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CRUACH CLENAMACRIE WIND FARM

CHAPTER 14:
AVIATION

November 2024

RESPONSIBILITIES

	DATE	NAME	FUNCTION
Elaboration	19/06/2024	M Spaven	Author
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CONTENTS

ABBREVIATIONS

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
AAIB	Aircraft Accident Investigation Branch	**IFP**	Instrument Flight Procedure
agl	above ground level	**IHS**	Inner Horizontal Surface
AIP	Aeronautical Information Publication	**km**	Kilometre
amsl	above mean sea level	**M**	metres
ANO	Air Navigation Order	**MoD**	Ministry of Defence
APDO	Approved Procedure Design Organisation	**MSA**	Minimum Sector Altitude
ARP	Aerodrome Reference Point	**NATS**	National Air Traffic Services
AS	Approach Surface	**NDB**	Non-Directional Beacon
ATC	air traffic control	**NERL**	NATS (En Route) plc
ATZ	Aerodrome Traffic Zone	**nm**	nautical mile
C/I	Carrier to Interference ratio	**OHS**	Outer Horizontal Surface
CAA	Civil Aviation Authority	**OLS**	obstacle limitation surface
CEMP	Construction Environment Management Plan	**PBN**	Performance-Based Navigation
CS	Conical Surface	**PSR**	primary surveillance radar
DME	Distance Measuring Equipment	**RAF**	Royal Air Force
EIA	Environmental Impact Assessment	**RAG**	Red-Amber-Green
ft	Feet	**RNP**	Required Navigation Performance
GNSS	Global Navigation Satellite System	**TAA**	Terminal Arrival Altitude
GPA	Glasgow Prestwick Airport	**TOCS**	Take-Off Climb Surface
HIAL	Highlands & Islands Airports Ltd	**VHF**	Very High Frequency
IAP	Instrument Approach Procedure	**VFR**	Visual Flight Rules
ICAO	International Civil Aviation Organisation	**VRP**	Visual Reference Point

14 AVIATION

14.1 Introduction

This chapter considers the likely significant effects on aviation associated with the construction, operation, and decommissioning of the Proposed Development. It has been compiled by Malcolm Spaven, Director of Gladhouse Planning Ltd.

14.2 Legislation, Policy and Guidance

The following legislation has been reviewed and taken into account as part of the assessment in this chapter:

- The Air Navigation Order (ANO) 2016 (as amended);
- The Civil Aviation Act 1982; and
- The Town and Country Planning (Safeguarded Aerodromes, Technical Sites, Meteorological Technical Sites and Military Explosives Storage Areas) (Scotland) Direction 2016.

The following policy and guidance have been reviewed and taken into account as part of the assessment in this chapter:

- International Civil Aviation Organisation (ICAO) Annex 14, Volume 1, Aerodrome Design and Operations (2022);
- The Scottish Government Onshore Wind Policy Statement (2022);
- Civil Aviation Authority (CAA), CAA Policy and Guidelines on Wind Turbines, CAP 764 (Sixth Edition, 2016);
- CAA Policy and Guidelines on Wind Turbines, CAP 764 (Draft Seventh Edition, 2024);
- CAA, Licensing of Aerodromes, CAP 168 (2019);
- CAA, Air Traffic Services Safety Requirements, CAP 670 (2019);
- CAA, Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level (2017); and
- Scottish Government Planning Circular 2/2003, Safeguarding of Aerodromes, Technical Sites, Meteorological Technical Sites, and Military Explosives Storage Areas (Revision 1.0, March 2016).

14.3 Consultation

Consultation responses received from aviation stakeholders at scoping stage are set out in **Table 14.1.**

TABLE 14.1: AVIATION SCOPING RESPONSES

CONSULTEE	RESPONSE	ACTION
Civil Aviation Authority	The CAA requires notification of a change to aviation obstacles if it or they are 100 metres or more above sea level, in accordance with Article 225A of the Air Navigation Order (2016).	Noted. If required, a planning condition will be applied to deliver this requirement to notify the CAA.

