



Clash Gour Wind Farm ACP-2021-046

Full Options Appraisal

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1 Full Options Appraisal

1.1 Introduction

Force9 Energy (Force9), jointly with EDF Energy Renewables Limited (EDFER) is developing the Clash Gour Wind Farm (Clash Gour) in the name of its wholly owned subsidiary Clash Gour Holdings (CGH). Clash Gour will be a substantial onshore windfarm which will be located in the Moray Council Area, approximately 14 Nautical Miles (nm) southwest of Elgin and 13 nm southeast of Nairn. Clash Gour will consist of 48 wind turbines with a maximum blade tip height of 180 metres (m) above ground level (agl).

Clash Gour will have an installed capacity of up to circa 225 MegaWatt (MW) which will make it one of the largest onshore windfarms currently under consideration in Scotland. Clash Gour is expected to produce between 570 GigaWatt (GW) hours and 710 GW hours of electricity annually which is sufficient to power up to 193,000 houses. Clash Gour is a strategically important project in the context of Scottish national targets for renewable energy production (12GW of new onshore wind capacity by 2030).

1.2 Full Options Appraisal

In developing the Clash Gour Wind Farm, Force9 have initiated an Airspace Change Proposal (ACP) under the process defined in Civil Aviation Publication (CAP) 1616, regulated and approved by the UK Civil Aviation Authority (CAA).

Airspace Change Proposals vary greatly in terms of size and complexity. Therefore the Airspace Change process is sufficiently scalable to accommodate different types of proposal. This means that not all airspace change proposals necessarily need to be subjected to each and every element of the process. As identified in the Initial Options Appraisal submission accepted at the Stage 2 Gateway, this ACP is expected to result in minimal change to the impacts over the ground when compared to the current environment.

The Full Options Appraisal requires change sponsors to assess each of the design options against each other in relation to the criteria defined in CAP1616, Appendix E using primarily quantitative metrics. These metrics include the assessment of the environmental impacts of the proposed change. However, the Initial Options Appraisal conducted at Stage 2 deduced that not all of the environmental metrics are relevant to this particular airspace change and as such, are unlikely to be collected during Stage 3. This is due to the unique circumstances of this ACP, where very limited information is available as this development does not relate directly to an airport. The evidence suggested that the sponsor would be unable to provide any meaningful noise measurement in Stage 3 and the change sponsor has concluded that it is not appropriate to collect the standard noise metrics and conduct a full noise assessment in Stage 3. Therefore, the qualitative assessment, backed up by the quantitative data of the traffic survey, conducted during the Initial Options Appraisal



will form the Full Options Appraisal for this proposal, and is included at Appendix A1 to this document.

Further details on the analysis conducted at Stage 2 can be found in the following section.

2 Full Options Appraisal Methodology

2.1 Full Options Appraisal Evidence Capture

Consistent with the requirements of CAP1616, the Initial Options Appraisal is a qualitative analysis of each option against a defined baseline. This is expanded on within the Full Options Appraisal, which is conducted at Stage 3, to include quantitative analysis. The Full Options Appraisal, requires change sponsors to assess each of the design options against each other in relation to the criteria defined in CAP1616, Appendix E using primarily quantitative metrics. These metrics include the assessment of the environmental impacts of the proposed change.

As defined in CAP1616a, the Full Options Appraisal requires change sponsors to collect quantitative environmental metrics that describe the baseline scenario and conduct a series of modelling activities for each of the design options, to enable an environmental comparison. The required metrics include:

- 10-year traffic forecasts
- Standard noise metrics:
 - LAeq noise contours
 - 100% noise mode contours
 - Nx contours
 - Difference contours
 - Lmax spot point levels
 - Operational diagrams
 - Overflight (based on the CAA definition of overflight found in CAP1498)

The modelling is intended to provide a comparison between today's operation (the baseline), to show the impact of the proposed change at the point of implementation and also 10 years post-implementation. Modelling is also required to show the situation at the proposed implementation date and 10 years post-implementation without applying the proposed change. However, the change sponsor believes that it is not appropriate to provide these metrics in Stage 3.

