

Chapter 12

Aviation and Radar

This page is intentionally blank.

12 Aviation and Radar

Contents

12.1	Executive Summary	12-1
12.2	Introduction	12-1
12.3	Legislation, Policy and Guidelines	12-2
12.4	Consultation	12-4
12.5	Assessment Methodology and Significance Criteria	12-7
12.6	Baseline Conditions	12-9
12.7	Scope of the Assessment	12-9
12.8	Assessment of Potential Effects	12-10
12.9	Mitigation	12-11
12.10	Residual and Cumulative Effects	12-13
12.11	Summary	12-13
12.12	References	12-16

Figures

Figure 12.1 Proposed Aviation Lighting Scheme

This page is intentionally blank.



12 Aviation and Radar

12.1 Executive Summary

- 12.1.1 This chapter considers the potential effects of the Proposed Development on existing and planned military and civil aviation activities and infrastructure.
- 12.1.2 The Proposed Development lies underneath the Scottish Terminal Area, 31 km from Prestwick Airport, 36 km from Glasgow Airport and over 55 km from Edinburgh Airport. These are the only aerodromes with any potential for impacts. In addition to these stakeholders, National Air Traffic Services (NATS) (En-Route) plc operate radar in the area and the site lies within a military Tactical Training Area (TTA) used for low flying training, making the Ministry of Defence (MOD) an important consultee as well.
- 12.1.3 The site would be expected to generate radar impacts, in the form of displayed clutter, on the airport radars at Glasgow and Glasgow Prestwick and on NATS radars. Mitigation is required and will be agreed to address all these impacts, using proven solutions already implemented for other wind farms in the immediate area.
- 12.1.4 Mitigation is also required to revise instrument flight procedures at Glasgow Airport and Glasgow Prestwick Airport (GPA). The Applicant is engaged with the airports to identify revised procedures that are acceptable to the airports. This is an ongoing process.
- 12.1.5 Because the turbines are over 150 m tall, aviation lighting is required, to mitigate against low flying risks. In this case a reduced lighting scheme will be used, with eight of the turbines installed with combined visible spectrum and infra-red lights, with the capacity for the visible spectrum lights to be dimmed to 10% of maximum intensity under conditions of good visibility.
- 12.1.6 No other mitigation is required, subject to the outcomes of the Edinburgh Airport Instrument Flight Procedures (IFP) assessment and the Glasgow Prestwick Very High Frequency (VHF) radio assessment.

12.2 Introduction

- 12.2.1 This chapter considers the potential effects of the Proposed Development on existing and planned military and civil aviation activities, including those resulting from impacts to radar. Other potential effects can result from the physical presence of the turbines as obstacles, and effects on navigational aids and radio communication stations. It is noted that the only element of the Proposed Development relevant to the assessment presented in this chapter is the wind farm; the proposed Battery Energy Storage System (BESS) elements will not result in any effects on aviation and radar. Any potential effects on aviation from possible glint and glare from the solar component of the Proposed Development are addressed within **Chapter 15 Glint and Glare**.
- 12.2.2 Radio waves are used in a variety of surveillance and communication systems within aviation, and any large structure has the potential to interfere with their broadcast and reception. The potential of a structure to affect the propagation of radio waves is principally dependent upon the size, shape and materials of construction. The blade rotation can cause turbines to show up on radar, which are specifically designed to detect movement. Whilst turbines can impact radar, whether or not this generates significant operational effects depends upon both the use of the radar and of the airspace above the Proposed Development.
- 12.2.3 The potential effects are highly dependent on the location of the wind farm and on the positions of the individual turbines. In some cases, there are no significant consequences and no mitigation is required, whilst in other cases the turbine specification or layout must be designed to accommodate local infrastructure. Mitigation is often available and appropriate to manage impacts.
- 12.2.4 There are no significant aviation impacts during the construction or decommissioning phases of the Proposed Development. This is because the turbines are viewed as temporary obstacles, for which processes are in place to advise airspace users. There are no radar impacts when the rotors are not



turning. The usual visible lighting of the cranes and notification of their use, as tall structures will be necessary. The primary consideration in terms of impacts and any requirement for mitigation, arises from the operational phase of the Proposed Development.

12.3 Legislation, Policy and Guidelines

- 12.3.1 The relevant sections of key policy and guidance documents are described below, which together place a responsibility on the Scottish Ministers and the Applicant to assess potential impacts on aviation activities and infrastructure.

Legislation

Article 222 of the Air Navigation Order (2016)

- 12.3.2 The Air Navigation Order (ANO), under the authority of the Civil Aviation Authority (CAA), is the UK-wide legislation that governs air navigation, including the treatment of obstacles to aviation. This order sets the legal framework for how obstacles on the ground must be marked, lit, and assessed to ensure they do not pose a hazard to aviation.
- 12.3.3 Article 222 of the ANO deals with the lighting of en-route obstacles, which includes tall structures such as wind turbines, that may pose a hazard to aircraft. It establishes requirements for lighting obstacles to ensure their visibility to pilots, especially during night-time or in poor weather conditions.
- 12.3.4 Onshore Obstacle Lighting Requirement International Civil Aviation Organization (ICAO) regulations (ICOA Annex 14, Volume I. Aerodrome Design and Operations) and article 222 of the ANO 2016 require that structures away from the immediate vicinity of an aerodrome, which have a height of 150 m (492 ft) or more AGL (above ground level) are:
- Fitted with medium intensity steady red lights positioned as close as possible to the top of the obstacle, and also equally spaced at intermediate levels, so far as practicable, between the top lights and ground level with an interval not exceeding 52 m; and
 - Illuminated at night, visible in all directions and any lighting failure is rectified as soon as is reasonably practicable.
- 12.3.5 Under Article 222 of the ANO, the lighting requirements can be changed under provisions given in section 6 which states, *“A permission may be granted for the purposes of this article for a particular case or class of cases or generally”*.