CONSULTEE	RESPONSE	ACTION
	The statutory requirement for aviation lighting for civil aviation, set out in the Air Navigation Order, Article 222, Lighting of En-Route obstacles, is any building, structure or erection, the height of which is 150 metres or more above ground level.	A lighting scheme has been submitted to and approved by the CAA. It will also be controlled by a condition requiring the scheme to be submitted to the planning authority for approval.
	Effects on Instrument Flight Procedures (IFPs) may be relevant for windfarms built within 30 nautical miles (~55km) of an aerodrome.	Noted. There are no aerodromes with IFPs within 30nm of the Proposed Development. Further analysis has been undertaken of the potential effects on a proposed IFP to runway 01 at Oban Airport and this is addressed in section 14.6 of this chapter.
	Wind turbines located within the line-of-sight of surveillance systems (in particular, primary radar) can cause clutter and interference and can result in performance degradation.	Potential effects on civil en route and military radar have been addressed through consultation with NATS and the Ministry of Defence (MoD). There are no radar-equipped aerodromes with the potential to detect wind turbines in the Proposed Development.
	Very High Frequency (VHF) communications systems may also be affected.	Potential effects on Oban Airport VHF air-ground-air radio communications have been assessed in consultation with Oban Airport and are addressed in **Section 14.6** of this chapter.
Glasgow Airport	This proposal is located outwith the consultation zone for Glasgow Airport. As such we have no comment to make and need not be consulted further.	Noted. No further action required.
Glasgow Prestwick Airport	The Proposed Development lies outside the GPA safeguarding area and consequently we would have no comment or valid objection to make.	Noted. No further action required.

CONSULTEE	RESPONSE	ACTION
Ministry of Defence (MoD)	The addition of turbines in this location has the potential to introduce a physical obstruction to low flying aircraft operating in the area. To address the impact upon low flying given the location and scale of the development, the MoD would require that conditions are added to any consent issued requiring that the development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction. As a minimum the MoD would require that the development be fitted with MoD accredited aviation safety lighting in accordance with the Air Navigation Order 2016.	The requirement to notify the MoD is a legal requirement under ANO Article 225A. If required, a planning condition will also be applied to deliver this requirement. A lighting scheme has been submitted to and approved by the CAA and has been submitted to the MoD for comment.
Highlands & Islands Airports Ltd (HIAL)	With reference to the above proposal, our preliminary assessment shows that, at the given position and height, this development would not infringe the safeguarding criteria and operation of Inverness Airport. Therefore, Highlands and Islands Airports Limited has no objections to the proposal.	Noted. No further action required.
NATS (En Route) plc	The Proposed Development has been examined from a technical safeguarding aspect and does not conflict with our safeguarding criteria. Accordingly, NATS (En Route) Public Limited Company ("NERL") has no safeguarding objection to the proposal.	Noted. No further action required.
Oban Airport	Further consultancy/scoping required:- • Potential impact the development would have on a proposed GNSS approach for RWY 01 with 4.49 degree approach angle. • Assess if a VHF interference survey should be carried out with the development falling into the RAG Amber Zone. • Further clarification on turbulence effects on aircraft on final approach / climb out. • Clarification on turbine directing in-line with the runway for long finals in terms of heights and OHS breaching.	The Applicant has engaged with Oban Airport to address the issues raised. These are covered in **Section 14.6** of this chapter.

14.4 Methodology

The description of baseline conditions for aviation has been completed using the following methods:

- Assessment of the turbine visibility to all potentially affected air traffic control and air defence radars;

- Desk studies to identify all potentially affected airfields, airstrips and other aviation activity sites in the vicinity of the Site, referencing the UK Aeronautical Information Publication (AIP), the UK Military AIP, aeronautical charts and published pilots' guides; and
- Consultation with identified aviation consultees.

The potential impacts of the Proposed Development on aviation have been assessed by considering:

- Whether any of the turbines would be within line of sight of, and in an area of operational significance to, any aeronautical or defence radar equipment; and
- Whether any of the turbines would breach the obstacle limitation surfaces (OLSs) around civil or military airfields or pose an obstacle hazard to aircraft in the vicinity of airfields or conducting military low flying.

In addition, the assessment in this chapter has considered issues raised by aviation consultees.