It is the view of the change sponsor that not all of the defined metrics are relevant to this particular airspace change and as such, the metrics listed above have not been collected during Stage 3. This is due to the unique circumstances of this ACP, where very limited information is available as this development does not relate to an airport. Following feedback from the CAA regarding noise assessment, the change sponsor provided a detailed traffic survey and explained why it was not appropriate to collect the above metrics and conduct a full noise assessment in Stage 3. Pertinent observations from the Traffic Survey conducted at Stage 2 are included in the following paragraphs. Full details of the survey can be found in the Initial Options Appraisal document on the airspace change portal alongside this document.

2.1.1 Traffic Survey

The proposed Clash Gour Wind Farm site is currently located within Class G airspace meaning there is uncontrolled access to air platforms of all types. An initial qualitative traffic assessment conducted by the change sponsor concluded that the

area in question featured low traffic levels in the area involving users such as local general aviation (GA) traffic (including gliding; recreational and leisure aircraft); military transit and training traffic; as well as infrequent off-route commercial air traffic. Subsequently, the change sponsor conducted a more detailed quantitative analysis of traffic within the area surrounding the proposed wind farm development. The aim of the traffic assessment was to determine the type and density of transiting traffic in the area and estimate the number of aircraft potentially affected by the proposed airspace solutions.

2.1.2 Results

During the 2-week period, a total of 468 movements transited the surveyed volume of airspace. Of this total, 263 movements transited the surveyed volume below 20,000 ft, averaging approximately 19 movements per day. The most movements on a single day was 34 on the 10th August. The least was 6 on the 13th August. Fifty-nine of the movements were aircraft inbound to Inverness Airport and were concentrated on a path in the western side of the surveyed area that went from south to north to make a left turn for Runway 23. Seventy-four of the movements were general Aviation (GA) aircraft (including single engine piston aircraft, twin engine GA aircraft, gliders or other GA aircraft). Figure 1 below provides a representation of the aircraft tracks in the vicinity of the proposed Clash Gour site for the 24-hour period on the 10th August, the busiest day. The aircraft inbound to Runway 23 at Inverness Airport can be seen on the left-hand side of the image.

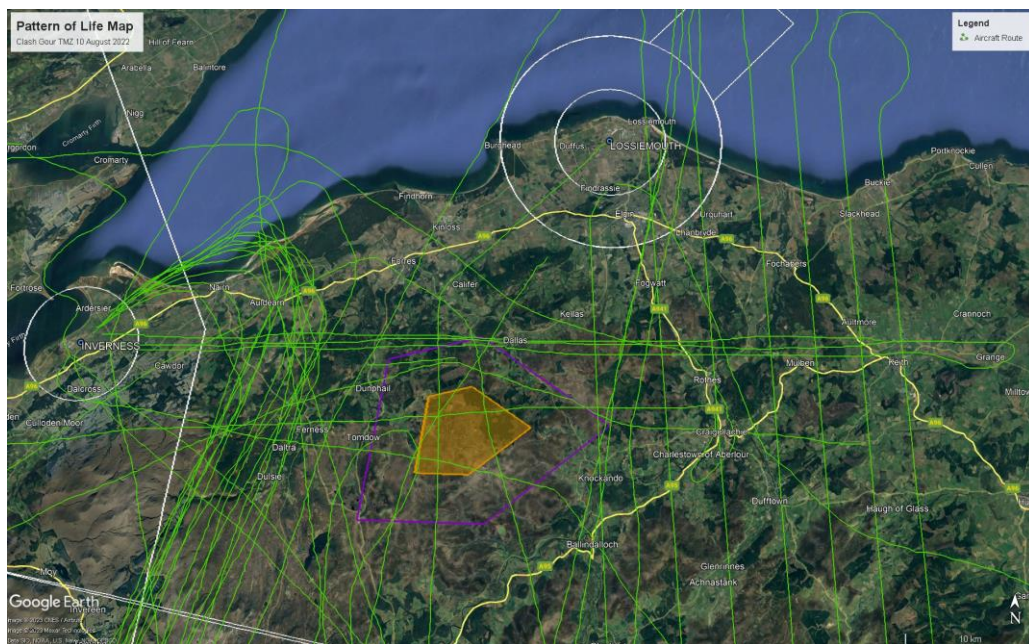


Figure 1 Pattern of Life Map – 10th August 2022

Source: Google Earth

It should be noted that only aircraft carrying the necessary transponder equipment would be identified by the aircraft tracking system. As previously stated, it is not mandatory in the UK for all aircraft to have this equipment and therefore movements in the area (particularly GA) may have occurred that have not appeared in the survey. To estimate the maximum potential effect of the development, a scaling factor has been applied to the GA traffic data.

