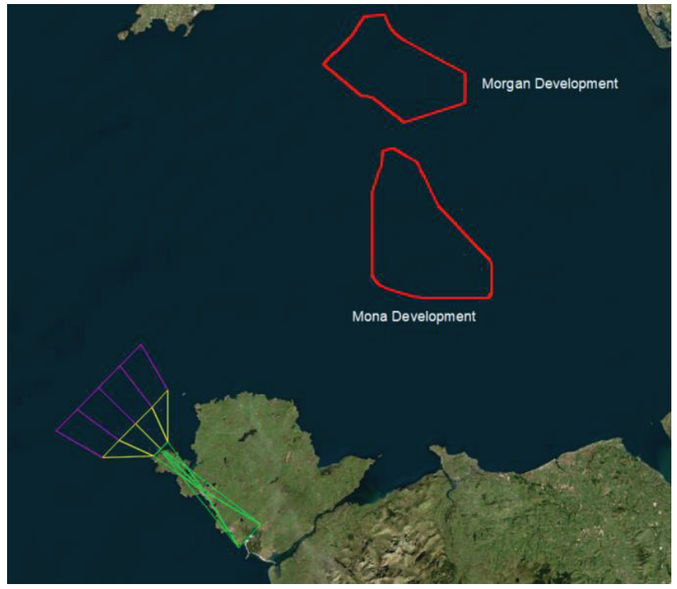

Figure 182 - TAC to ILS/DME RWY 13 (Point X-Ray Hold) Protection Areas

The proposed windfarms would have no impact on the TAC to ILS/DME RWY 13 (Point X-Ray Hold) Procedure.

6.2.15 AD 2 EGOV-1-28 TAC RWY 01 (Point Alpha Hold)

The TAC RWY 01 Procedure has an initial altitude of 2520ft at the IF.

With a maximum MOC of 300m the proposed turbines require a MOCA of:

324m + 300m MOC = 624m / 2048ft AMSL, which is below the procedure altitude for TAC RWY 01.

The proposed windfarms would have no impact on the TAC RWY 01 (Point Alpha Hold) Procedure.

6.2.16 AD 2 EGOV-1-29 TAC RWY 13 (Point X-Ray Hold)

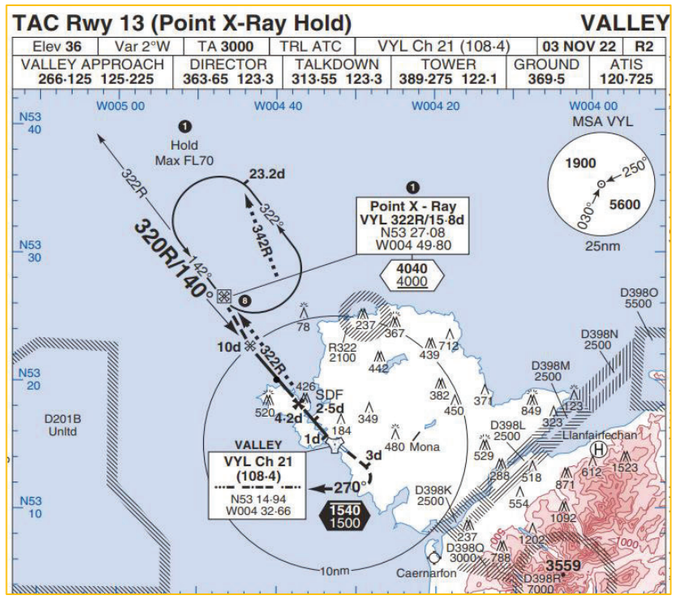

Figure 183 - TAC RWY 13 (Pint X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC procedure to runway 13 which arrives from the Point X-Ray Hold.

The Missed Approach climbs ahead on runway track before turning right, away from the windfarms and would not be affected.

The proposed windfarms would have no impact on the TAC RWY 13 (Point Alpha Hold) Procedure.

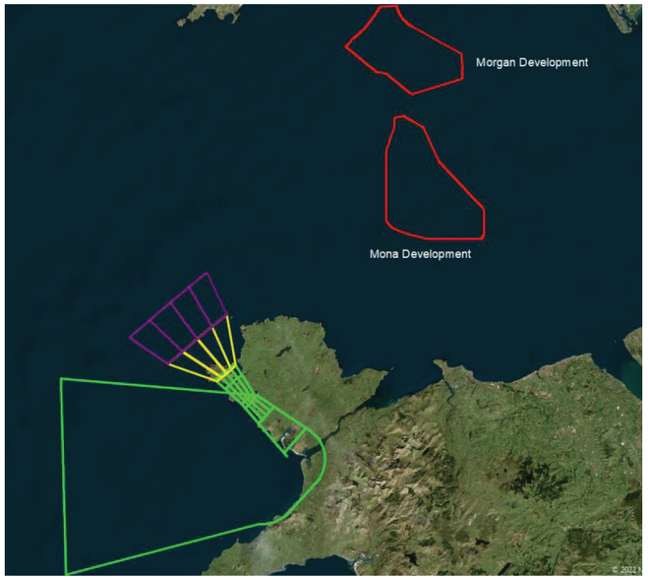

Figure 184 - TAC RWY 13 (Point X-Ray Hold) Protection Areas

The proposed windfarms would have no impact on the TAC RWY 13 (Point X-Ray Hold) procedure.

6.2.17 AD 2 EGOV-1-30 TAC RWY 19 (Point X-Ray Hold)

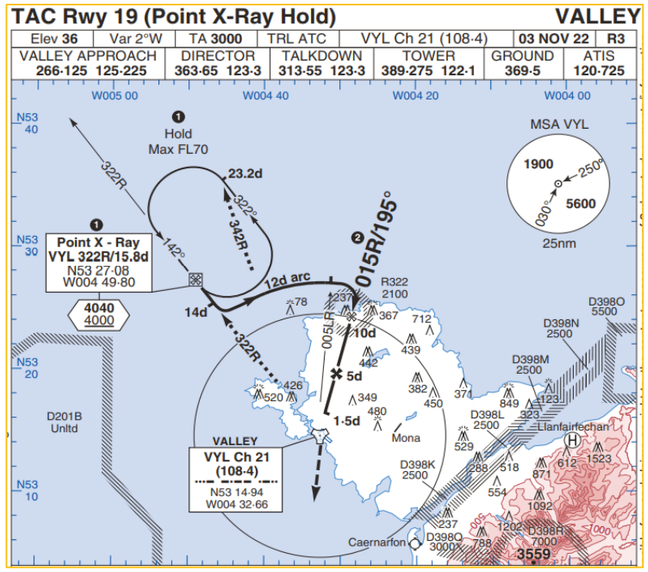

Figure 185 - TAC RWY 19 (Point X-Ray Hold) Procedure

Both windfarms lie outside the protection areas for the TAC procedure to runway 19 which arrives from the Point X-Ray Hold.

The Missed Approach tracks south, away from the windfarms and climbs to 2540ft so is not affected.

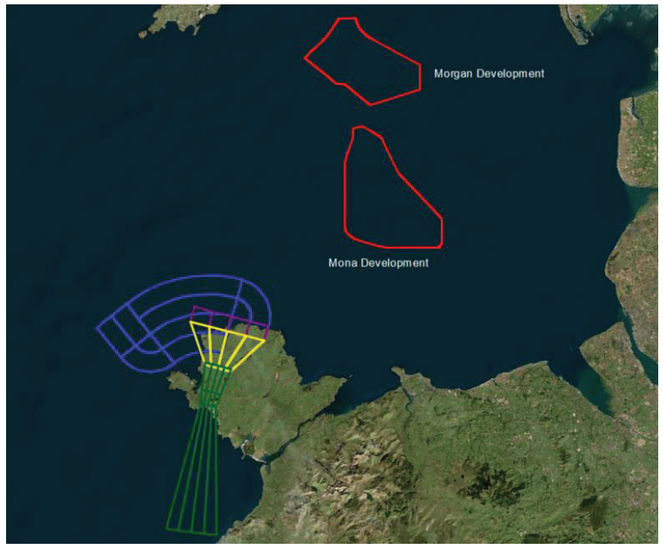

Figure 186 - TAC RWY 19 (Point X-Ray Hold) Protection Areas

The proposed windfarms would have no impact on the TAC RWY 19 (Point X-Ray Hold) procedure.