The Study Areas for the aviation assessment were selected using the recommended distances set out in CAA guidance (CAP 764)[1], modified to ensure that all radars with the range to detect wind turbines are included. The distances used are radii from the centre of the Site, as follows:

- 100km for air traffic control (ATC) primary surveillance radars (PSRs);
- 200km for air defence PSRs;
- 30km for Meteorological Office rainfall radars;
- 20km for secondary surveillance radars and aeronautical radio navigation aids;
- 30km for licensed, certificated and Government aerodromes; and
- 10km for unlicensed aerodromes and airstrips, gliding sites and military low flying areas.

Significance criteria for assessment of impacts on aviation, unlike those for environmental effects, are not based on the sensitivity of the receptor. Further, while the magnitude of impact can be determined in some circumstances, it typically does not provide a standardised metric on which to measure the significance of any effects. In this context, the significance of effects on aviation has been determined in this chapter by application of professional judgement, underpinned by consideration of the magnitude of impact (where measurable), the regulations and procedures in place for ensuring that aviation infrastructure meets required performance standards, the safeguarding policies and practices in use by specific aviation stakeholders, and the consultation responses from those stakeholders.

Residual adverse effects of the Proposed Development on aviation are described as either nil, negligible, minor, moderate, or major. Nil, negligible, or minor impacts are categorised as not significant. Moderate or major effects are categorised as significant. The definitions of these criteria are shown in **Table 14.2.**

TABLE 14.2: AVIATION SIGNIFICANCE CRITERIA

LEVEL OF EFFECT	DESCRIPTION
Major	Regular, frequent, or permanent effects which require changes to existing operational and/or technical practice in order to mitigate adequately, or which are not capable of being mitigated adequately; and/or the owner of the affected aviation asset requires mitigation; and/or mitigation is required by law.
Moderate	Periodic effects experienced which may require alterations to existing operational practice; and/or the owner of the affected aviation asset requires mitigation; and/or

[1] CAA, CAA Policy and Guidelines on Wind Turbines, CAP 764 (Sixth Edition, 2016, and Draft Seventh Edition, 2024.

LEVEL OF EFFECT	DESCRIPTION
	mitigation is required by law.
Minor	Occasional effects experienced which do not require any alteration of existing operational and technical practice.
Negligible	Normally no measurable change from baseline conditions; occasional, fleeting or very short term effects experienced which do not require any alteration of existing operational and technical practice.
Nil	No measurable change from baseline conditions.

14.5 Baseline

The aviation baseline has been determined as follows:

- The Site is located in uncontrolled airspace extending from ground level to Flight Level 195 (approximately 19,500 feet);
- There are no air traffic service routes (formerly known as ‘airways’) within 20km of the Site;
- The MoD air defence primary surveillance radar (PSR) at South Clettraval, North Uist (referred to by the MoD as "RRH Benbecula" or “RAF Benbecula”) is located 186km north-west of the Site;
- The NERL ATC PSR at Ben Hynish, Tiree, is located 97km west of the Site;
- There are no other PSRs within the Study Area;
- There are no Meteorological Office radars within the Study Area;
- Oban Airport, a CAA-licensed aerodrome, is located 6km north-west of the Site;
- There are no secondary surveillance radars within the Study Area;
- Two aeronautical radio navigation aids are located on Oban Airport: a Distance Measuring Equipment (DME) and a Non-Directional Beacon (NDB);
- Transmitter/receiver aerials for Oban Airport air-ground-air VHF radio communication facilities are located on the roof of the airport control tower;
- The Site is wholly within an area classified by the MoD as a "low priority military low flying area less likely to raise concerns"; and
- There are no other aviation-related launching/landing sites within 10km of the Site.

14.6 Likely Significant Effects

14.6.1 Construction

PSRs used for air traffic control and air defence are designed to filter out objects that are not moving. Since the turbine rotors will not be turning during the construction phase, the effects of the Proposed Development on air traffic control and air defence PSRs is assessed as **nil**.

During the construction phase, turbine components and construction equipment up to 200 metres above ground level (m agl) may be present on the Site and could therefore present a hazard to aircraft flying at low altitudes. Since the Site is in an area designated by the MoD as “low priority” for low flying these effects are assessed as of **minor** significance and therefore not significant.