Although an exact figure is difficult to determine, a report produced by EGIS¹ as part of a project working on behalf of the CAA to Develop Minimum Technical Standards for Electronic Conspicuity and Associated Surveillance suggests that approximately 40% of GA aircraft are fitted with the appropriate equipment. It can therefore be estimated that as well as the 74 GA aircraft identified, there would have been a further 111 aircraft not fitted with the equipment, and therefore not identified in the survey. This would give a total of 185 GA aircraft over the two weeks surveyed. This averages approximately 13 movements per day and considering that the survey took place at the height of summer, when GA traffic is busiest, this is likely to be an upper estimate compared to the rest of the year. Of these 13 aircraft, 5 are likely to be fitted with transponder equipment, and would not be required to avoid a TMZ. Therefore, it can be estimated that on average, only 8 aircraft per day would be flying in the area without the use of a transponder. Not all of these aircraft may need to avoid the TMZ as their routing may avoid anyway.

2.1.3 Conclusion

The change sponsor has concluded, from the previous qualitative statements and this quantitative assessment, that the airspace is a low-density air traffic environment and that the evidence suggests that the sponsor would be unable to conduct or provide any meaningful noise measurement in Stage 3.

2.1.4 Noise Metrics

In assessing the potential for any of the options to make a difference to extant noise levels, the change sponsor has assessed that the low population numbers in the vicinity of Clash Gour mean that the number of residents affected at the lowest observed adverse effect level (LOAEL) would be minimal. Furthermore, we have assessed noise contours for a UK commercial airport of approx. 60,000 movements per year (comprising 35,000 ATM, 19,000 GA and 2,000 Business aviation plus 3,000 other movements), against RAF Lossiemouth², to provide a comparative example of the most likely effect that similar assessed noise levels could have upon the local population. It shows that the representative 51dB LAeq 16 hour (hr) (daytime) noise contour³ would extend no further than 4 nm from the runway, hence is contained within the MATZ (Military Aerodrome Traffic Zone) of RAF Lossiemouth. The civilian airport 45dB LAeq 8hr (night-time) noise contour would extend further from the airport than the daytime noise contour, but we do not anticipate RAF Lossiemouth night flying creating the same impact, hence we have used the daytime noise contour (the night-time one would only extend a further 800m to the south-west, so would still be contained in their MATZ). The conclusion from this is that the low traffic levels in the vicinity of the proposed Clash Gour Wind Farm and any of the associated airspace options would not produce adverse noise levels (daytime noise annoyance at 51dB LAeq, 16h and night-time noise at 45dB LAeq, 8h) nor would they necessitate in conducting a quantified noise modelling assessment.

The sponsor has also considered any commensurate changes to noise levels because of aircraft not electing, or being unable, to fly through the proposed airspace described in the options. For example, in the case of a potential TMZ option, a non-

¹ [Minimum Technical Standards For Electronic Conspicuity And Associated Surveillance](#)

² Assessed noise levels data is not available for RAF Lossiemouth.

³ The Department for Transport (DfT) directs that this is the level above which noise is considered to be a nuisance during the day. DfT policy regards 51dBA as the point at which the adverse effects of noise on health and wellbeing begin to be seen on a community basis.

transponding aircraft may elect to not use their radio (if available) to transit through the TMZ (with the controlling authority's agreement) and elect to alter their course to avoid the TMZ. By doing so, other traffic, such as an aircraft positioning for an instrument approach into Runway 05 at RAF Lossiemouth, may then alter their course commensurately although any change in traffic pattern due to avoidance of airspace should have no impact on 51 dB noise contour. This could change the noise levels over the ground for both of the aircraft in this example but this hypothetical scenario, whilst feasible, is not measurable and again does not necessitate a quantified noise modelling assessment.

The combination of the comparison analysis, above, and the traffic assessment, has led the sponsor to conclude that it is not appropriate to collect the standard noise metrics and conduct a full noise assessment in Stage 3.