6.2.18 AD 2 EGOV-1-31 TAC RWY 31 (Point Alpha Hold)

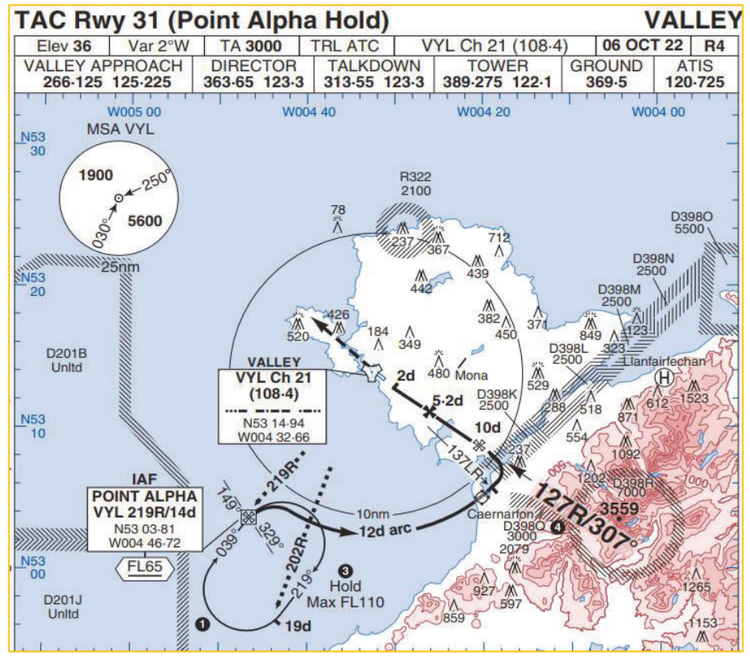

Figure 187 - TAC RWY 31 (Point alpha Hold) Procedure

The TAC RWY 31 Procedure has an initial altitude of 2530ft at the IF.

With a maximum MOC of 300m the proposed turbines require a MOCA of:

324m + 300m MOC = 624m / 2048ft AMSL, which is below the procedure altitude for TAC RWY 31.

The Missed Approach tracks north-west, away from the windfarms and climbs to 2530ft and is not affected.

The proposed windfarms would have no impact on the TAC RWY 31 (Point Alpha Hold) procedure.

6.2.19 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

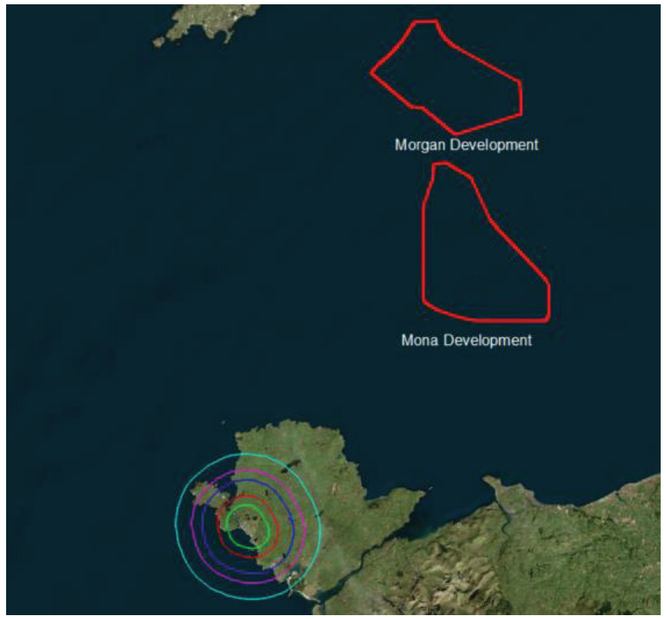

Figure 188 - Visual Circling Protection Area

The proposed windfarms would have no impact on the Visual Circling at RAF Valley.

6.2.20 Holding

Point X-Ray Hold

Both windfarms lie outside the protection areas associated to the Point X-Ray Hold, including its buffers – therefore there will be no impact on the Point X-Ray Hold.

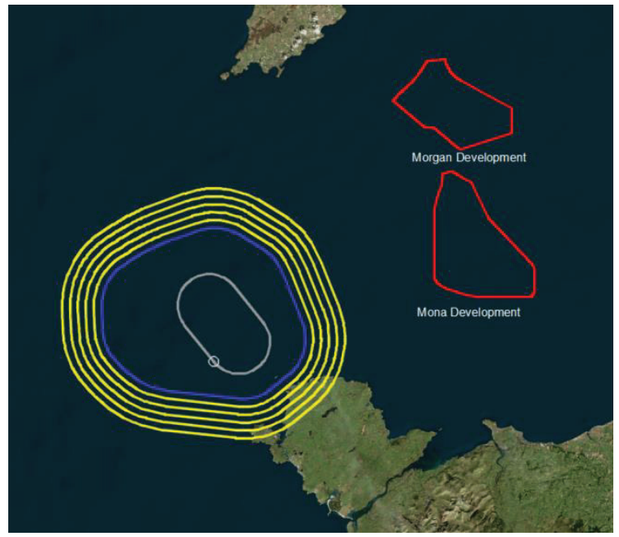

Figure 189 - Point X-Ray Hold Protection Areas and Buffers

Point Alpha Hold

Both windfarms lie outside the protection areas associated to the Point Alpha Hold, including its buffers – therefore there will be no impact on the Point Alpha Hold.

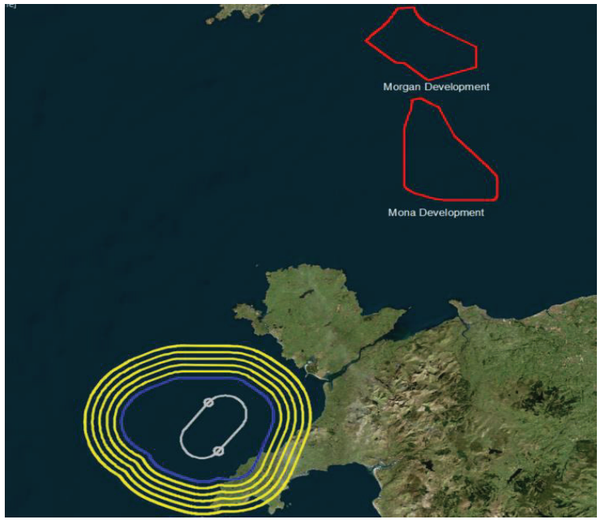

Figure 190 - Point Alpha Hold Protection Area and Buffers

The proposed windfarms would have no impact on any of the holds for RAF Valley.

6.2.21 Visual Segment Surface (VSS)

The proposed windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for RAF Valley's Runways.

6.2.22 Minimum Sector Altitudes

MSA VYL 25NM

The Mona Windfarm lies within the buffer area of the north-west sector of the MSA VYL 25NM which has a published MSA of 1900ft.

The windfarms do not need to be considered towards the south-east sector of the MSA as they are outside the protection areas.

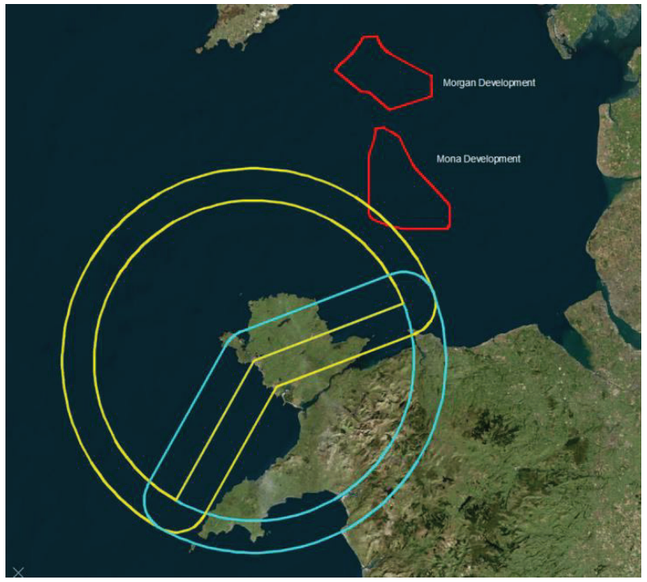

Figure 191 - MSA VYL 25NM and Buffer Area

The Windfarm produces a MOCA of 324m + 300m MOC = 624m / 2048ft AMSL for the north-west sector and would impact the current published MOCA in this sector.