Planning Policy

- 12.3.6 The Planning Statement associated with this Section 36 application sets out the planning policy framework that is relevant to the EIA. This section considers the relevant aspects of National Planning Framework 4 (NPF4), Planning Advice Notes, the South Lanarkshire Local Development Plan (LDP) (2021), and other relevant guidance. Note that all the wind turbines fall within the South Lanarkshire Council area. Only the turbines themselves have any potential for aviation impacts, within the context of this chapter.

National Planning Framework 4 (February 2023)

- 12.3.7 NPF4 states, under Policy 11 concerning development proposals for all forms of renewables, that project design and mitigation will demonstrate how *“impacts on aviation and defence interests and seismological recording”* are addressed.

Scottish Onshore Wind Policy Statement (OWPS) (2022)

- 12.3.8 Under Chapter 6, Onshore Wind and Aviation Considerations, it is noted wind turbines have the potential to impact aviation operations, including, but not limited to, impact on aviation radar.
- 12.3.9 The document recognises recent progress stating that bespoke solutions which alleviated specific, individual objections have been deployed successfully over the last decade or more, releasing



significant volumes of renewable generation. However, the pace of deployment necessitated by the climate emergency means we must find a way to alleviate these impacts in an effective, efficient and timely manner. It is also important that solutions are cognisant of the cost of deploying renewable energy, particularly given the need to focus on both security of supply and low-cost generation, given the current international and economic situation.

- 12.3.10 Beyond the above statement of need, the document sets out the structure and aims of Industry and Government groups set up to address the issues of radar impacts and aviation lighting; specifically the Onshore Wind Aviation Radar Delivery 2030 group and the Aviation Lighting Working Group.
- 12.3.11 The Aviation Lighting Working Group has developed draft guidance focussed on delivering consistent methods, practices and recommendations to aid in assessing aviation obstacle lighting impacts. The draft guidance is out to consultation with relevant stakeholders.

Planning Circular 2/03: Safeguarding of Aerodromes, Technical Sites and Military Explosives Storage Areas (revised March 2016)

- 12.3.12 This Circular summarises the Scottish Ministers' understanding of the general effect of the relevant primary or secondary legislation.
- 12.3.13 It contains four annexes. Annexes 1 and 2 describe the formal process by which planning authorities should take into account safeguarding, including in relation to wind energy developments. Annex 3 lists officially safeguarded civil aerodromes and Annex 4 lists planning authority areas containing civil en-route technical sites for which separate official safeguarding maps have been issued.
- 12.3.14 The Circular also refers planning authorities, statutory consultees, developers and others to CAA Civil Aviation Publication (CAP) 764 (CAA Policy and Guidance on Wind Turbines), which is discussed further under Guidance below, and Met Office guidelines.

CAA 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 (June 2017)

- 12.3.15 This policy statement highlights and clarifies the requirements set out in the ANO, for the lighting of onshore turbines.
- 12.3.16 Lights should be operated by an acceptable control device (e.g., photocell, timer, etc.) adjusted so the lights will be turned on whenever illuminance reaching a vertical surface falls below 500 Lux. The control device should turn the lights off when the illuminance rises to a level of 500 Lux or more.
- 12.3.17 If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the wind farm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type.
- 12.3.18 In practice the CAA considers every proposed development on a case by case basis, taking into account the specific environment, including the existing developments and lighting as well as the benefits of reduced lighting schemes where light pollution is an issue. Where supported by appropriate studies and consultations the CAA may agree to a variation to the lighting requirements specified in the ANO, under provisions given in the Air Navigation Order (ANO) Article 222 section 6, described in **paragraph 14.3.3** above.

The South Lanarkshire Local Development Plan (2021)

- 12.3.19 The South Lanarkshire LDP has associated Supporting Planning Guidance (2022). This guidance includes a section on the impacts on aviation and defence interests and seismological recording. It also highlights the need for aviation lighting for structures over 150 m tall, with specific requirements to be agreed with the CAA.
- 12.3.20 In section 5.95 of the Supporting Planning Guidance document, concerning the impacts on aviation and defence interests and seismological recording, it is highlighted that South Lanarkshire is affected by a number of aviation and defence interests, specifically:



- The northern part of South Lanarkshire is within the radar coverage for Glasgow Airport.
- An area on the western edge of South Lanarkshire is within the radar coverage for Prestwick Airport.
- The north-east of South Lanarkshire is within the radar coverage for Edinburgh Airport.
- Almost all of South Lanarkshire is identified by NATS (En Route) as an area where wind farm developments are likely to interfere with operational infrastructure.
- The south of South Lanarkshire is within the 50 km buffer zone around Eskdalemuir Seismic Array.
- MOD TTA covers the southern and western area of South Lanarkshire (low flying operations take place across all of South Lanarkshire not just in the TTA).
- There is a small airfield at Strathaven, where local safeguarding requirements apply.