2.1.5 Fuel Burn and Greenhouse Gas Emissions

Due to the small scale of this change (in terms of TMZ dimensions) and small number of aircraft likely to be affected, any re-routing by light aircraft expected to have a minimal impact. Any additional greenhouse gas emissions caused by the re-routing of light aircraft must be balanced against the fact that this ACP facilitates a carbon positive development. Therefore, no quantitative analysis of fuel burn and greenhouse gas emissions has been carried out at this stage.

2.1.6 Future Traffic Forecast

In line with the CAA's Airspace Modernisation Strategy (2022), it is expected that the demand on use of UK Airspace will expand, not only from existing airspace users such as Commercial Air Transport, GA, and the Military, but also from new users such as Unmanned Aircraft Systems, Advanced Air Mobility (AAM), Spaceflight, and High-Altitude Platform Systems (HAPS)⁴. However, there is not expected to be any significant change in numbers of those aircraft that may be impacted by this ACP, with the number of fixed-wing GA aircraft operating in the UK remaining broadly similar over the next 10-year period. Therefore, there is not expected to be any significant change in the environmental impacts, fuel burn and economic impact during this time period. In addition, future requirements for the carriage of electronic conspicuity devices in UK airspace is likely to reduce the number of aircraft affected by the introduction of a TMZ, considerably reducing any impact.

2.1.7 TAG Analysis

The Change Sponsor has concluded that it is not appropriate to conduct TAG analysis due to the minimal impact of this ACP, and therefore quantitative TAG analysis is scoped out of this ACP.

2.2 High-level Objectives & Assessment Criteria

For an airspace change, the criteria against which appraisal options are assessed is defined within CAP 1616, Appendix E, Table E2. These criteria are described in Table 1 below. Additionally, Safety Assessment, Tranquillity and Biodiversity (as defined in CAP 1616, Appendix B) have been added at the bottom.

⁴ Minimum Technical Standards For Electronic Conspicuity And Associated Surveillance

The scale of this airspace change proposal is considered by the Change Sponsor to be small relative to other ACPs that are currently being progressed. There is minimal population in the vicinity of the proposal and together with the nature of light aircraft operations in the area, the environmental impacts are expected to be limited. Therefore, the Change Sponsor has concluded that a Full Options Appraisal based on a qualitative assessment, backed up by the quantitative data of the traffic survey, is deemed proportionate and appropriate.

Affected Group	Impact	Description
Communities	Noise impact on health and quality of life	Requires consideration of noise impact on communities including residents, schools, hospitals, parks, and other sensitive areas.
	Air Quality	Any change in air quality is to be considered ⁵ .
Wider Society	Greenhouse Gas impact	Assessment of changes in greenhouse gas levels in accordance with WebTAG is required.
	Capacity and resilience	A qualitative assessment of the impact on overall UK airspace structure.
General Aviation (GA)	Access	A qualitative assessment of the effect of the proposal on the access to airspace for GA users.
GA/commercial airlines	Economic impact from increased effective capacity	Forecast increase in air transport movements and estimated passenger numbers or cargo tonnage carried.
	Fuel burn	The change sponsor must assess fuel costs based on its assumptions of the fleets in operation.
Commercial airlines	Training costs	An assessment of the need for training associated with the proposal.
	Other costs	Where there are likely to be other costs imposed on commercial aviation, these should be described.
Airport/Air Navigation Service Provider	Infrastructure costs	Where a proposal requires a change in infrastructure, the associated costs should be assessed.
	Operational costs	Where a proposal would lead to a change in operational costs, these should be assessed.

⁵ Air Quality assessments are only applicable below 1,000 feet and includes the consideration of Air Quality Management Areas (AQMAs).

Affected Group	Impact	Description
	Deployment costs	Where a proposal would lead to a requirement for retraining and other deployment, the costs of these should be assessed.
Safety Assessment	Safety Assessment	CAP 1616 requires a safety assessment of the proposal to be undertaken in accordance with CAP 760 (Guidance on the Conduct of Hazard Identification, Risk Assessment, and the Production of Safety Cases: For Aerodrome Operators and Air Traffic Service Providers).
Wider Society	Tranquillity	The impact upon tranquillity need only be considered with specific reference to Areas of Outstanding Natural Beauty (AONB) ⁶ and National Parks (NPs) unless other areas for consideration are identified through community engagement.
	Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.


