Chapter 15: Aviation

Contents

15 Aviation

15.1 Executive Summary

15.1.1 This section of the EIA Report describes the likely effects of the Proposed Development on aviation stakeholder interests and reports on consultation and potential mitigation solutions. It shows that the only aviation issues that will need to be addressed are the potential effects on Inverness Airport Instrument Flight Procedures (IFP) and Primary Surveillance Radar (PSR) and the requirement to provide aviation lighting to both Civil Aviation Authority (CAA) and Ministry of Defence (MOD) requirements.

15.2 Introduction

15.2.1 This section of the EIA Report presents the findings of the assessment of effects of the Proposed Development in relation to aviation and defence. The assessment considers potential effects on the aviation and air defence activities of the MOD as safeguarded by the Defence Infrastructure Organisation (DIO). It also considers the possible effects of wind turbines upon the National Air Traffic Services En Route Ltd (NERL) communications, navigation and surveillance (CNS) systems which consist of a network of primary and secondary radars and navigation facilities around the country. Finally, it considers the possible effects on airport radars and other aviation stakeholder interests.

15.2.2 As well as examining the technical impact of wind turbines on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations to determine whether a development will breach obstacle clearance criteria.

15.2.3 This assessment should be read in conjunction with Appendix 15.1: Wind Farm Aviation Lighting and Mitigation Report.

15.2.4 Wind turbines have the potential to affect civil and military aviation. This chapter presents the methodology used to undertake the aviation safeguarding assessment, lists the aviation references used and describes the aviation baseline condition, consultation requirements, identified potential impacts, and mitigations to be applied, if required.

15.2.5 The Aviation Chapter has been written by Cdr John Taylor RN (Ret) of Wind Power Aviation Consultants Ltd (WPAC). John has over 35 years of experience as an Air Traffic Controller, Fighter Controller and Aviation Regulator and was head of Air Traffic Control for the Royal Navy. His responsibilities included responding to wind farm consultations on and offshore. Since 2008, WPAC has provided advice on the interaction between wind turbines and aviation, including assessing over 3000 wind turbine proposals and has given evidence at over 20 Public Inquiries and appeals in England and Scotland. John has also advised a number of Local Authorities on aviation related issues. WPAC has expertise in a number of areas including radar propagation and modelling, general aviation operations, turbine induced turbulence, aviation lighting and low flying operations.

15.3 Legislation, Policy and Guidelines

15.3.1 There are a number of aviation publications relevant to the interaction of wind turbines and aviation containing guidance and legislation, which cover the complete spectrum of aviation activity in the UK, as listed below:

- Civil Aviation Authority (2020). Safeguarding of Aerodromes, Version 3, CAP738 CAA;
- Civil Aviation Authority (2010). Safe Operating Practices at Unlicensed Aerodromes, Ed 1, CAP 793 CAA;
- Civil Aviation Authority (2016) Policy and Guidance on Wind Turbines Version 6, CAP764 CAA;
- Civil Aviation Authority (2017). 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 CAA;
- Civil Aviation Authority (2023). Manual of Air Traffic Services, Part 1, Ed 11.0, CAP 493 CAA;
- Civil Aviation Authority (2021). UK Flight Information Services, Ed 4, CAP 774 CAA;
- Civil Aviation Authority (2019). ATS Safety Requirements, Version 3, CAP 670 CAA;
- Civil Aviation Authority (2022). Licensing of Aerodromes, Version 12, CAP 168 CAA;
- Civil Aviation Authority (2020). Parachuting, Ed 5, CAP660 CAA;

- Civil Aviation Authority (2022). Implementation of Safeguarding of Instrument Flight Procedures (IFPs) in the UK, Ed 2, Version 2, CAP 785B CAA;
- Civil Aviation Authority (2021) 'Guidance to crane users on aviation lighting and notification' CAP 1096 CAA: and
- Ministry of Defence (MoD) (2022). Military Aviation Authority Regulatory Article 2330 (Low Flying).

15.3.2 The above noted publications have also been considered in the aviation lighting assessment.

15.4 Consultation

15.4.1 Initial consultation responses were received from aviation stakeholders as a result of EIA Scoping, with further consultation carried out as required. These are reported below in Table 15.1.

Table 15.1 Aviation Consultation

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
NATS En Route Ltd (NERL) Ref SG35671 dated 04 July 2023	Scoping	No safeguarding objection.	None required
MOD DIO 10059306 dated 20 July 2023	Scoping	Concerns raised over turbines creating a low flying obstruction.	An aviation lighting and mitigation report has been provided to the MOD.
Highlands and Islands Airports Ltd (HIAL) 2023/206/INV dated 20 July 2023	Scoping	'This development may impact the safeguarding criteria and operations of Inverness Airport'.	HIAL requested an Aviation Impact Feasibility Study (AIFS) of the Proposed Development. This is currently being provided and referred to later in this chapter.