Guidance

12.3.21 Recognition has been taken of the following best practice guidance.

CAP 764: CAA Policy and Guidance on Wind Turbines (Feb 2016)

- 12.3.22 CAA guidance within CAP 764, sets out recommended consultation and assessment criteria for the impacts of wind turbines on all aspects of civil aviation.
- 12.3.23 The CAA involvement in the Wind Farm Pre-Planning Consultation Process ceased on 25 December 2010. CAP 764 now states that *“developers are required to undertake their own pre-planning assessment of potential civil aviation related issues.”*
- 12.3.24 Within CAP 764 the CAA provides a chapter describing the *“wind turbine development planning process”*, within which the main civil aviation stakeholders and their interests are listed and described in brief. Table 1 within the guidance document provides an overview of considerations and the following paragraphs detail what developers will need to consider, conducting associated consultations as appropriate.
- 12.3.25 The CAA observes in section 2.36 that impact on communications, navigation and surveillance infrastructure alone is not sufficient to support an objection; rather those impacts need to have a negative impact on the provision of an air traffic service.
- 12.3.26 The CAA notes in section 5.25 of CAP 764 that *“it is incumbent upon the developer to liaise with the appropriate aviation stakeholder to discuss – and hopefully resolve or mitigate – aviation related concerns without requiring further CAA input. However, if these discussions break down or an impasse is reached, the CAA can be asked to provide objective comment”*.
- 12.3.27 Section 5.26 of CAP 764 states that *“the CAA will not provide comment on MOD [Ministry of Defence] objections or arguments unless such comments have been requested by the MOD.”*

12.4 Consultation

- 12.4.1 Key aviation stakeholders have been consulted ahead of submission, to confirm the anticipated impacts and initiate dialogue, as appropriate, on mitigation. The key stakeholders are NATS (En Route) plc, Glasgow Airport, Glasgow Prestwick Airport and Edinburgh Airport.
- 12.4.2 In addition to dialogue addressing the potential impacts, consultations have also been conducted to determine an aviation lighting scheme that meets the requirements of aviation whilst minimising the nighttime visual impacts.
- 12.4.3 **Table 12.1** below summarises all the recent written consultations to date, separating out the lighting specific consultations. In addition to these formal responses, the Applicant has had continuous engagement with the key stakeholders, Glasgow Prestwick Airport in particular, including many on-line meetings.



Table 12.1 – Consultations

Consultee	Response	Actions
NATS (En Route) plc; Response to request for Scoping Opinion, by email dated 27 February 2024	<p>NATS (En Route) plc objects to the proposal. The reasons for NATS's objection are outlined in the attached report Technical and Operational Advice (TOPA) SG34117.</p> <p>The report identified impacts to primary surveillance radars at Lowther Hill, Cumbernauld and Glasgow. The Prestwick Centre Air Traffic Control (ATC) unit deemed the impacts to be unacceptable (without mitigation).</p>	<p>The Applicant will agree and contract for mitigation that fully meets the requirements of NATS.</p> <p>This is a prolonged process that will necessarily be completed post-submission.</p> <p>Once contracted, NATS will remove their objection, conditional upon mitigation being implemented prior to turbine erection.</p>
Glasgow Airport; Written response to request for Scoping Opinion, to the Energy Consents Unit (ECU) dated 11 March 2024	<p>The scoping report submitted has been examined from an aerodrome safeguarding perspective and we would make the following observations:</p> <ul style="list-style-type: none"> – the site is outwith the obstacle limitation surfaces for Glasgow Airport; – it is within the radar safeguarding area and will likely require technical mitigation; – it is within the instrument flight procedures safeguarding area and will likely impact. <p>Detailed assessments will be required and we would encourage the applicant to engage with us on this as early as possible.</p> <p>Our position with regard to this proposal will only be confirmed once the turbine details are finalized and we have been consulted on a full planning application. At that time we will carry out a full safeguarding impact assessment and will consider our position in light of, inter alia, operational impact and cumulative effects.</p>	<p>The Applicant has commissioned an IFP assessment, the results of which were not available at the time of submission. In the event of any impacts to flight procedures, The Applicant will work with the airport and its appointed, external Procedure Design Organisation, to identify and implement mitigation. This is likely to be in the form of acceptable modifications to procedures.</p> <p>The Applicant will also work with the airport and its representatives, to contract for radar mitigation. As for NATS above, once contracted, the airport will remove their objection, conditional upon mitigation being implemented prior to turbine erection.</p>
GPA; Written response to request for Scoping Opinion, to ECU dated 12 March 2024	<p>The safeguarding assessment process has identified potential adverse effects on the Airport's primary surveillance radar, IFPs and VHF Communication Equipment. Those issues having been identified; the Airport conducted an ATC Operational Impact Assessment.</p> <p>The operational impact assessment determined that if any of the turbines are confirmed visible to the Airport's primary surveillance radar then mitigation would be required.</p> <p>Other issues raised in the ATC Operational Impact Assessment included:</p> <ol style="list-style-type: none"> a. the need for aviation lighting for obstacles above 150 m in height; b. potential loss of VHF Ground to Air communications in the vicinity of the 	<p>The Applicant is working with the airport and its representatives to agree mitigation.</p> <p>Impact assessments have established that a number of turbines are likely to be visible to the primary surveillance radar and that some procedures will be impacted. Mitigation has been identified for both. Further feasibility assessments are required before mitigation can be agreed. The additional assessment work was ongoing at the time of submission. The above addresses points i and ii</p>