Table 1 Full Options Appraisal Assessment Criteria

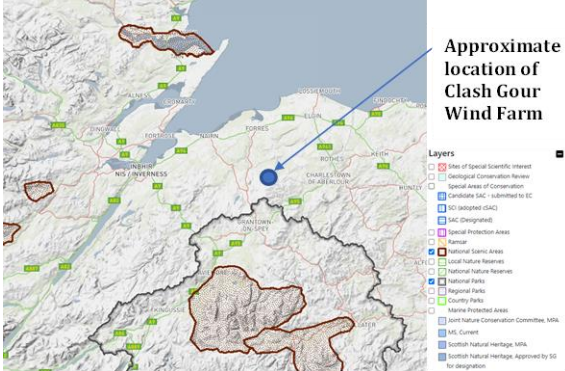
⁶ AONBs are not applicable in Scotland and the equivalent designation is a National Scenic Areas which shall be assessed instead.

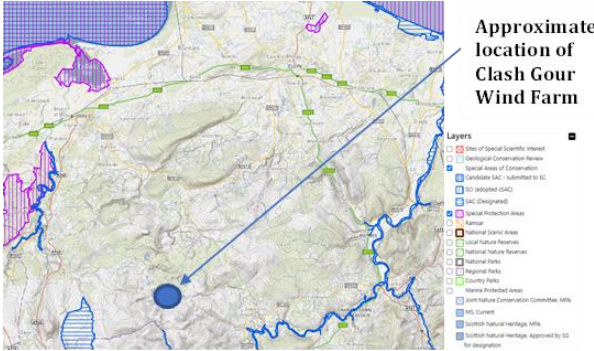
A1 Options Appraisal

A1.1 Do Nothing Baseline

<p>Option 0 - Do Nothing Baseline – Clash Gour Wind Farm has not been constructed. Wind farms that are already established in the immediate vicinity of the proposed Clash Gour Wind Farm (i.e. Berry Burn) are included within the baseline scenario (current situation)</p>		
<p>Option 0 (the Do Nothing baseline) provides no change to the current situation and therefore the impacts of aviation activity in the area remain the same as they are today. Furthermore, it is assumed that the extant airspace arrangements are safe and remain so.</p> <p>Option 0 was previously rejected as part of the Design Principle Evaluation but has been carried forward into the Full Options Appraisal for comparative purposes only.</p>		
Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	In the Do Nothing baseline scenario, aircraft movements (and therefore noise) are exactly the same as they are today. In this scenario, aircraft operating in the vicinity of the proposed development site are able to fly anywhere within the realms of Glass G airspace and are not mandated to carry a transponder or communicate with ATC unless they wish to enter the Aerodrome Traffic Zone (ATZ) at Inverness Airport or the Military Air Traffic Zone (MATZ) at RAF Lossiemouth. As such, aircraft noise within this scenario is the same as it is today and may be widely dispersed. However, due to the limited population density in the area, the impact of aircraft noise on local communities is likely to be minimal.

	Air Quality	<p>In the Do Nothing baseline scenario, it is unlikely that local air quality is impacted by aircraft movements. The rationale being that to avoid terrain and nearby existing operational turbines, aircraft operating in the vicinity of the Clash Gour development are likely to be above 1,000ft. As a result, there is unlikely to be an impact on local air quality due the effects of mixing and dispersion above 1,000ft as per CAP 1616, Appendix B, Para B74. It should also be noted that there are no AQMAs in the area of the proposed development.</p> 
Wider Society	Greenhouse Gas impact	In the Do Nothing baseline scenario, aircraft operating in the vicinity of the proposed development are able to operate anywhere within Class G airspace. The greenhouse gas impact of the current situation is likely to be minor due to the fact that only a limited number of aircraft operate in the area.
	Capacity and resilience	As the Do Nothing baseline scenario reflects the current situation, it represents no change or impact on capacity and resilience.