This is above the published MSA for the north-west sector which has a MOCA of 1900ft which would need to be increased to 2100ft to clear Mona Windfarm.

7 Blackpool Airport OLS and IFP Assessment

7.1 OLS Assessment

7.1.1 Overview

The OLS for Blackpool Airport has been constructed in accordance with Annex 14 and CAP 168.

7.1.2 Runway Data Used

The following declared distances and threshold details are published in the AIP:

Runway designator	TORA	TODA	ASDA	LDA	Remarks
1	2	3	4	5	6
10	1868 M	2170 M	1868 M	1868 M	
28	1868 M	2129 M	1868 M	1868 M	
10	1452 M	1754 M	1452 M		Take-off from intersection of Taxiway Delta.
10	1017 M	1319 M	1017 M		Take-off from intersection of Taxiway Echo.
28	866 M	1127 M	866 M		Take-off from intersection of Taxiway Echo.
13	998 M	1077 M	998 M	970 M	
31	852 M	852 M	970 M	970 M	ASDA/LDA ends 24 M before end of pavement.

Figure 192 - Declared Distances

Designations RWY Number	True bearing	Dimensions of RWY	Surface of RWY/ SWY/ Strength (PCN)	THR co-ordinates/ THR Geoid undulation	THR elevation/ Highest elevation of TDZ of precision APP RWY	Slope of RWY/ SWY
1	2	3	4	5	6	7
10	094.63°	1868 x 45 M	RWY surface: Asphalt PCN 33/F/A/W/T	534620.06N 0030233.67W 171.6 FT	THR 31.8 FT	
28	274.66°	1868 x 45 M	RWY surface: Asphalt PCN 33/F/A/W/T	534615.16N 0030051.98W 171.5 FT	THR 28.0 FT TDZ 29.1 FT	
13	127.30°	998 x 24 M	RWY surface: Asphalt PCN 14/F/A/W/T	534625.45N 0030231.30W 171.6 FT	THR 32.1 FT	
31	307.31°	998 x 24 M	RWY surface: Asphalt PCN 14/F/A/W/T	534608.74N 0030154.29W 171.6 FT	THR 31.1 FT	

Figure 193 - Threshold Details

Runway 28 has precision approaches and is runways are more than 1800m in length, as is RW10. Runways 13 and 31 are less than 1199m in length.

Runway 10 is a CODE 4, Non-Precision Runway

Runway 28 is a CODE 4, Precision Instrument Runway (**Lowest threshold, 8.53m**)

Runway 13 is a CODE 2, Non-Precision Runway

Runway 31 is a CODE 2, Non-Precision Runway

7.1.3 OLS Construction

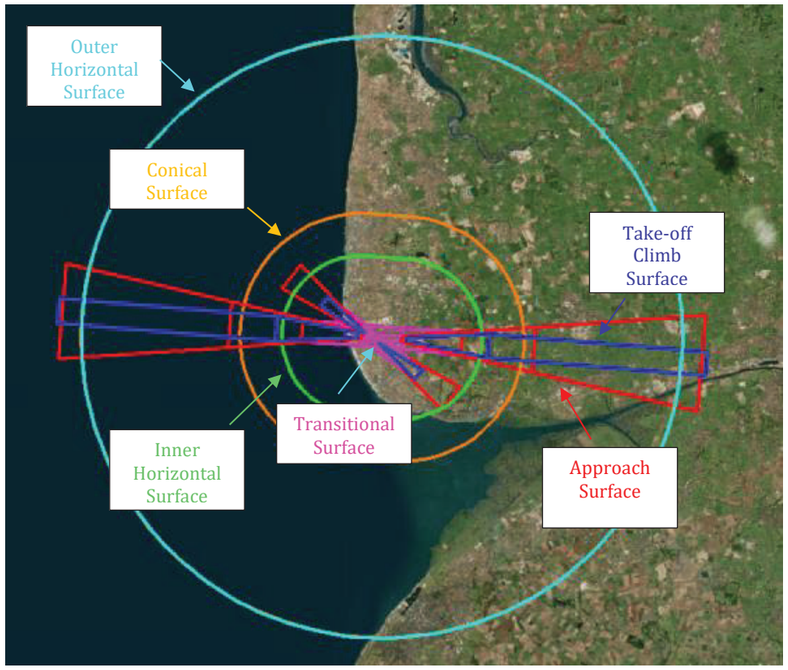

Figure 194 - OLS for Blackpool Airport

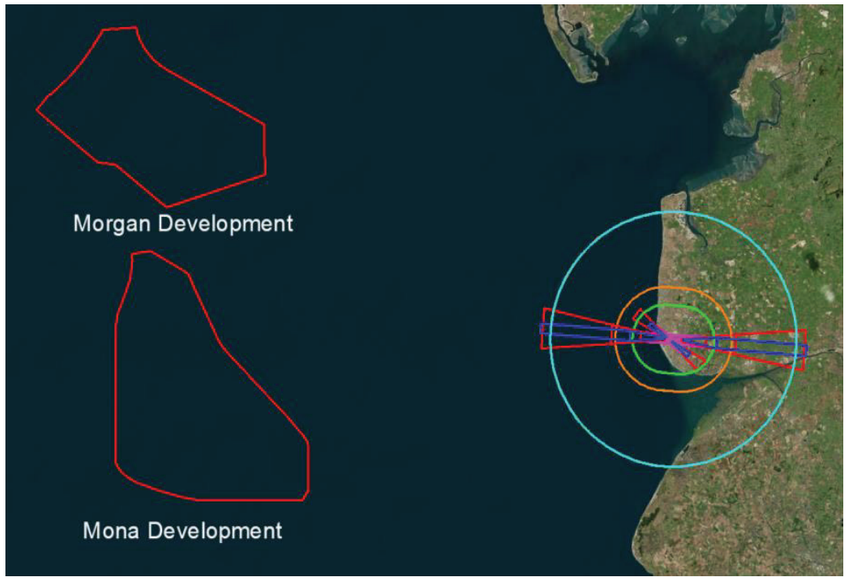

Figure 195 - Blackpool OLS in Relation to Windfarms

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7.1.4 OLS Analysis

The OLS for Blackpool Airport lies entirely outside of the boundaries of both windfarms and is not affected by the development.

The proposed windfarms will have no impact on the OLS for Blackpool Airport.

7.2 IFP Analysis

The IFPs assessed are as follows:

AIRAC 11/2022 (Effective 03 NOV 2022)

- AD 2.EGNH-8-1 NDB(L)/DME RWY 10 (06 OCT 22)
- AD 2.EGNH-8-2 NDB(L) RWY 10 (06 OCT 22)
- AD 2.EGNH-8-3 ILS/DME RWY 28 (06 OCT 22)
- AD 2.EGNH-8-4 LOC/DME RWY 28 (06 OCT 22)
- AD 2.EGNH-8-5 RNP RWY 28 (06 OCT 22)
- AD 2.EGNH-8-6 NDB(L)/DME RWY 28 (06 OCT 22)

Additionally, the following were checked:

- Visual Circling
- Holding
- Visual Segment Surface (VSS)
- Minimum Sector Altitudes (MSA)

7.2.1 NDB(L)/DME RWY 10 (06 OCT 22)

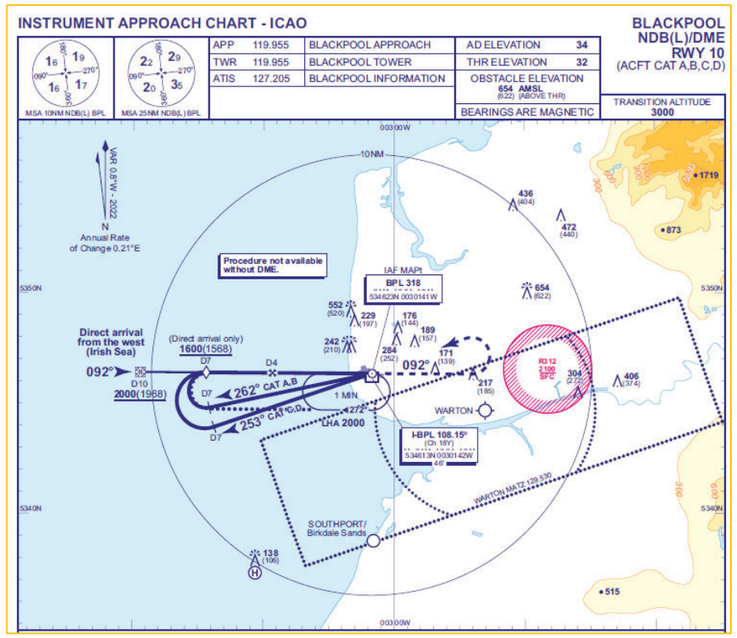

Figure 196 - NDB(L)/DME RWY10 Procedure

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Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L)/DME Procedure to Runway 10 (Including Arrival from IAF I-BPL DME 10).