Consultee	Response	Actions
	<p>windfarm as a consequence of the large turbines.</p> <p>c. The potential for a full Airspace Change Process regarding changes to the Terminal Arrival Altitude, with a possible requirement to alter the heights of the RNP (Radio Navigation Performance) 21 Procedure.</p> <p>The Airport request that any proposed Aviation Impact Assessment considers the issues raised in this response letter, namely:</p> <ul style="list-style-type: none"> i. A detailed Radar Line of Sight analysis against the Airport's primary surveillance radar(s); ii. An updated and expanded IFP assessment to re-evaluate the new turbine positions and heights, and to explore the technical feasibility of any proposed changes, after which a further operational impact assessment would be conducted by the Airport. iii. A VHF radio communication assessment in the vicinity of the proposed windfarm against the Airport's VHF Ground to Air radio equipment(s) infrastructure. iv. Full details of the proposed aviation lighting scheme. 	<p>of the airport's requested aviation proposed impact assessment.</p> <p>The required VHF communications assessment listed as point iii will be initiated in due course, once the airport has finalised its process for conducting these assessments.</p> <p>It is the intention of the Applicant to enter agreements with the airport to mitigate radar and procedure impacts. Once contracted, the airport can remove their objection, conditional upon mitigation being implemented prior to turbine erection.</p> <p>They have now seen and approved the proposed aviation lighting scheme raised in point iv (refer to Figure 12.1).</p>
<p>Edinburgh Airport;</p> <p>Written response to request for scoping opinion, to ECU dated 07 March 2024</p>	<p>This proposal has been examined from an aerodrome safeguarding perspective and conflicts with safeguarding criteria.</p> <p>Instrument Flight Procedure (IFP) Assessment</p> <p>No turbine tower of any turbine may be erected, unless and until such time as the Scottish Ministers receive confirmation from the Airport Operator in writing that:</p> <ul style="list-style-type: none"> (a) an IFP Assessment has demonstrated that an IFP Scheme is not required; or (b) if an IFP Scheme is required such a scheme has been approved by the Airport Operator; and (c) if an IFP Scheme is required the Civil Aviation Authority has evidenced its approval to the Airport Operator of the IFP Scheme (if such approval is required); and (d) if an IFP Scheme is required the scheme is accepted by NATS AIS for implementation through the AIRAC Cycle (or any successor publication) (where applicable) and is available for use by aircraft. 	<p>The Applicant is commissioning the required IFP assessment. This is expected to yield no conflicts. However, in the unlikely event that there is a conflict with published procedures, then the Applicant will work with the airport to a resolution in order to discharge the IFP planning condition.</p>
<p>MoD;</p> <p>Written response to request for scoping</p>	<p>the Proposed Development falls within TTA 20T, an area within which fixed wing aircraft may operate to conduct low level flight training. The addition of turbines in this</p>	<p>The Proposed Development will have aviation lighting to mark it as an en-route obstacle to low flying aircraft. The lighting</p>



Consultee	Response	Actions
opinion, to ECU dated 05 March 2024	location has the potential to introduce a physical obstruction to low flying aircraft operating in the area. The MOD require conditions are added to any consent issued requiring that the Proposed Development is fitted with aviation safety lighting and that sufficient data is submitted to ensure that structures can be accurately charted to allow deconfliction.	requirements will be agreed with the CAA, with the lights meeting the requirements set out in the UK ANO. It is proposed that eight turbines will be lit (see Figure 12.1), marking the Proposed Development periphery and the highest points.
East Ayrshire Council; Written response to request for scoping opinion, to ECU dated 13 March 2024	It would be expected that every effort is made to reduce the impacts of visible aviation lighting as far as possible, particularly given the substantial increase in cumulative pressure/impacts from visible aviation lighting associated with large numbers of wind farm proposals / consents for turbines over 150 m in height.	The Applicant is proposing a reduced lighting scheme for the Proposed Development, subject to CAA approval. This would be for 8 of the 18 turbines to be fitted with visible lighting, as shown in Figure 12.1 . An assessment of the visual effects is presented in Appendix 5.2 of the EIA Report.
Aviation Lighting Scheme Consultations		
Glasgow Airport	No response at the time of submission.	Not applicable
GPA; By email dated 17 December 2024	Confirm that we are content with the proposed lighting scheme for [the Proposed Development], with the usual caveat that we would like further information should Aircraft Detection Lighting System (ADLS) become viable for the site.	The Applicant will implement the agreed lighting scheme, subject to CAA approval.
MOD; By email dated 21 January 2025	Confirm that Low Flying [subject matter experts] have had sight of the proposed Obstacle Lighting Scheme for [the Proposed Development] and are content that infra-red lights to MoD specification will be installed on the perimeter turbines: T1, T4, T6, T9, T11, T13, T16 and T18.	The Applicant will implement the agreed lighting scheme, subject to CAA approval.
Police Scotland; By email dated 21 December 2024	No issues.	The Applicant will implement the agreed lighting scheme, subject to CAA approval.
Scottish Air Ambulance; By email dated 21 December 2024	The Proposed Development, with turbines T1, T4, T6, T9, T11, T13, T16 and T18 and the most elevated turbine being lit, with the unlit turbines lying within the lit ones would be acceptable from a Babcock Air Ambulance perspective.	The Applicant will implement the agreed lighting scheme, subject to CAA approval.