15.5 Assessment, Methodology and Significance Criteria

Study Area

15.5.1 The assessment of effects of the Proposed Development is based upon the guidance outlined in CAP 764. Consultation criteria for aviation stakeholders is defined in Chapter 4 of CAP764. The following distances inform the size of the study area and have been adopted in undertaking this assessment which comprise:

- Airfield with a surveillance radar – 30 km.
- Non radar licensed aerodrome with a runway of more than 1100 metres – 17 km.
- Non radar licensed aerodrome with a runway of less than 1100 metres – 5 km.
- Licensed aerodromes where the turbines would lie within airspace coincidental with any published Instrument Flight Procedure (IFP).
- Unlicensed aerodromes with runways of more than 800 metres – 4 km.
- Unlicensed aerodromes with runways of less than 800 metres – 3 km.
- Gliding sites – 10 km.
- Other aviation activity such as parachute sites and microlight sites within 3 km – in such instances developers are referred to appropriate organisations.

15.5.2 CAP 764 further states that these distances are for guidance purposes only and do not represent ranges beyond which all wind turbine developments will be approved, or within which they will always be objected to. These ranges are intended as a prompt for further discussion between developers and aviation stakeholders; which are reported upon in this chapter. For example, Glasgow Prestwick Airport have stated a requirement to be consulted in relation to wind farms out to the maximum range of their radars and Instrument Flight Procedures.

15.5.3 The assessment is desk based, drawing largely from published guidance and data.

15.5.4 It is necessary to take into account the aviation and air defence activities of the Ministry of Defence (MOD) as safeguarded by the Defence Infrastructure Organisation (DIO).

15.5.5 It is also necessary to take into account the possible effects of wind turbines upon the National Air Traffic Services En Route Ltd (NERL) communications, navigation and surveillance (CNS) systems – a network of primary and secondary radars and navigation facilities around the country.

15.5.6 In addition to examining the technical impact of wind turbines on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations, using the criteria laid down in CAP 168 Licensing of Aerodromes, to determine whether a proposed development will breach obstacle

clearance criteria. In this case, there are no physical safeguarding issues associated with the Proposed Development.

15.6 Assessment Methodology

Radar Modelling Methodology

15.6.1 The radar calculation results referred to in this chapter were produced using specialist propagation prediction software (RView Version 5). Developed over a number of years by WPAC it has been designed and refined specifically for the task. RView is used to identify potential aviation effects of the Proposed Development. The results are then used as a basis for consultation and liaison with relevant aviation bodies, as detailed below. RView models terrain using the Ordnance Survey (OS) Terrain 50 digital terrain model, which has a post spacing of 50 m and has a root mean square (RMS) error of 4 m. The results are verified using the Shuttle Radar Topography Mission (SRTM) dataset, a separate smoothed digital terrain model with data spacing of 3 arc seconds. By using two separate and independently generated digital terrain models, anomalies are identified and consistent results assured. Rview models the refractive effects of the atmosphere on radio waves and the First Fresnel Zone. A feature of RView is that as well as performing calculations in the manner believed to be most appropriate, it also allows comparison with results from simpler models. For example, RView can perform calculations using the true Earth Radius at the midpoint between the radar and the wind turbine or the simplified 4/3 Earth Radius model. If needed, Rview is also capable of modelling a range of atmospheric refractive conditions. RView models the trajectory of radar signals at different elevations allowing modelling of both volume surveillance and pencil beam radars as well as the effects of angular sterilisation as applied, for example, in Met Office radars.

15.7 Assessing Significance

15.7.1 There is no agreed or mandated definition of significance when assessing development proposals for wind farms in relation to aviation. Whilst technical effects on communications, navigation and surveillance (CNS) systems are simple to identify and evaluate, operational and flight safety effects can be subjective and are often challenged by third parties. It is sufficient in this context to identify any technical effects and then, taking into account the statements in CAP 764 regarding the status of aviation stakeholders, in general to accept the judgement of those stakeholders in assessing the significance of the effects. For example CAP 764 states:

> *"Where an ANSP determines that it is likely that a planned wind turbine development would result in any of the above effects on their CNS infrastructure, this may not, in itself, be sufficient reason to justify grounds for rejection of the planning application. The ANSP must determine whether the effect on the CNS infrastructure has a negative impact on the provision of the ATS. The developer should pay for an assessment of appropriate mitigating actions that could be taken by the ANSP and/or wind energy developer to deal with the negative impact. The position of an ANSP at inquiry would be significantly degraded if they had not considered all potentially appropriate mitigations."*