14.6.1.1 Oban Airport obstacle limitation surfaces

Oban Airport has a single runway, oriented north/south (designated 01/19), with a declared length of 1199m and is therefore a Code 2 licensed aerodrome as defined by the criteria set out in CAP 168. Code 2 aerodromes with runway lengths of 1100m or more have the following obstacle limitation surfaces (OLSs) of relevance to the Proposed Development:

- A Take-Off Climb Surface (TOCS) extending to 2500m beyond each end of the runway;
- An Approach Surface (AS) extending to 2500m along each approach path;
- An Inner Horizontal Surface (IHS) extending to 2500m (for visual only runways) or 4000m (for non-precision instrument runways) from the mid-point of the runway;
- A Conical Surface (CS) extending to 3600m (for visual only runways) or 6100m (for non-precision instrument runways) from the mid-point of the runway; and
- An Outer Horizontal Surface (OHS) extending from the periphery of the CS to a radius of 10,000m from the Aerodrome Reference Point (ARP).

The Proposed Development is located outside the boundaries of the TOCS and AS for both runways and is also outside the airport's IHS. It is also outside the boundary of the current Oban Airport CS because Oban Airport is a visual-only aerodrome, with no IFPs. In the event that an IFP was established at the airport, Turbine 1 of the Proposed Development would be within the 6100m radius of the revised CS.

The Site is wholly within the horizontal boundary of the Oban Airport OHS. The OHS is a horizontal plane at a level 100m above the elevation of the lowest runway threshold existing or proposed for the aerodrome. The lowest runway threshold is that of runway 01, at 22.7 feet (6.9m) above mean sea level (amsl). Therefore, the elevation of the OHS is 106.9m amsl.

The elevation of the terrain throughout the Site exceeds 150m amsl. Consequently, all of the terrain at the Site infringes the Oban Airport OHS and any constructions on that terrain will also infringe the OHS.

The purpose of the OHS is to give "*consideration…to the control of new obstacles in order to facilitate practicable and efficient instrument approach procedures, and together with the conical and inner horizontal surfaces to ensure safe visual manoeuvring in the vicinity of an aerodrome.*"[2] The CAA advises that "*New objects or additions to existing objects should not extend above an inner horizontal surface, a conical surface or an outer horizontal surface, except when in the opinion of the CAA the object would be shielded by an existing immovable object or it is determined that the object would not adversely affect the safety or significantly affect the regularity of aircraft operations.*"[3]

The airspace around Oban Airport is extensively constrained by high terrain, infringing all of the OLSs listed above. This is not unusual for licensed aerodromes in the Highlands & Islands, with Barra, Campbeltown, Islay, Stornoway, Sumburgh and Tingwall Airports all having significant infringements of at least the IHS and/or OHS by terrain and other obstacles, including wind turbines. The CAA advises that "*In ideal circumstances all the surfaces will be free from obstacles but when a surface is infringed, any safety measures required by the CAA will have regard to:*

1. the nature of the obstacle and its location relative to the surface origin, to the extended centreline of the runway or normal approach and departure paths and to existing obstructions;

2. the amount by which the surface is infringed;

3. the gradient presented by the obstacle to the surface origin;

4. the type of air traffic at the aerodrome; and

5. the instrument approach procedures published for the aerodrome."[4]

[2] CAP 168 paragraph 4.41.
[3] CAP 168 paragraph 4.51.
[4] CAP 168 paragraph 4.2.

Regarding shielding, there are no objects between the Proposed Development and the airport with elevations high enough to be considered as "shields". This aspect can therefore be disregarded.

In relation to the criterion of "facilitat[ing] practicable and efficient instrument approach procedures", Oban Airport currently has no such procedures. Effects on possible future IFPs for Oban Airport are considered below – it is considered that the Proposed Development will have no impact on a future Required Navigation Performance (RNP) instrument approach procedure to runway 01 at Oban Airport.

As regards "ensur[ing] safe visual manoeuvring in the vicinity of an aerodrome", the following aspects are relevant:

- The wind farm is located outside Oban Airport's Aerodrome Traffic Zone (ATZ), which is the airspace feature designed to contain all aircraft operating in the vicinity of an aerodrome including all aircraft entering or leaving the aerodrome traffic circuit;
- The wind farm is located beyond the visual circuit pattern for Oban Airport;
- The closest turbine will be 3.2km away from the closest point on the extended runway centreline, at a point 8.2km from touchdown; and
- For aircraft approaching Oban Airport from, or departing to the south-east, the wind farm will occupy a 16° sector between 137° and 153° True from the ARP. The pilots of aircraft flying in this sector must already take account of terrain and obstacles higher than the proposed wind farm at ranges of 10.2km and beyond from the ARP.