12.5 Assessment Methodology and Significance Criteria

- 12.5.1 The objective is for the Proposed Development to have no significant residual effects on aviation operations, coming either from direct physical obstruction or from impacts on infrastructure, such as radars and navigational aids. This in turn requires an assessment of impacts on infrastructure, noting that impacts on infrastructure do not automatically lead to impacts on operations. This determination of impacts and their resultant effects and acceptability is addressed through



consultation with all relevant stakeholders within the consenting process. The task of the Applicant is to independently assess the potential effects and, where significant effects may occur, to enter a dialogue with the affected stakeholders prior to submission as far as is possible. Whilst the aim of this pre-submission dialogue is to elicit the approval of all stakeholders, typically solutions are identified but do not reach full maturity in terms of the assessment by the stakeholders and the contracting of mitigation where required. The stakeholders consider dialogue a higher priority and more meaningful once design iterations are completed and a live application exists.

12.5.2 The significance of effects is ultimately determined, in the first instance, by the aviation stakeholder. This results in a response that either approves the Proposed Development, or raises an objection on specified grounds.

12.5.3 The study area includes all potentially sensitive receptors. This covers assessment to the limit of range of relevant radars in the area, up to 200 km in the case of NATS En-Route primary radars and MOD air defence primary radars. Beyond this range the curvature of the earth prevents impacts. Broadly, the distances over which potential civil aviation conflicts have been assessed has been in accordance with the CAA guidance CAP 764 (CAA, 2016), as follows;

- within 30 km of an aerodrome with a surveillance radar facility. The distance can be far greater than 30 km depending upon a number of factors including the type and coverage of the radar and the particular operation at the aerodrome (this is up to 111 km for some aerodromes);
- within airspace coincidental with any published IFP to take into account the aerodrome's requirement to protect its IFPs (taken to be up to 60 km);
- within 17 km of a non-radar equipped licensed aerodrome with a runway of 1,100 m or more;
- within 5 km of a non-radar equipped licensed aerodrome with a runway of less than 1,100 m;
- within 4 km of a non-radar equipped unlicensed aerodrome with a runway of more than 800 m; and
- within 3 km of a non-radar equipped unlicensed aerodrome with a runway of less than 800 m.

12.5.4 In addition to which the following assessment distances have been applied;

- 60 nautical miles (nm), which is 111 km, for military air traffic control primary surveillance radars;
- 20 nm, which is 37 km, of military Precision Approach Radars;
- 30 km for Meteorological Office weather radars;
- 10 km for secondary surveillance radars, aeronautical navigation aids and radio communication stations; and
- 30 km for military aerodromes with no radar.

12.5.5 An initial assessment was conducted to identify the assets and stakeholders potentially affected by the Proposed Development. This desk based assessment included a review of the following:

- Airspace environment:
 - proximity to all aerodromes;
 - airspace class - Proximity to Air Traffic Service (ATS) routes;
 - Transponder Mandatory Zones (TMZs), Areas of Intense Aerial Activity, Control Areas, restricted areas etc; and
 - proximity to military training areas.
- Checks for physical obstruction



- through an infringement of obstacle limitation surfaces; and
- potential for penetration of IFP safeguarding surfaces.
- Radar Line of Sight analysis for the following radars:
 - NATS En-route primary and secondary radar;
 - civil and military aerodrome air traffic control radar;
 - military precision approach radar;
 - military Air Defence radar; and
 - weather radar.
- Proximity to other technical sites:
 - navigational aids such as beacons; and
 - air-ground-air comms stations operated by NATS En-Route.

12.6 Baseline Conditions

- 12.6.1 The Proposed Development lies underneath the Scottish Terminal Area, 31 km from Prestwick Airport, 36 km from Glasgow Airport and over 55 km from Edinburgh Airport. No further aerodromes have the potential for impacts.
- 12.6.2 NATS En-Route and the MOD are also consulted as statutory consultees.
- 12.6.3 There are no military radars with potential to be affected by the Proposed Development. The northern development area does lie within a military TTA 20T used for military low flying training. However, impacts are highly dependent on the location and the MOD has a history of not objecting to low flying impacts in this part of the Tactical Training Area.
- 12.6.4 NATS operate radar in the area which will be affected, requiring mitigation.
- 12.6.5 The site does have partial visibility to the primary surveillance radars at Glasgow Airport and GPA; partial visibility meaning that some of the turbines are expected to be detectable by these radar and hence generate impacts. Because the airports provide radar based air traffic control services in the area of the Proposed Development, any primary radar impacts will need to be mitigated.
- 12.6.6 There are no NATS air-ground-air radio communication stations or navigational aids sufficiently close to require an impact assessment. There are also no MET (Meteorological) Office radar sufficiently close to present any impact risk. The nearest Met Office radar is at Holehead, 47 km north of the site. The site is beyond the 50 km radius safeguarding zone associated with the Eskdalemuir Seismic Array.
- 12.6.7 Because proposed tip heights are over 150 m, there is a statutory requirement for aviation obstacle lighting.

12.7 Scope of the Assessment

- 12.7.1 The scope is essentially defined as the inclusion of any aviation related operator with any potential to be affected, either in terms of infrastructure or operations. The acceptability of the Proposed Development, in terms of net effects on aviation related interests, is established through direct consultation with all relevant stakeholders within the consenting process. Most of these organisations will register their area of interest, or safeguarding area, with the ECU and/or the Local Planning authorities. They are then automatically consulted by the planning authorities and their response will be taken into account within the planning process. The assessment scope must therefore identify and include these organisation plus any smaller stakeholders which may be affected, but which may not be consulted automatically. The initial assessment therefore aims to exhaustively identify all stakeholders with any potential for effects and where significant effects may occur, to enter a dialogue with the affected stakeholders as far as possible, noting that some do not



enter a meaningful dialogue ahead of submission. Where impacts are of concern additional analysis may be required and where impacts are deemed unacceptable, mitigation solutions identified and explored with the goal of reducing impacts to acceptable levels.