15.7.2 Therefore, it is not considered to be appropriate for the Applicant to make an assessment of the significance of an effect in relation to aviation interests. Also, it is often the case that different Air Navigation Service Providers (ANSP) take a different view of the same scenario and may disagree with the assessment findings; this can require further post submission consultation, to confirm the findings of the assessment and/or agree to the need for and extent of mitigation. Therefore, this assessment does not make a judgement of significance but is focussed on identifying potential impacts and agreeing mitigation with aviation stakeholders as required.

15.8 Baseline Conditions

Existing Baseline

15.8.1 The Proposed Development is located 36 km to the west-north-west of Inverness Airport and within Class G unregulated airspace. It is just to the south of Class E regulated airspace in the form of an airway that extends from Inverness to Stornoway, designated as the Moray Control Area (CTA) which has a base of Flight Level (FL) 95 (approximately 9500ft). In military terms, the Proposed Development is well clear of any military airfields or facilities, the closest is RAF Lossiemouth, 78 km to the east. The Proposed Development is also just outside the boundary of Restricted Area R610A, also known as the Highlands Restricted Airspace (HRA) and area used by military aircraft for tactical low flying.

15.9 Assessment of Effects

Effects Scoped Into the Assessment

15.9.1 The turbine layout of the Proposed Development has changed since Scoping and initial consultation was completed and it is, therefore, essential to reassess what the effect of the application layout will be on aviation and defence. The following section assesses the effect on both radar and non-radar facilities, in accordance with the guidance in CAP 764.

Radar Equipped CAA Licensed Aerodromes

15.9.2 There are no radar equipped CAA licensed aerodromes within consultation distance. The closest is Inverness Airport, 36km to the east-south-east and beyond the distance within which an assessment of physical safeguarding is required. However, it is within the area that HIAL require an assessment of the effect of the Proposed Development on Instrument Flight Procedures. This assessment has been instructed by the Applicant using a CAA Approved Procedure Design Organisation (APDO) and will be provided to HIAL when it is completed. Radar modelling against both the main Thales primary surveillance radar (PSR) and the Terma Scanter 4002 Windfarm Radar has been undertaken with the results shown in Tables 15.2 and 15.3 below and provided to HIAL. These results show that all of the turbines will be visible to both radars and will have the potential to create clutter and obscuration on the PSR. If required by HIAL it will be necessary to configure the Terma radar to remove the turbine induced clutter. As the mitigation solution is already being installed, radar mitigation can be subject to a suitably worded planning condition to protect and safeguard operations at Inverness.

Table 15.2 Inverness Airport PSR

Turbine	Distance (km)	Radar Line of Sight (metres AGL)
1	36.283	153.8
2	35.91	104.2
3	35.45	49
4	34.903	36.7
5	34.736	42
6	36.488	92
7	36.168	49.6
8	35.673	14.9
9	35.252	13.1

Table 15.3 Inverness Airport Terma Scanter 4002

Turbine	Distance (km)	Radar Line of Sight (metres AGL)
1	36.896	154.1
2	36.527	103.8
3	36.072	49.3
4	35.525	37.5
5	35.362	42.8
6	37.109	97.7
7	36.794	51.7
8	36.301	18.9
9	35.883	24.4

Non-Radar Equipped CAA Licensed Aerodromes

15.9.3 There are no non-radar equipped CAA licensed aerodromes within consultation distance. The closest is at Wick, well over 130 km to the north-east. Consultation is not required and there will be no effect on Wick operations.

Unlicensed Aerodromes, Gliding and Micro-light Sites

15.9.4 There are no unlicensed aerodromes, gliding sites or micro-light sites within consultation distance. The closest is at Knockbarin Farm, over 10km to the east. Consultation is not required and there will be no effect on aerodrome operations.

NATS En Route (NERL) Communications, Navigation and Surveillance (CNS) Systems

15.9.5 There are two radars that cover this area; Perwinnes (Aberdeen) and Alanshill near Banff. Radar modelling shows that there is no possibility of the turbines being visible due to extensive terrain screening to either radar and this is confirmed by the NERL response at scoping.

Ministry of Defence ATC Radars

15.9.6 The only military ATC radar within the area is located at RAF Lossiemouth, over 78 km to the east. Radar modelling shows that there is no possibility of the turbines being visible to the radar due to extensive terrain screening and this was confirmed by the MOD DIO response at scoping indicating there were no radar issues of concern.