In view of the constraints on flight paths and altitudes already imposed by terrain and other obstacles in the area to the south-east of the airport, it is concluded that the wind farm would not adversely affect the safety or significantly affect the regularity of aircraft operations. The effect of the Proposed Development on Oban Airport OLSs is therefore assessed as of **minor** to **moderate** significance. If minor, the effect will not be significant. If moderate, the effect will be significant.

14.6.1.2 Oban Airport instrument approach procedure

Construction equipment and turbines on the Site also have the potential to affect the design parameters and operational viability of a planned future satellite-based instrument approach procedure to runway 01 at Oban Airport. These types of approach procedure are variously referred to as Performance-Based Navigation (PBN), Required Navigation Performance (RNP) or Global Navigation Satellite System (GNSS). Initial feasibility work on such a procedure has been carried out for Oban Airport by a CAA Approved Procedure Design Organisation (APDO). Further work to develop the procedure awaits funding.

The potential for the Proposed Development to constrain the options for design of an RNP procedure to runway 01 at Oban Airport has been assessed for this chapter by applying the standard design parameters for RNP approaches set out in ICAO Doc 8168[5] and the approval requirements for Instrument Approach Procedures (IAPs) to aerodromes without Approach Control and/or with a non-instrument runway – as is the case with Oban Airport – set out in CAA policy document CAP 2304[6].

Applying the parameters in those documents, it is concluded that any future IAP to runway 01 at Oban Airport would be likely to have:

- A final approach track aligned to the runway centreline, with no possibility of a final approach track offset to the east to mitigate the effects of the high ground of Beinn Lora, to the north of the airport;
- A final approach obstacle assessment area extending to 1.45nm (2.7km) either side of the final approach track; and

[5] International Civil Aviation Organisation, Doc 8168: Aircraft Operations: Procedures For Air Navigation Services, Volume II: Construction of Visual and Instrument Flight Procedures, Seventh Edition, 2020.
[6] CAA, Applications for instrument approach procedures to aerodromes without Approach Control and/or with a non-instrument runway – additional policy, guidance, and Acceptable Means of Compliance, CAP 2304, 2022.

- A Minimum Sector Altitude (MSA)/Terminal Arrival Altitude (TAA) of 4700ft, dictated by the summit of Ben Cruachan.

The Proposed Development will be wholly outside the +/-1.45nm final approach obstacle assessment area and will not, therefore, affect the procedure minimum altitudes for the final approach phase of the procedure. With a maximum turbine tip height of 1513ft amsl, the Proposed Development would not require any alteration of the likely MSA/TAA of 4700ft.

It is concluded that the potential effect of the Proposed Development on a future PBN/RNP/GNSS instrument approach to runway 01 at Oban Airport is **nil**.

14.6.1.3 Oban Airport radio communications

The potential for wind farms to affect the performance of aeronautical VHF radio communications is addressed in CAA guidance document CAP 670[7]. This identifies two potential effects: multipath effects, caused by reflection and re-radiation of a radio signal from the turbine tower structure; and amplitude modulation in the form of repetitive fast fading of the signal as it passes through the rotating blades of a turbine. The former is an effect that may occur when the turbines are not turning and therefore applies in the construction, operation and decommissioning phases of the Proposed Development. The latter effect can only occur when the turbines are turning. However, for simplicity the potential for both effects is addressed in this section.

CAP 670 sets out a suggested methodology for assessing the potential effects of wind turbines on VHF radio communications. Method 1 – a "zonal assessment" – is applicable to turbines with tip heights up to 158m. Since the Proposed Development would have turbines with tip heights of 200m, this method has limited application. In these circumstances, CAP 670 recommends use of Method 2 - Carrier to Interference (C/I) ratio prediction. The application of the C/I method is relatively untested, particularly for small General Aviation aerodromes in uncontrolled airspace such as Oban Airport. The applicant therefore proposed and obtained agreement from Oban Airport to conduct an assessment using an alternative methodology in which:

- Other aerodromes, similar in size and type of operation to Oban, were identified that have operational wind farms in their vicinity;
- Method 1 was applied to those aerodromes to determine whether the risk of adverse effects on VHF radio communications was 'Red', 'Amber' or 'Green' as defined in CAP 670; and
- Consultations undertaken with the operators of those aerodromes to ascertain whether they had experienced any adverse effects on VHF radio performance that might be attributable to the presence of wind turbines.