- 12.7.2 It is worth noting that the aviation section does also include potential impacts to Met Office weather radar. This arises from the history of the Met Office being safeguarded by the MOD, which is no longer the case and because of the technical similarities with the assessment of impacts to other radar types.
- 12.7.3 **Section 12.5** above highlights the criteria used to search for organisations and infrastructure with any potential to be affected, largely drawn from the guidance provided from within the CAA publication CAP 764 - CAA Policy and Guidelines on Wind Turbines (Feb 2016), but also from aviation charts and the experience and knowledge of the aviation consultant.
- 12.7.4 It is proposed to scope out the assessment of effects during the construction and decommissioning of the Proposed Development during which the turbine blades will not be turning, preventing radar impacts. The construction and decommissioning phases involve cranes as temporary obstacles, which will be dealt with in the normal way through NOTAMs (Notices to Airmen). The critical effects and their mitigation occur during the enduring, operational phase only.

12.8 Assessment of Potential Effects

Operation

- 12.8.1 There is potential for major adverse (significant) effects on aviation interests during the operational phase of the Proposed Development, in the absence of mitigation.
- 12.8.2 The Proposed Development would have effects on Glasgow Airport, GPA and NATS (En Route) plc. These are summarised below, followed by a fuller description for each stakeholder.
- 12.8.3 The Proposed Development is predicted to have impacts on the airport primary radars at Glasgow and Prestwick, requiring mitigation to allow the normal operation of the airports.
- 12.8.4 The Proposed Development is also expected to have impacts on the NATS En-route radars at Lowther Hill, Glasgow Airport and Cumbernauld, requiring mitigation to allow normal operation.
- 12.8.5 Both Glasgow Airport and GPA have identified infringements of IFP safeguarding surfaces. Whilst Edinburgh Airport has not conducted any assessment of IFP impacts, it notes that the Proposed Development turbines are within the range of IFP safeguarding surfaces and suggests condition wording to address this as a potential issue.
- 12.8.6 There are no effects on other airfields, NATS air-ground-air radio stations, navigational aids, Met Office radar or military low flying. The MOD has accepted the proposed aviation lighting scheme to address low flying concerns; see lighting sections.

NATS (En-Route)

- 12.8.7 The NATS scoping response identified impacts to primary radars that form a part of their infrastructure at Lowther Hill, Cumbernauld and Glasgow Airport. The latter is the same radar that the airport themselves use, fed into the NATS control centre at Prestwick. The Applicant has independently reviewed radar visibility and found that all turbines will be visible to the Lowther Hill radar. This is the key NATS radar for air traffic management in the Scottish Terminal Area and mitigation would be required.
- 12.8.8 There are two options for mitigating these impacts, the details of which are described in the mitigation section below (**Section 12.9**).

Glasgow Airport

- 12.8.9 The turbines located on the more elevated areas of the site are expected to be visible to the Glasgow Airport Primary Surveillance radar (PSR). Mitigation is required to remove these impacts, details of which are described in the mitigation section below. The airport scoping response highlighted this



possibility stating *'It is within the radar safeguarding area and will likely require technical mitigation'*.

- 12.8.10 The site is also within the safeguarding range for the airport's instrument flight procedures (IFPs). This was noted by the airport in their scoping response, within which they stated *'It is within the instrument flight procedures safeguarding area and will likely impact. Detailed assessments will be required and we would encourage the applicant to engage with us on this as early as possible'*.
- 12.8.11 Some of the turbines would infringe the current Air Traffic Control Sector Minimum Altitude Chart (ATCSMAC). This would require chart amendments to increase the sector minimum altitude around the Proposed Development. It is possible that some flight procedures would also require amendment, but this can only be established through the completion of an IFP impact assessment conducted by a CAA approved procedure design organisation. The Applicant has engaged with the airport and an IFP assessment has been commissioned. The results of the assessment were not available at the time of submission.
- 12.8.12 The Applicant will continue to work with the airport to fully determine impacts and agree mitigation.

Glasgow Prestwick Airport

- 12.8.13 The situation with GPA is much the same as for Glasgow Airport. Some of the turbines are expected to be visible to the airport's primary surveillance radar and there are some infringements of IFP safeguarding surfaces.
- 12.8.14 Mitigation of the radar impacts is straightforward, with a well-established process to follow, explained further in the mitigation section below (**Section 12.9**).
- 12.8.15 An IFP impact assessment has been completed and established that there is one procedure that needs to be changed to accommodate the Proposed Development turbines. Mitigation of the IFP impacts is more complicated and the Applicant is working with the airport and its procedure designer to derive and assess acceptable procedure changes that will remove the impacts. More details are provided in **Section 12.9** below.