Ministry of Defence Air Defence Radars

15.9.7 The closest air defence radar is at Buchan, near Peterhead and over 150 km to the east. Radar modelling confirms there is no possibility of the turbines being visible to, or affecting the performance of the radar, as confirmed by the MOD DIO scoping response.

Ministry of Defence Low Flying

15.9.8 The Proposed Development is outside the boundary of the Highlands Restricted Area (HRA) and in an area designated as 'Blue' on the MOD low flying and wind farm interaction chart published by the MOD. A 'Blue' area is defined as: "*a low priority military low flying area less likely to raise concerns*". The MOD response at scoping confirms that, provided suitable aviation lighting is provided, the MOD will not object to the Proposed Development. The obligation to provide suitable MOD specification infrared (IR) lighting can be ensured through the imposition of a suitably worded planning condition. In addition, the Applicant has provided the MOD with a lighting design which includes both CAA visible red lighting and MOD specification infrared lighting. This issue has been fully addressed in the Aviation Lighting and Mitigation technical Appendix at 15.1.

15.10 Effects Scoped Out of the Assessment

15.10.1 There is no requirement to consider the effects on Met Office radars as the closest radar is at Hill of Dudwick, near Aberdeen, and in excess of 80km from the Proposed Development. The Met Office only require to be consulted in relation to wind turbine proposals within 20km of their weather radar facilities.

15.11 Potential Construction Effects

15.11.1 There are no technical effects on aviation interests during construction. The only aviation issues are those associated with the operation of large cranes which will be the subject of standard conditions for crane operations as laid down in CAA CAP1096 'Guidance to crane users on aviation lighting and notification'.

15.12 Potential Decommissioning Effects

15.12.1 There are no technical effects on aviation interests during decommissioning. The only aviation issues are those associated with the operation of large cranes which will be the subject of standard conditions for crane operations as laid down in CAA CAP1096 'Guidance to crane users on aviation lighting and notification.

15.13 Additional Mitigation and Enhancement

Aviation Lighting

15.13.1 Wind turbines with a tip height in excess of 150 m are required to be illuminated with medium-intensity red aviation obstruction lights installed on the turbine hub in accordance with the Civil Aviation Authority Policy Statement: 'Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150 m Above Ground Level'. The Applicant provided a reduced lighting scheme that fulfils the requirements for flight safety whilst minimising environmental (visual) effects and gained approval from the CAA for the design (see Appendix 15.1 for details of the proposed mitigation). This sets out the arrangement of the aviation lights, together with an assessment of the intensity of the visible lights at selected viewpoints assessed in the LVIA (see Chapter 7: Landscape and Visual Impact Assessment)

and provides an estimate of the percentage of time that the lights will be at full power and at 10% intensity based on historical Met Office records of visibility and cloud base in the region. As noted above, each turbine will be fitted with MOD specification IR lighting to mitigate effects on military low flying. The implementation of the proposed lighting scheme (both visible and infrared) will be subject to a suspensive planning condition to the consent if granted. The Aviation Lighting and Mitigation Report technical Appendix 15. 1 was drafted prior to the publication of the NatureScot Guidance on Aviation Lighting Impact Assessment published in November 2024, however the report already covers all of the requirements within that guidance.

15.14 References

Civil Aviation Authority (2020). Safeguarding of Aerodromes, Version 3, CAP738 CAA;

Civil Aviation Authority (2010). Safe Operating Practices at Unlicensed Aerodromes, Ed 1, CAP 793 CAA;

Civil Aviation Authority (2016). Policy and Guidance on Wind Turbines Version 6, CAP764 CAA;

Civil Aviation Authority (2017). 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 CAA;

Civil Aviation Authority (2023). Manual of Air Traffic Services, Part 1, Ed 11.0, CAP 493 CAA;

Civil Aviation Authority (2021). UK Flight Information Services, Ed 4, CAP 774 CAA;

Civil Aviation Authority (2019). ATS Safety Requirements, Version 3, CAP 670 CAA;

Civil Aviation Authority (2022). Licensing of Aerodromes, Version 12, CAP 168 CAA;

Civil Aviation Authority (2020). Parachuting, Ed 5, CAP660 CAA;

Civil Aviation Authority (2022). Implementation of Safeguarding of Instrument Flight Procedures (IFPs) in the UK, Ed 2, Version 2, CAP 785B CAA;

Civil Aviation Authority (2021). Guidance to crane users on aviation lighting and notification' CAP 1096 Version 2.2 CAA;

Ministry of Defence (MoD) (2022). Military Aviation Authority Regulatory Article 2330 (Low Flying).