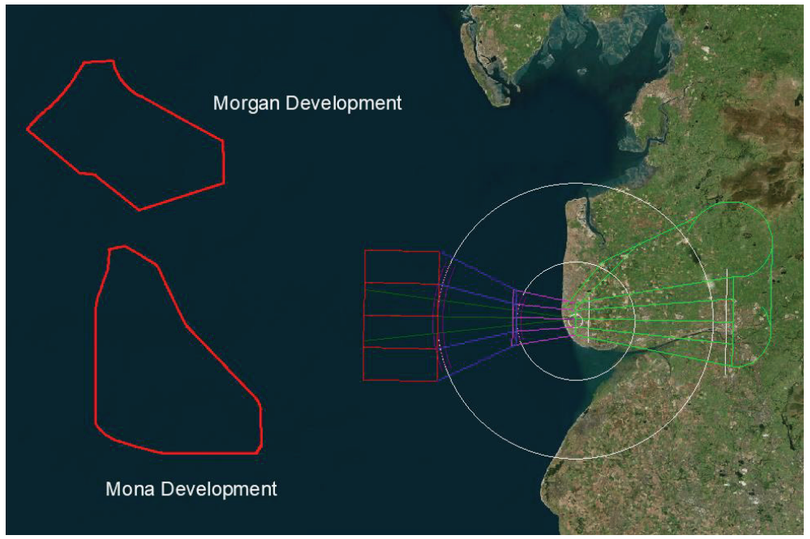

Figure 197 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 10 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IAF NDB(L) BPL have been constructed:

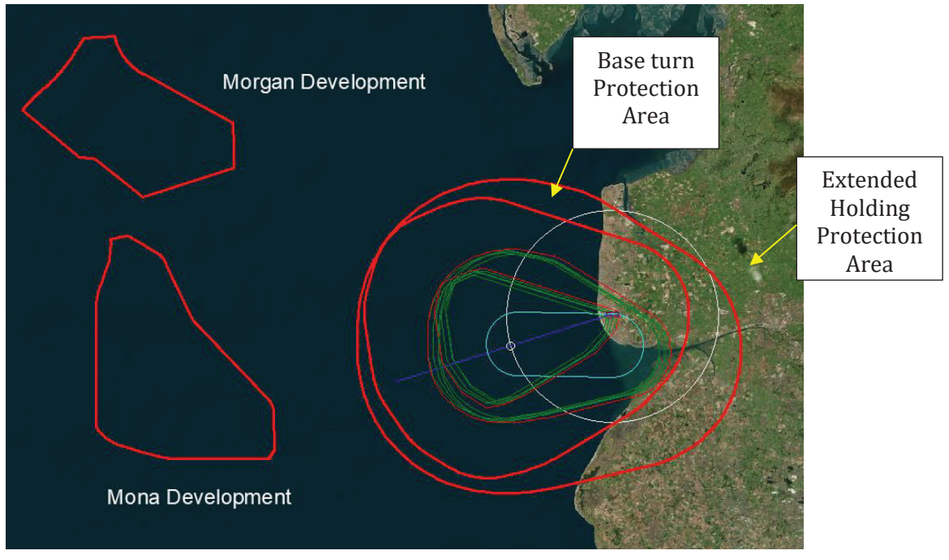

Figure 198 - Windfarms vs NDB(L)/DME RWY 10 Base turn & Extended Holding

As both windfarms are outside the protection areas for the Base turn and the extended holding, they will not impact the reversals.

The NDB(L)/DME RWY10 has been assessed for approaches starting at IAF I-BPL DME 10, which are safe for the current 'at or above' 2000ft altitude restriction. However, aircraft on a direct arrival from the West (Irish Sea), until reaching the IAF I-BPL DME 10, would be covered by the MSA NDB(L) BPL Assessment, which has been done separately – See Section 7.2.10.

Figure 199 - NDB(L)/DME RWY 10 - Direct Arrival from the West.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 10 Procedure.

7.2.2 NDB(L) RWY 10

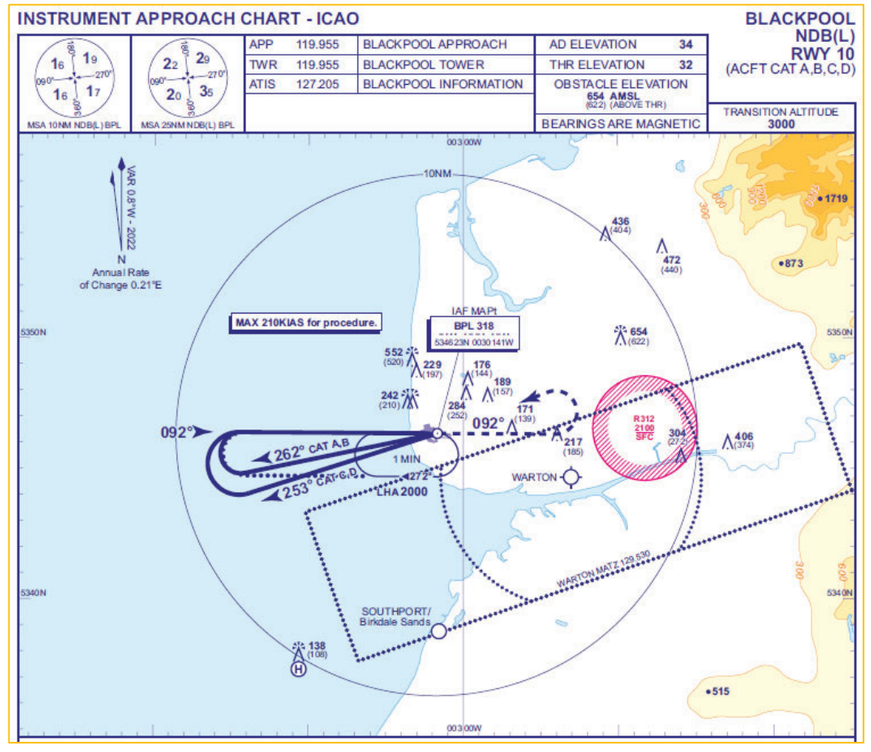

Figure 200 - NDB(L) RWY 10 Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L) Procedure to Runway 10.

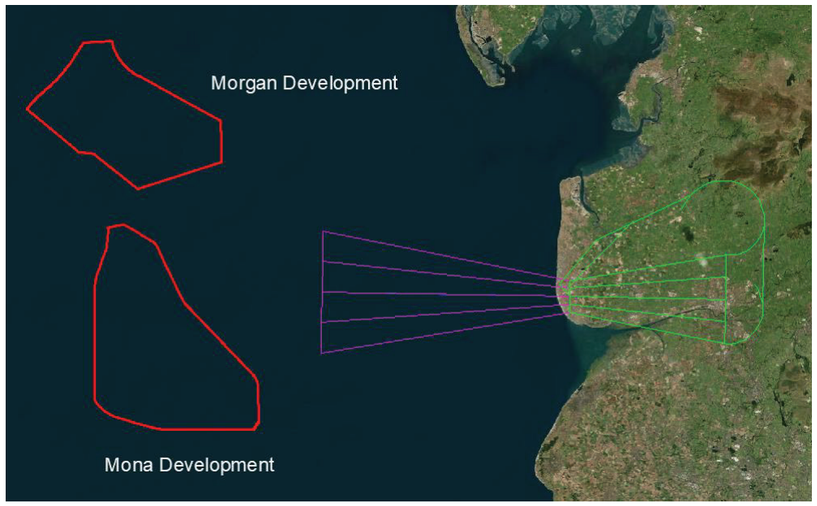

Figure 201 - Morgan and Mona Windfarm vs NDB(L) RWY 10 Protection Areas

Additionally, procedure reversals published on the approach chart (CAT A,B & CAT C,D Base turns and the Alternative Extended Holding Pattern, as per the textual note in the chart) from IAF NDB(L) BPL have been constructed:

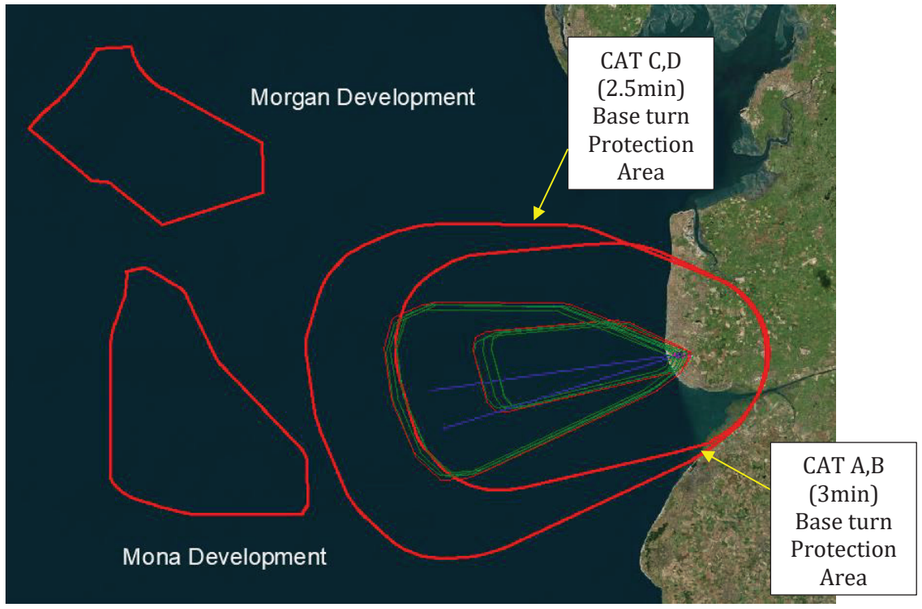

Figure 202 - Windfarms vs NDB(L) RWY 10 Base turns

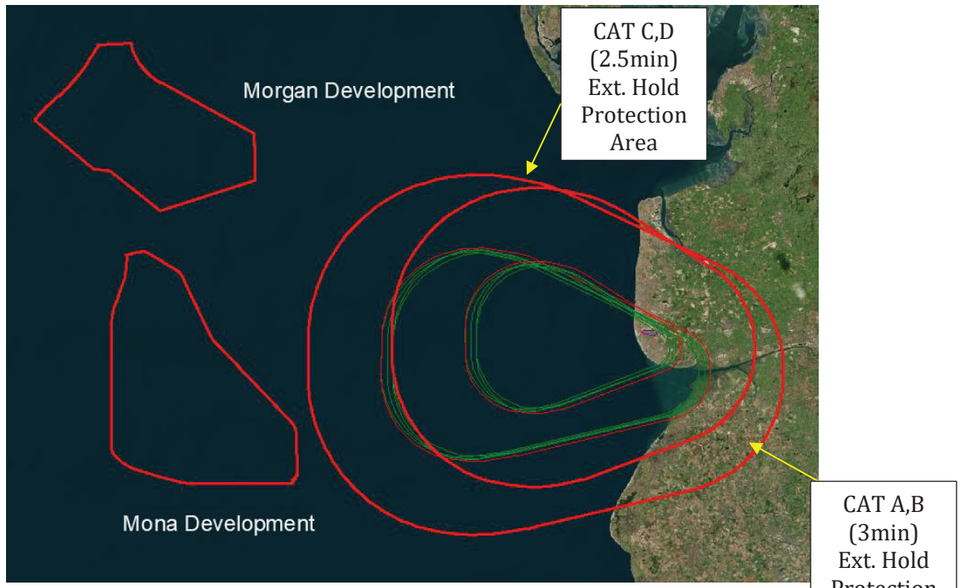

Figure 203 - Windfarms vs NDB(L) RWY 10 Extended Holdings

As both windfarms are outside the protection areas for the base turns and the extended holdings, they will not impact the reversals.

The proposed windfarms will not have an impact on the NDB(L) RWY 10 Procedure.

7.2.3 ILS/DME RWY 28

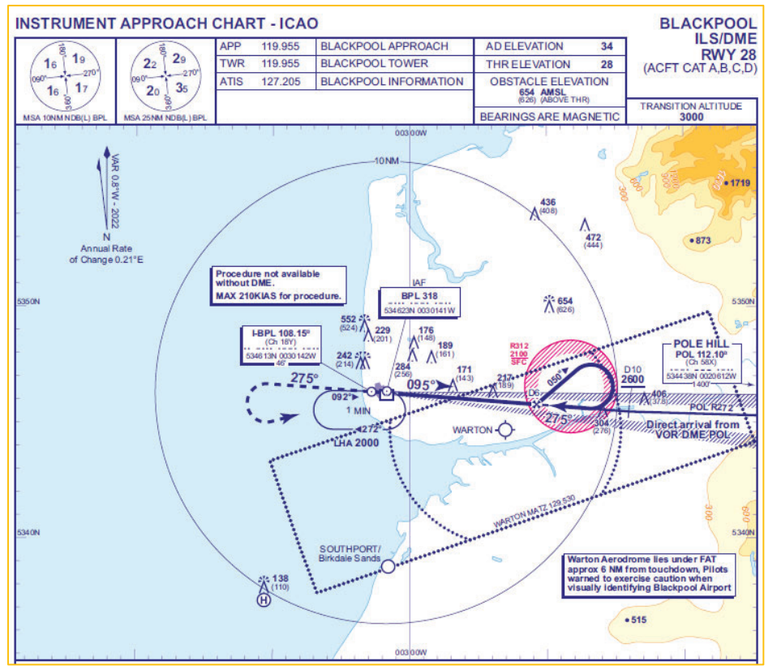

Figure 204 - ILS/DME RWY28

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the ILS/DME Procedure to Runway 28.

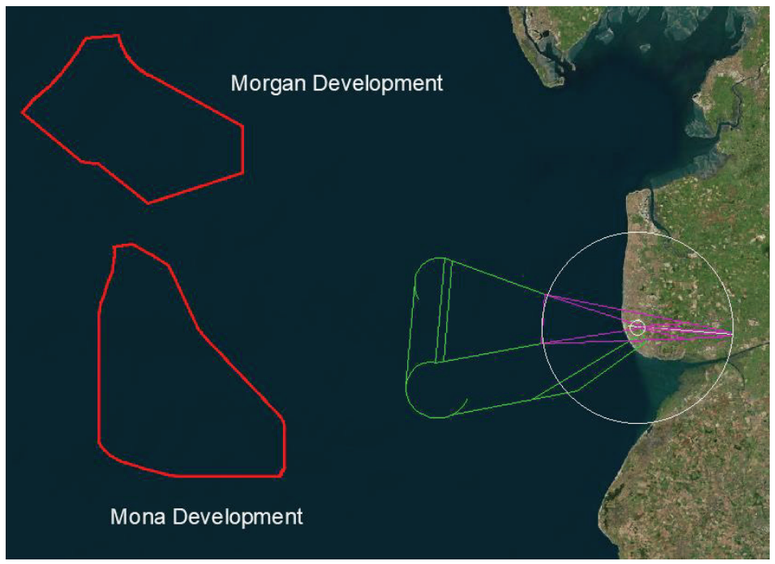

Figure 205 - Morgan and Mona Windfarm vs ILS/DME RWY 28 Protection Areas

Additionally, procedure reversal published on the approach chart (45°/180° Procedure Turn) from IAF NDB(L) BPL have been constructed:

Figure 206 - Windfarms vs ILS/DME RWY 28 Reversal

As both windfarms are outside the protection areas for the reversal, they will not cause an impact.

The proposed windfarms will not have an impact on the ILS/DME RWY 28 Procedure.