12.9 Mitigation

- 12.9.1 Mitigation is required to address the impacts on radars operated by NATS, Glasgow Airport and GPA.
- 12.9.2 Mitigation is also required to revise instrument flight procedures at Glasgow Airport and GPA.
- 12.9.3 Because the turbines are over 150 m tall, aviation lighting is required as a form of standard mitigation to address low flying risks.
- 12.9.4 No other mitigation is required, subject to the outcomes of the Edinburgh Airport IFP assessment and the Glasgow Prestwick VHF assessment. Because of the distance of the Proposed Development from the GPA radio station and the Edinburgh runway, the risk of further impacts is low. The findings of these studies will be taken into account within the GPA and Edinburgh Airport final responses to the planning application.

NATS (En-Route)

- 12.9.5 There are two off-the-shelf forms of mitigation available to address the NATS radar impacts. The Proposed Development is one of many in the immediate area, centred around Hagshaw Hill, the first wind farm in this area. All of these wind farms impact the NATS Lowther Hill radar and all use the same mitigation. This mitigation comprises of the blanking, or removal of all radar returns, from the affected radar(s) and infilling the resultant radar black hole with data from the Glasgow Airport Terma radar. This is the preferred solution for the Proposed Development. The alternative solution is to exploit the built in mitigation capability of the Lowther Hill radar and to blank the remaining affected radar. This is also a proven technology, already is use to mitigate wind farms, but likely to be less cost effective for the Proposed Development.
- 12.9.6 Glasgow Airport has two primary radars; a conventional (main) air traffic control radar that is impacted by wind turbines and a specialist radar installed for the explicit purpose of mitigating wind



turbine impacts, just for those areas where wind turbines affect the main radar. The Glasgow radar feed used by NATS is the mitigating radar, a Terma Scanter 4002, which has the built in turbine mitigation capability. Similarly GPA has installed a Terma Scanter radar to effect the same mitigation on its radar picture.

- 12.9.7 Prior to the blanking and infill solution above being fully approved, it is necessary to conduct a Terma feasibility study. This ensures that the required radar performance will be achieved. Because the NATS and the Glasgow Airport mitigation will both use the Glasgow Terma radar, a combined Terma study will be commissioned. This will establish the resultant radar performance for both NATS and the airport.
- 12.9.8 Because the Proposed Development is well within the normal operational range of the Glasgow Terma radar, the performance can be expected to fully meet requirements.
- 12.9.9 Once the Terma study has been completed, The Applicant can enter a contract with NATS for the provision of the mitigation. Once contracted, NATS will be in a position to remove their objection, subject to a condition requiring the Applicant to implement the mitigation prior to turbine erection.

Glasgow Airport

- 12.9.10 Some of the turbines are predicted to be visible to the Glasgow Airport Primary Surveillance Radar (PSR), requiring mitigation. As described above, for the mitigation of the NATS PSR impacts, this mitigation will be achieved through blanking and infill, using the Glasgow Terma radar to provide the infill data.
- 12.9.11 The process for the approval of the mitigation will also be as for NATS, initially requiring the completion of a combined Terma feasibility study, followed by contracting for the mitigation. Once contracted, the airport will be in a position to remove their objection, subject to a condition requiring the Applicant to implement the mitigation prior to turbine erection.
- 12.9.12 There will also be a need to mitigate infringements of one or more instrument flight procedures. Whilst the IFP assessment is yet to be completed, it is known that some of the turbines would infringe the current ATCSMAC. This would require chart amendments to increase the sector minimum altitude around the Proposed Development. It is possible that some flight procedures would also require amendment, but this can only be established through the completion of the IFP impact assessment, being conducted by a CAA approved procedure design organisation. The Applicant has engaged with the airport and the IFP assessment has been commissioned. The results of the assessment were not available at the time of submission.
- 12.9.13 The Applicant will continue to work with the airport to fully determine impacts and agree and mitigation as appropriate. As for the radar impacts, the requirement to implement IFP amendments prior to turbine erection can be managed through the application of suitable conditions.

Glasgow Prestwick Airport

- 12.9.14 The situation with GPA is much the same as for Glasgow Airport, with a requirement to mitigate primary surveillance radar impacts and for some amendments to instrument flight procedures.
- 12.9.15 Mitigation of the radar impacts is straightforward, with a well established process as outlined in the above section for Glasgow Airport and described within the airport's scoping response. An additional Terma study is needed, dedicated to the GPA Terma. Flight trials will form a part of the feasibility assessment, required to establish the base-line radar probability of detection.
- 12.9.16 An IFP impact assessment has been completed and established that there is one procedure that needs to be changed to accommodate the Proposed Development. Mitigation of the IFP impacts is more protracted than radar mitigation, requiring the airport's procedure design organisation to design revised procedures. Whilst this is not necessarily a complicated process, there is an industry wide backlog of IFP work and each stage of the process can become prolonged.
- 12.9.17 A study has been commissioned to design a modified procedure. Whilst the work has been commissioned, it had not been completed at the time of submission. This work needs to ensure that the procedure redesign does not generate any conflicts with other procedures. Once a revised



procedure has been generated, the users of the airport will need to be consulted to establish if it is acceptable to them. Once the feasibility has been established an IFP condition can be applied to enable the consenting process to be completed.

Aviation Obstacle Lighting

- 12.9.18 As a form of standard mitigation the Proposed Development will have aviation lighting to mark it as an en-route obstacle to low flying aircraft. The lighting requirements will be agreed with the CAA, with the lights meeting the requirements set out in Article 222 of the UK ANO.
- 12.9.19 A lighting scheme has been designed and key aviation stakeholders consulted. The lighting scheme has been approved by the MOD, GPA, the Scottish Police and the Scottish Air Ambulance Service. Glasgow Airport did not respond. The proposed scheme and stakeholder responses have been compiled into a study, sent to the CAA for their approval. A CAA response was outstanding at the time of submission.