The study identified seven aerodromes in Scotland and England with operational wind farms within a 10km radius. Application of the 'zonal assessment' method determined that one of these had turbines in the 'Red' and 'Amber' zones; six had turbines in the 'Amber' zone; and the Proposed Development would have turbines in the 'Red' and 'Amber' zones from Oban Airport. This exercise also identified that the terrain at the Site is within the 'Amber' zone from Oban Airport and the terrain beyond the Site, at Deadh Choimhead and Beinn Ghlas, is in the 'Red' zone as measured from Oban Airport.

Consultations with the operators of the seven aerodromes found no cases of adverse effects on VHF radio communications that were attributed to wind turbines.

[7] CAA, Air Traffic Services Safety Requirements, CAP 670, Third Issue, 2019, Appendix A to GEN 02: Methodology for the Prediction of Wind Turbine Interference Impact on Aeronautical Radio Station Infrastructure.

Trials carried out by QinetiQ, the Maritime & Coastguard Agency and the Royal Air Force in 2004-2005 found no degradation of VHF radio performance when search and rescue helicopters were operating within and in the vicinity of an offshore wind farm.

CAP 670 advises that the results of any technical assessment of the potential for adverse effects on VHF radio communications should be additionally subjected to an operational impact assessment, taking into account the geographic location and volume of affected airspace; and the type of operational usage. In the case of Oban Airport, such an operational impact assessment would be expected to take account of the fact that:

- All radio messages to aircraft on the Oban Information frequency are in the form of information, not instructions;
- All aircraft operating on the Oban Information frequency are flying under the Visual Flight Rules (VFR) in uncontrolled airspace where pilots bear the sole responsibility for avoidance of the terrain, obstacles and other aircraft, and for their routing and altitude;
- The Proposed Development is located significantly beyond the boundary of the Oban Aerodrome Traffic Zone (ATZ), within which pilots are required to be in radio contact with Oban Information; and
- CAA guidance advises limiting transmissions to heights up to 1,000 ft in the immediate vicinity of the aerodrome.

Taking those factors and the results of the study of other aerodromes into account, the effect of the Proposed Development on Oban Airport VHF radio communications is assessed as being of **minor** significance and therefore not significant.

14.6.1.4 Oban Airport radio navigation aids

Two aeronautical radio navigation aids are located at Oban Airport: a Distance Measuring Equipment (DME) and a Non-Directional Beacon (NDB). Both types of equipment have the potential to be affected by multipath effects, where terrain and/or structures reflect the signal, causing erroneous distance/bearing information to be received in the aircraft.

The recommended technical safeguarding zones around DME and NDB installations, within which other structures should not be placed, are set out in CAA guidance CAP 670. For a stand-alone DME, as is the case at Oban Airport, CAP 670 stipulates a zone consisting of "*a 2% (1:50) slope surface originating at the site ground level extending 300 m radially.*"[8] This zone does not extend beyond the Oban aerodrome boundary.

ICAO European guidance material on safeguarding aeronautical radio navigation aids recommends that structures should not infringe a surface extending from ground level at the base of a DME antenna, at an elevation angle of 1° above the horizontal, to a maximum radius of 3,000 metres from the facility.[9]

For NDB, CAP 670 stipulates a zone "*From the centre of the aerial, at a height of 5 m out to 30 m radius, with a further slope to a height of 14 m above ground, out to 90 m radius.*"[10] This zone does not extend beyond the Oban aerodrome boundary.

[8] CAP 670 GEN02.19.
[9] ICAO, European Guidance Material on Managing Building Restricted Areas, ICAO EUR DOC 015, 3rd Edition, 2015, Appendix 1, Table 1.
[10] CAP 670 GEN02.28.

ICAO European guidance material on safeguarding aeronautical radio navigation aids recommends that structures should not infringe a surface extending from ground level at the base of an NDB antenna, at an elevation angle of 5° above the horizontal, to a maximum radius of 1,000 metres from the facility.[11]

Since the Proposed Development would be well outside the CAA and ICAO recommended safeguarding zones for DME and NDB equipment, it is concluded that any effects of the Proposed Development on these facilities would be of **negligible** significance and therefore not significant.