7.2.4 LOC/DME RWY 28

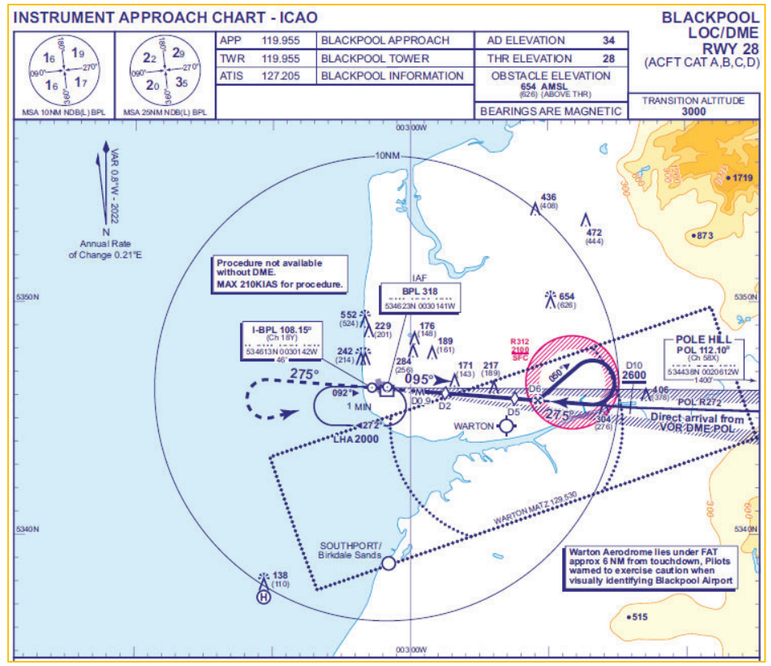

Figure 207 - LOC/DME RWY 28 Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the LOC/DME Procedure to Runway 28.

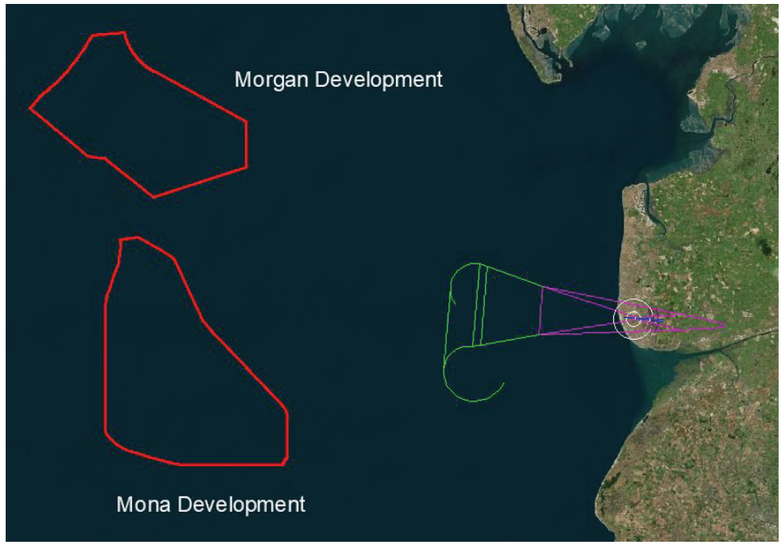

Figure 208 - Morgan and Mona Windfarm vs LOC/DME RWY 28 Protection Areas

The procedure reversal published on the approach chart (45°/180° Procedure Turn) from IAF NDB(L) BPL has already been assessed in Section 7.2.3 and it is not impacted.

The proposed windfarms will not have an impact on the LOC/DME RWY 28 Procedure.

7.2.5 RNP RWY 28

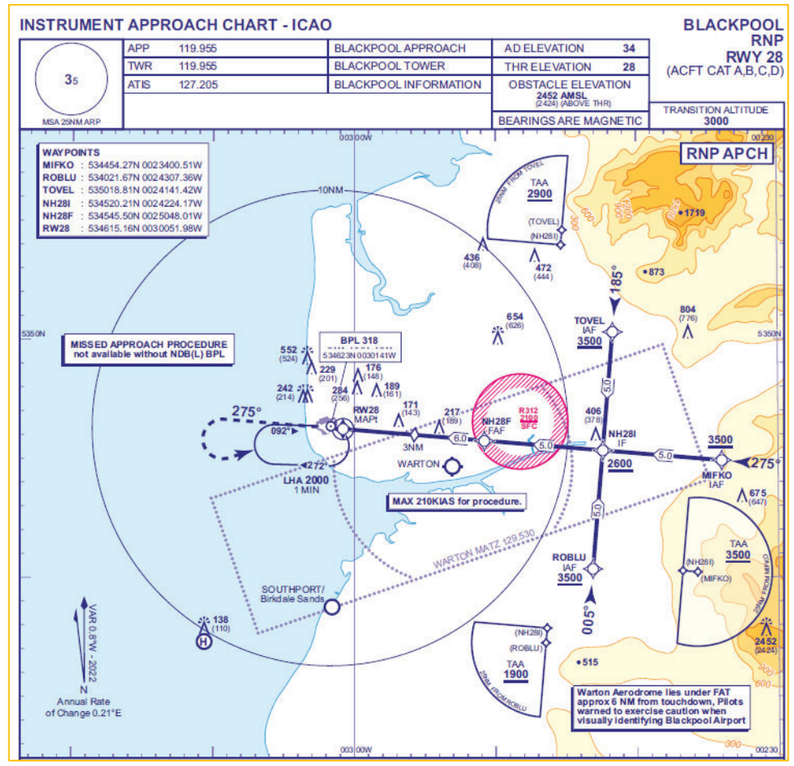

Figure 209 - RNP RWY 28 Procedure

Both windfarms lie outside the protection areas associated to the RNP Procedure to Runway 28.

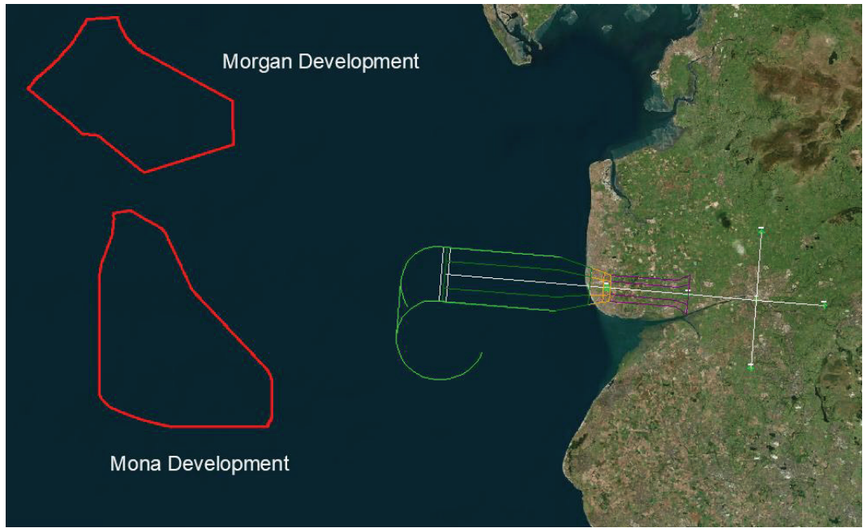

Figure 210 - Morgan and Mona Windfarm vs RNP RWY 28 Protection Areas

Additionally, Terminal Arrival Altitudes (TAAs) on each of the Initial Approach Fixes (IAFs; TOVEL, MIFKO and ROBLU) have been constructed:

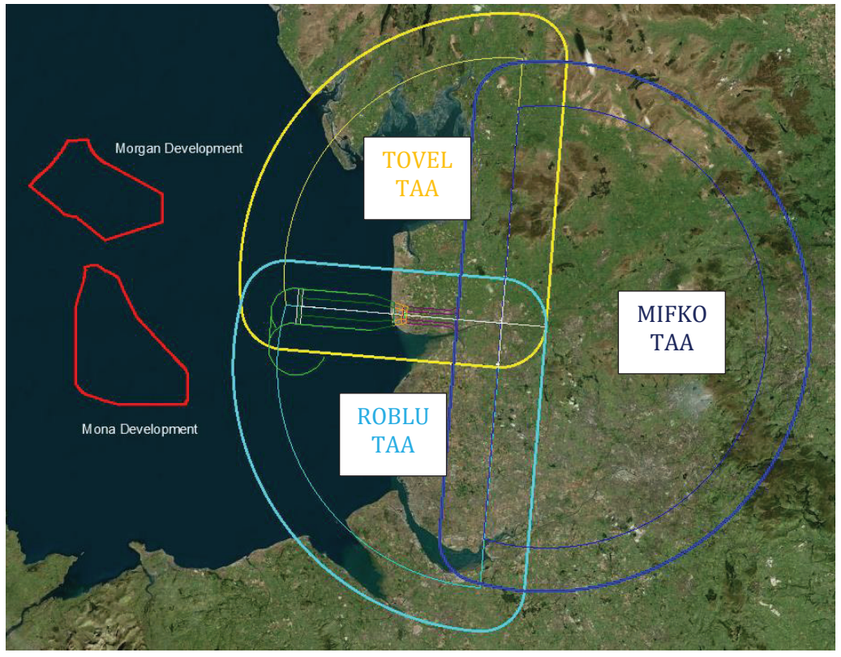

Figure 211 - Windfarms vs RNP RWY 28 TAAs

As both windfarms are outside the protection areas for the TAAs, they will not cause an impact.