The proposed lighting scheme

- 12.9.20 The details of the lighting scheme are as follows and shown on **Figure 12.1**:
- combi-lighting on the nacelles of turbines T1, T4, T6, T9, T11, T13, T16 and T18 (8 in total); consisting of medium intensity steady red (2000 candela) visible spectrum light plus MOD IR (infra-red) light meeting the requirements of the MOD.
 - a second combi-light on the nacelles of the above turbines to act as alternatives in the event of a failure of the main light; and
 - the visible spectrum component only on these turbines to be capable of being dimmed to 10% of peak intensity when the visibility as measured at the northern development area exceeds 5 km.
- 12.9.21 There is no requirement for intermediate level lights to be fitted on the turbine towers.

12.10 Residual and Cumulative Effects

- 12.10.1 There will be no residual or cumulative aviation effects during the construction or decommissioning phases of the Proposed Development.
- 12.10.2 Following implementation of appropriate mitigation with respect to NATS, Glasgow Airport and GPA, there will be no residual or cumulative effects on aviation operations or infrastructure during the operation of the Proposed Development.

12.11 Summary

- 12.11.1 This chapter has considered the potential effects of the Proposed Development on existing and planned military and civil aviation activities and infrastructure.
- 12.11.2 The Proposed Development lies underneath the Scottish Terminal Area, 31 km from Prestwick Airport, 36 km from Glasgow Airport and over 55 km from Edinburgh Airport. No further aerodromes have the potential for impacts.
- 12.11.3 The site has full or partial visibility to civil radars operated by NATS, Glasgow Airport and GPA. Because the airports and NATS provide radar based air traffic control services in the area of the Proposed Development turbines, any primary radar impacts will need to be mitigated.
- 12.11.4 There is a common radar solution that can be applied in all cases called blanking and infill. Just for the airspace over the Proposed Development turbines, the affected radar or radars can be blanked, removing all radar returns. The subsequent hole in coverage is then filled using data from an unaffected radar. NATS and Glasgow Airport will use the Glasgow Terma radar to provide the infill data and Prestwick will use its own Terma radar to provide the infill data. The Terma radars have a built in turbine mitigation capability that will remove the turbine impacts.



- 12.11.5 Mitigation is also required to revise instrument flight procedures at Glasgow Airport and GPA. The Applicant is engaged with the airports to identify revised procedures that are acceptable to the airports. This is an ongoing process.
- 12.11.6 Because the turbines are over 150 m tall, aviation lighting is required as a form of standard mitigation to address low flying risks. In this case a reduced lighting scheme will be used, with eight of the turbines installed with combined visible spectrum and infra-red lights, with the capacity for the visible spectrum lights to be dimmed to 10% of maximum intensity under conditions of good visibility.
- 12.11.7 No other mitigation is required, subject to the outcomes of the Edinburgh Airport IFP assessment and the Glasgow Prestwick VHF assessment.
- 12.11.8 The Applicant will continue to work with the airports and NATS to fully determine impacts and agree mitigation as appropriate. As for the radar impacts, the requirement to implement IFP amendments prior to turbine erection can be managed through the application of suitable conditions.



Table 12.2 – Summary of Residual Effects

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
During Construction & Decommissioning					
No effects on aviation and radar interests during construction and decommissioning					
During Operation					
Effects on MoD low flying interests (TTA 20T)	Significant	Adverse	Aviation lighting will be installed on 8 of the proposed 18 turbines. The lighting requirements will be agreed with the CAA, with the lights meeting the requirements set out in in Article 222 of the UK ANO	Negligible	Neutral
Effects on NATS (En-Route) infrastructure: Lowther Hill, Cumbernauld and Glasgow Airport PSRs.	Significant	Adverse	Mitigation measure agreed between the Applicant and NATS, likely in the form of using the Glasgow Terma radar to provide the infill data.	Negligible	Neutral
Effects on Glasgow Airport infrastructure: Glasgow PSR, IFPs and ATCSMAC.	Significant	Adverse	Mitigation measure agreed between the Applicant and NATS, likely in the form of using the Glasgow Terma radar to provide the infill data. Application of an IFP condition (to be agreed).	Negligible	Neutral
Effects on GPA infrastructure: IFPs and PSR.	Significant	Adverse	Mitigation measure agreed between the Applicant and NATS, likely in the form of using the Glasgow Terma radar to provide the infill data. Application of an IFP condition (to be agreed).	Negligible	Neutral
Cumulative Effects					
No cumulative effects on aviation and radar interests subject to mitigation measures agreed and put in place					



12.12 References

Civil Aviation Authority (Feb 2016), CAP 764: *CAA Policy and Guidelines on Wind Turbines*.

Civil Aviation Authority (Jun 2017), *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*.

Civil Aviation Authority (Feb 2021), CAP 393: *The Air Navigation Order 2016 (ANO) and Regulations*.

Scottish Government (revised March 2016), *Planning Circular 2/03: Safeguarding of Aerodromes, Technical Sites and Military Explosives Storage Areas*.

Scottish Government (2023), *National Planning Framework 4*. Available at:
<https://www.gov.scot/publications/national-planning-framework-4/>

Scottish Government (Dec 2022), *Onshore wind: policy statement*. Available at:
<https://www.gov.scot/publications/onshore-wind-policy-statement-2022/>