14.6.2 Operation

14.6.2.1 MoD radar

Published data on MoD radar coverage shows that there is no line of sight from the MoD North Uist air defence radar at 200m agl within a 70km radius of the Site. The scoping consultation response from the MoD does not refer to any potential effects on military radar equipment. The effect of the Proposed Development on the North Uist air defence radar is therefore assessed as **nil**.

14.6.2.2 NERL radar

Published data on NERL radar coverage shows that there is no line of sight from the NERL Tiree radar at 200m agl within a 6km radius of the Site. The scoping consultation response from NERL confirms that they have no objection to the Proposed Development. The effect of the Proposed Development on the NERL Tiree radar is therefore assessed as **nil**.

14.6.2.3 Oban Airport

Predicted effects on Oban Airport obstacle limitation surfaces, future RNP approach procedure to runway 01, VHF radio communications, and DME/NDB navigation aids during the operational phase will be the same as those predicted for the construction phase.

Turbulence in the airspace downwind of wind turbines can only occur in the operational phase when the wind turbines are turning. The draft Seventh Edition of CAA guidance CAP 764 advises that "*published research suggests a distance of 8-12 rotor diameters downstream of the wind turbine is a distance at which the turbulence effects are not expected to affect conventional aircraft flying.*"[12]

Analysis of the potential for turbulence to affect aircraft flying to/from Oban Airport found that:

- There is one case of a light aircraft accident in the UK which the pilot suggested that downwind turbulence from a nearby wind farm was a factor. However the accident occurred 17 rotor diameters downwind of the nearest turbine and neither the Aircraft Accident Investigation Branch (AAIB) nor the aerodrome concerned could verify the pilot's view;
- There is no evidence from Mandatory Occurrence Reports to the CAA of downwind turbulence from wind turbines posing a safety risk to aircraft;
- Research studies show that turbulence effects on aircraft are unlikely to occur further than eight rotor diameters downstream from a wind farm;
- In the author's experience of flight in light aircraft in the airspace theoretically subject to downwind turbulence from wind turbines, no turbulence has been experienced;
- The worst case turbulence zones downwind of the Proposed Development will not extend to the final approach track for runway 01 or straight climb-out from runway 19 at Oban Airport;

[11] ICAO, European Guidance Material on Managing Building Restricted Areas, ICAO EUR DOC 015, 3rd Edition, 2015, Appendix 1, Table 1.
[12] CAA, CAP 764 Draft Seventh Edition, March 2024, paragraph 2.56.

- Some arrival routes to runway 01 from the south-east could pass over or within 12 rotor diameters downwind of the turbines. Minor deviations of flight path would keep these aircraft clear of the potential turbulence zones; and
- Some departure routes from runway 19 to the south-east could pass over or within 12 rotor diameters downwind of the turbines. Minor deviations of flight path would keep these aircraft clear of the potential turbulence zones and many aircraft will have climbed above the potential turbulence zones before reaching their horizontal boundaries.

On the basis of those conclusions, it is assessed that the effect of downwind turbulence from the Proposed Development on air traffic using Oban Airport would be of **minor** to **moderate** significance. If minor, the effect will not be significant. If moderate, the effect will be significant.

14.6.3 Decommissioning

The effects of the Proposed Development on aviation in the decommissioning phase would be the same as those during the construction phase.

14.7 Mitigation

14.7.1 Oban Airport obstacle limitation surfaces

Since all turbines in the Proposed Development will infringe the Oban Airport OHS, mitigation measures can be expected to be recommended by the CAA. CAP 168 suggests that these mitigation measures could include:

- Promulgation in the UK AIP of appropriate information;
- Marking and/or lighting of the obstacle;
- Variation of the runway distances declared as available;
- Limitation of the use of the runway to visual approaches only;
- Restrictions on the type of traffic. [13]

Since the Proposed Development will not infringe the Approach or Take-Off Climb Surfaces for either runway, variation of the declared runway distances is not required or relevant in this case.

The aerodrome is already restricted to visual approaches only and it is assessed that the Proposed Development would not impose any constraints on development of an instrument approach procedure.