The proposed windfarms will not have an impact on the RNP RWY 28 Procedure.

7.2.6 NDB(L)/DME RWY 28

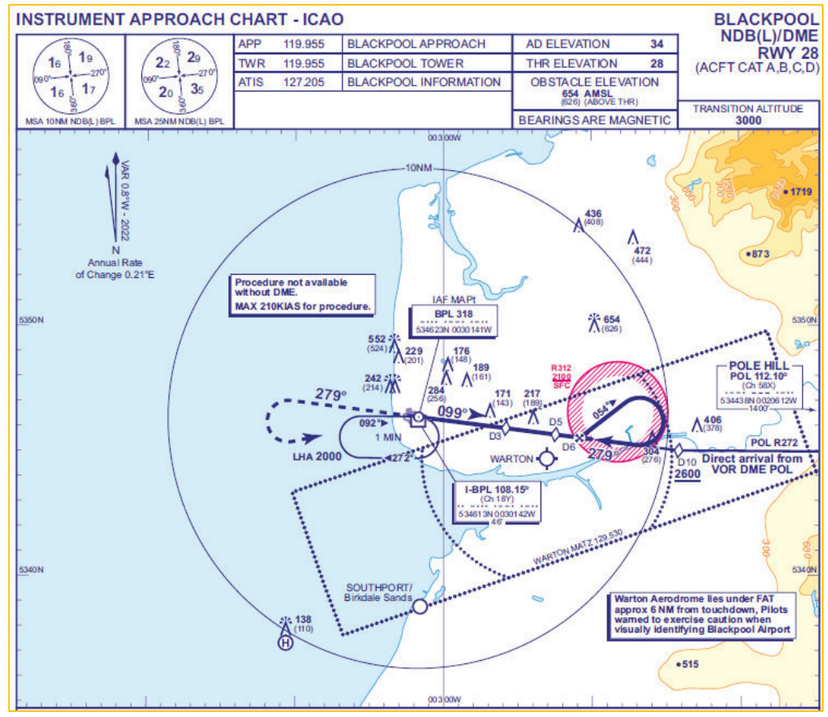

Figure 212 - NDB(L)/DME RWY 28 Procedure

Both windfarms (Morgan and Mona) lie outside the protection areas associated to the NDB(L)/DME Procedure to Runway 28.

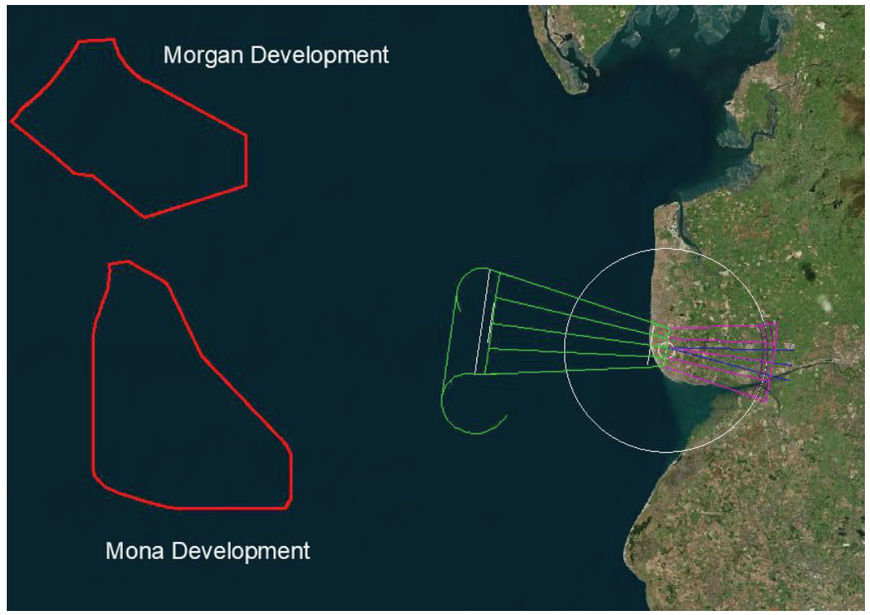

Figure 213 - Morgan and Mona Windfarm vs NDB(L)/DME RWY 28 Protection Areas

The procedure reversal published on the approach chart (45°/180° Procedure Turn) from IAF NDB(L) BPL has already been assessed in Section 7.2.3 and it is not impacted.

The proposed windfarms will not have an impact on the NDB(L)/DME RWY 28 Procedure.

7.2.7 Visual Circling

Both windfarms are outside the Visual Circling VM(C) Obstacle Clearance areas for all aircraft categories (A, B, C and D).

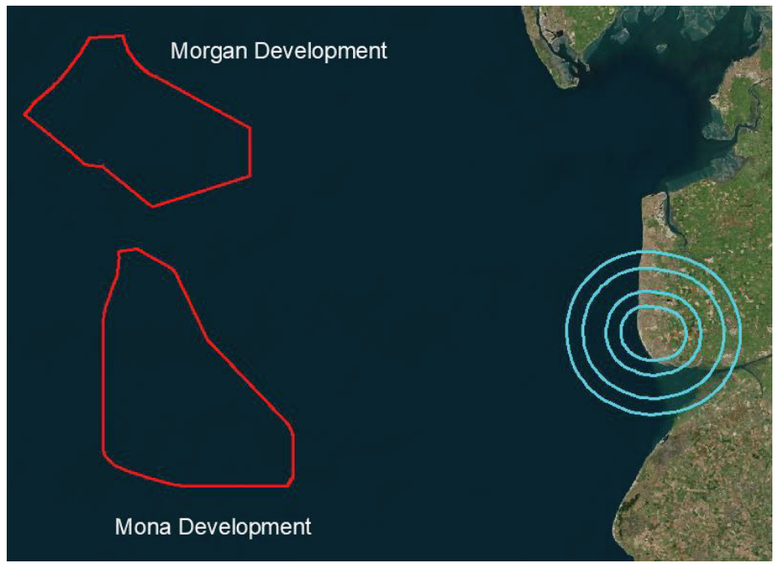

Figure 214 – Visual Circling Protection Area

The proposed windfarms would have no impact on the Visual Circling.

7.2.8 Holding

NDB(L) BPL Hold

The NDB(L) BPL Hold has an existing Lowest Holding Altitude (LHA) of 2000ft.

With a maximum MOC of 300m the proposed turbines would potentially impact the hold:

- 324m + 300m MOC = 624m / 2048ft AMSL
- Existing Lowest Holding Altitude (LHA) = 2000ft

However, further analysis has deemed that both windfarms lie outside the protection areas associated to the NDB(L) BPL Hold, including its buffers – therefore there will be no impact on the NDB(L) BPL Hold.

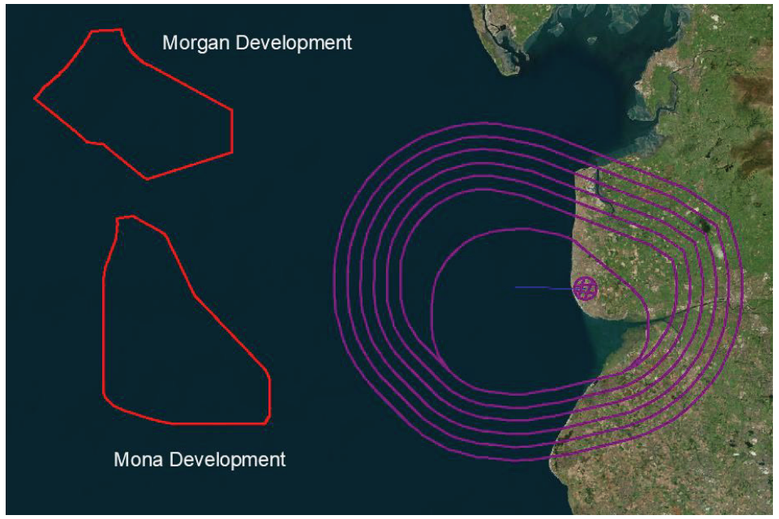

Figure 215 - NDB(L) BPL Hold Protection Area and Buffers

The proposed windfarms would have no impact on any of the holds for Blackpool Airport.

7.2.9 Visual Segment Surface (VSS)

Both windfarms lie outside the lateral confines of VSS for all Runways.

The proposed windfarms would have no impact on the VSS for Blackpool Airport Runways.

7.2.10 Minimum Sector Altitudes

MSA 25NM NDB(L) BPL

The Morgan Windfarm lies within the north-western quarter of the MSA 25NM NDB(L) BPL, which published MSA is 2200ft. Additionally, the Mona Windfarm lies within both the north-western and south-western quarters of the MSA 25NM NDB(L) BPL, which published MSAs are 2200ft and 2000ft respectively. The windfarms do not need to be considered towards any other sectors of the MSA as are outside their protection areas and associated buffers.

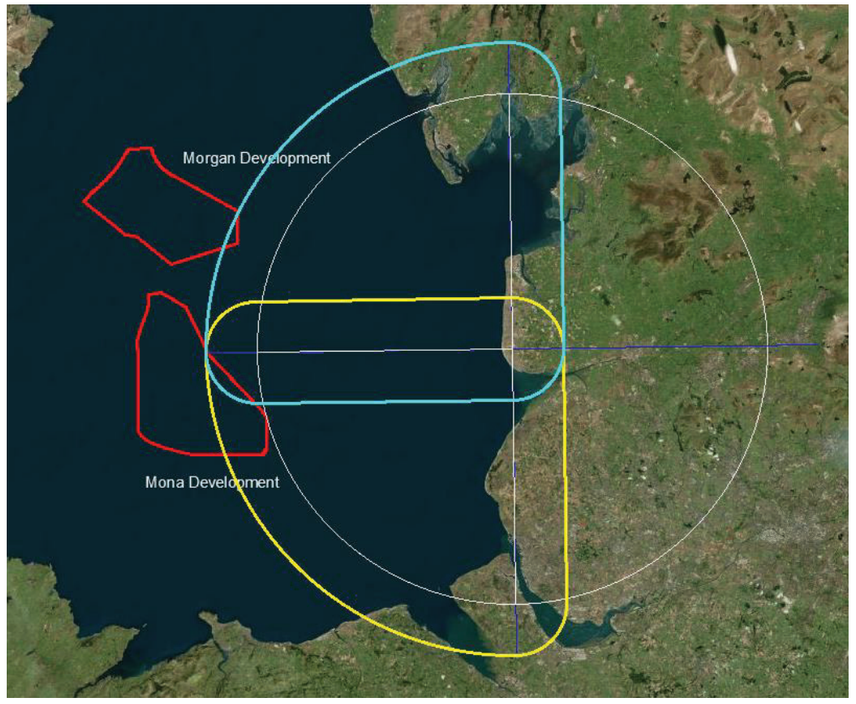

Figure 216 – NDB(L) UW BPL vs Windfarms

The proposed windfarms would produce a MOCA of 324m + 300m = 624m / 2048ft AMSL for the north-western and south-western quadrants.

This is below the NE quadrant published MSA which has a MOCA of 2200ft.

However, this is above the SW quadrant published MSA which has a MOCA of 2000ft which will need to be increased to 2100ft to clear the wind turbines.

This could indirectly impact the altitude restriction at the IAF I-BPL 10 for the NDB(L)/DME Approach to Runway 10, which might need to be increased to 2100ft.

The proposed windfarms would cause an impact on the published NDB(L) BPL MSA.

MSA 25NM ARP

We have additionally protected for an MSA based on the ARP because it is used on the RNP Procedures to Runway 28.

The proposed windfarms lie within single sector MSA 25NM ARP, which published MSA is 3500ft.

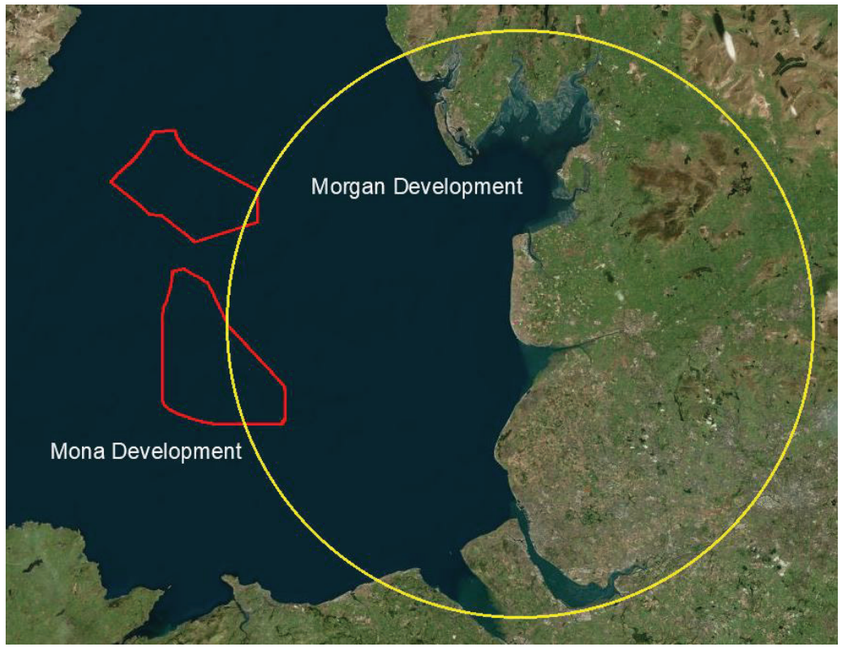

Figure 217 –ARP MSA vs Windfarms

The proposed windfarms would produce a MOCA of 324m + 300m = 624m / 2048ft AMSL for MSA ARP. This is below the currently published MSA ARP which has a MOCA of 3500ft.

The proposed windfarms would have no impact on the published ARP MSA.

8 Summary

None of the windfarms affects the OLS of the airports analysed in this report.

For a summary of Impact to IFPs see below table:

Windfarm / Airport	Mona Windfarm	Morgan Windfarm
Manchester	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Liverpool	No Impact on OLS. No Impact on IFPs.	No Impact on OLS. No Impact on IFPs.
Warton	No Impact on IFPs. **Impact on WTN TAC MSA 25NM SW Sector.** MOCA needs increasing from 1800ft to 2100ft. Although there is no impact to the WTN NDB MSA, it is likely this would be raised to remain consistent with the WTN TAC MSA. **See Section 4.2.20** Other IFPs unaffected.	No Impact on IFPs. No Impact on IFPs.
Isle of Man	No Impact on OLS. **Impact on ATCSMAC 1600ft SMAA.** MOCA needs increasing from 1600ft to 2100ft. See Section 5.2.1 No Impact on IFPs.	No Impact on OLS. **Impact on ATCSMAC 1600ft SMAA.** MOCA needs increasing from 1600ft to 2100ft. See Section 5.2.1 **Impact on IFP NDB(L)/DME RWY26 for DME I-RY Inoperative (CAT C, D).** Base turn MOCA needs increasing from 2000ft to 2100ft (which has knock-on effects on procedure). NO DME OCA needs increasing from 810ft to 1100ft. **See Section 5.2.11.** Other IFPs unaffected.

Valley	No Impact on OLS. **Impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs increasing to 2100ft QFE 2200ft QNH. See Section 6.2.1 **Impact on MSA VYL 25NM NW Sector.** MOCA needs increasing from 1900ft to 2100ft. See Section 6.2.22 Other IFPs unaffected.	No Impact on OLS. **Impact on ATCSMAC 1500ft QNH 1400ft QFE SMAA.** MOCA needs increasing to 2100ft QFE 2200ft QNH. See Section 6.2.1 Other IFPs unaffected.
Blackpool	No Impact on OLS. **Impact on MSA 25NM NDB(L) BPL SW Sector.** MOCA needs increasing from 2000ft to 2100ft. **See Section 7.2.10.** Other IFPs unaffected.	No Impact on OLS. No Impact on IFPs.
Barrow/Walney Island	**It should be noted that although a thorough assessment of Barrow/Walney Island Airport has not been included in this Safeguarding report, an informal check has highlighted that the MSA would be impacted by both Mona and Morgan Windfarms which could, in turn, affect the IFPs associated with the Airport.**	

Table 2 - Conclusions Summary