Restrictions on the type of traffic using the aerodrome would not be required or relevant in this case.

Therefore, the two mitigation measures that might be appropriate are:

- Promulgation in the UK AIP of appropriate information; and
- Marking and/or lighting of the obstacles.

The standard method for promulgating aerodrome obstacle information in the UK AIP is to list the surveyed data for at least the highest of a group of obstacles in Section AD 2.10 of the aerodrome's entry in the AIP. This is the standard method employed with the approval of the CAA in similar cases where terrain or other obstacles infringe the OHS. It is expected that a similar approach, in this case, will be acceptable to the CAA.

[13] CAP 168 paragraph 4.3.

14.7.2 Lighting

Since the turbines in the Proposed Development have tip heights of 150m or more agl they are subject to the mandatory lighting requirements of Article 222 of the Air Navigation Order 2016 (as amended).[14] Articles 222(6) and 222(7) of that order give the CAA the authority to approve lighting schemes which differ from the normal provisions of Article 222. In order to mitigate the night-time visual impact of the Proposed Development on non-aviation receptors, a reduced lighting scheme has been designed. It proposes 2000 candela steady red lights on five of the six turbines but no mid-tower lighting. The lighting scheme has been approved by the CAA and Oban Airport. Its delivery will be secured by a planning condition.

14.7.3 Downwind turbulence

In the event that it is considered necessary to mitigate the potential effects of downwind turbulence from the Proposed Development, this could be provided by:

- Advisory warning text in the airport's AIP entry; and/or
- Recommendation that arriving aircraft join the circuit at Oban via a Standard Overhead Join; and/or
- Designation of Visual Reference Points (VRPs) which would route aircraft away from the Proposed Development.

14.8 Residual Effects

Following the implementation of the mitigation measures to address the infringement of the Oban Airport OHS and potential turbulence effects on aircraft using Oban Airport, the residual effects of the Proposed Development on aviation are assessed as being of **minor** significance and therefore not significant.

14.9 Cumulative Assessment

The aviation cumulative assessment has considered existing and consented wind turbines within a 10km radius of the Proposed Development. These are as follows:

- Barran Caltum (two turbines with 54m tip height, 4km north-west of the Proposed Development);
- Beinn Ghlas (14 turbines with 54.1m tip height, 4km south-east of the Proposed Development); and
- Carraig Gheal (20 turbines with tip heights up to 124.8m, 8km south of the Proposed Development.

As regards potential cumulative impacts in terms of infringement of Oban Airport obstacle limitation surfaces, only the two Barran Caltum turbines are within the lateral boundaries of the OHS. The higher of the two turbines has blade tips of 544ft (165.8m) amsl, representing an infringement of the OHS by 58.9m. The two turbines are listed as obstacles in the Oban Airport entry in the AIP and are fitted with obstruction warning lights. The same mitigations will be applied to the Proposed Development. Following application of those mitigations, the cumulative impact of the Proposed Development with the Barran Caltum turbines is considered to be of **minor** significance, and therefore not significant. since with mitigation applied across cumulative schemes any effects experienced would not require any alteration of existing operational and technical practice.

In terms of the potential cumulative impact of downwind turbulence on air traffic using Oban Airport, any such effects from the Barran Caltum, Beinn Ghlas, and Carraig Gheal turbines would be below the level at which aircraft are normally flown in the vicinity of those wind turbines and can therefore be disregarded. The cumulative downwind turbulence impact of the Proposed Development is therefore considered to be of **minor** significance and therefore not significant.

[14] The Air Navigation Order 2016 (SI 2016 No.765).

14.10 Summary

The assessment of likely significant effects of the Proposed Development on aviation finds that:

- All turbines in the Proposed Development would infringe the Oban Airport Outer Horizontal Surface. This is an effect of **minor** to **moderate** significance. If minor, the effect is not significant in EIA terms. If moderate, the effect is significant in EIA terms.
- There is potential for the Proposed Development to generate turbulence which could affect aircraft flying to/from Oban Airport. This is an effect of **minor** to **moderate** significance. If minor, the effect is not significant in EIA terms. If moderate, the effect is significant in EIA terms.

Following application of mitigation measures, the residual effects of the Proposed Development on aviation will be of **minor** significance since with mitigation applied any effects experienced would not require any alteration of existing operational and technical practice.