	<p>Tranquillity</p>	<p>The Do Nothing baseline represents the current situation in which, the proposed location of the Clash Gour wind farm is located approximately 20 nm outside the nearest National Scenic Area (NSA - equivalent to an AONB in Scotland) and approximately 3.2 nm outside the nearest National Park boundary. As such the proposed development area lies out with any NSA or NP. There are no restrictions on aircraft flying over the National Park and although numbers are likely to be small, some aircraft may already overfly this area.</p>  <p>Approximate location of Clash Gour Wind Farm</p> <p>Layers</p> <ul style="list-style-type: none"> <input type="checkbox"/> Sites of Special Scientific Interest <input type="checkbox"/> Geological Conservation Review <input type="checkbox"/> Special Areas of Conservation <input type="checkbox"/> Candidate SAC - submitted to EC <input type="checkbox"/> SAC (Integrated GIAC) <input type="checkbox"/> SAC (Designated) <input type="checkbox"/> Special Protection Areas <input type="checkbox"/> Marine <input type="checkbox"/> National Scenic Areas <input type="checkbox"/> Local Nature Reserves <input type="checkbox"/> National Nature Reserves <input type="checkbox"/> National Parks <input type="checkbox"/> Regional Parks <input type="checkbox"/> Country Parks <input type="checkbox"/> Marine Protected Areas <input type="checkbox"/> Joint Nature Conservation Committee, MPA <input type="checkbox"/> MPA, Current <input type="checkbox"/> Scottish Natural Heritage, MPA <input type="checkbox"/> Scottish Natural Heritage, approved by SG for designation
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	Biodiversity	<p>In the Do Nothing baseline scenario (the current situation), the Clash Gour wind farm does not exist and therefore has no impact on Biodiversity.</p> <p>The change sponsor acknowledges the presence of a Special Conservation Area (SAC) and Special Protection Areas (SPAs) in the local area but this scenario will have no impact on these as there will be no change.</p>  <p>Approximate location of Clash Gour Wind Farm</p> <p>Layers</p> <ul style="list-style-type: none"> Site of Special Scientific Interest Geological Conservation Review Special Areas of Conservation Candidate SAC - submitted to EC EC designated SAC SAC Designated Special Protection Areas Marine National Marine Areas Local Nature Reserves National Nature Reserves National Parks Regional Parks County Parks Marine Protected Areas Scottish Natural Heritage, SNH SNH Corridor Scottish Natural Heritage, SNH Scottish Natural Heritage, Approved by EC for integration
General Aviation	Access	<p>In the Do Nothing baseline scenario, there are no changes to the extant airspace arrangements. GA users in the current situation are able to operate freely within Class G airspace and are not mandated to carry a transponder or be in communication with ATC, unless they wish to enter the Aerodrome Traffic Zone (ATZ) at Inverness Airport or the Military Air Traffic Zone (MATZ) at RAF Lossiemouth. This scenario reflects and maintains this arrangement.</p> <p>Traffic analysis carried out by the change sponsor shows that airspace usage is currently low density.</p>
General Aviation / commercial airlines	Economic impact from increased effective capacity	As specified in the Statement of Need, this ACP is aimed at mitigating the impacts of the proposed Clash Gour wind farm. Therefore, there will be no change to the number of air traffic movements in the area as a direct result of this ACP, which reflects the current situation.
	Fuel burn	In the Do Nothing baseline scenario, there are no changes to the extant airspace arrangements and as such there is no impact on aircraft fuel burn.
Commercial airlines	Training costs	As this is the Do Nothing baseline scenario there are no additional training costs for commercial airlines due to the fact that there is no change to the extant airspace arrangements.

	Other costs	As this is the Do Nothing baseline scenario there are no additional other costs for commercial airlines due to the fact that there is no change to the extant airspace arrangements.
Airport / Air navigation service provider	Infrastructure costs	As this is the Do Nothing baseline scenario there are no additional infrastructure costs for Airports/ANSPs due to the fact that there is no change to the extant airspace arrangements.
	Operational cost	As this is the Do Nothing baseline scenario there are no additional operational costs for Airports/ANSPs due to the fact that there is no change to the extant airspace arrangements.
	Deployment costs	As this is the Do Nothing baseline scenario there are no additional deployment costs for Airports/ANSPs due to the fact that there is no change to the extant airspace arrangements.
	Safety	As the Do Nothing baseline scenario includes the fact that the Clash Gour wind farm does not exist and reflects the current situation, there is no impact on aviation safety. The baseline assumption remains that the extant airspace arrangements are safe and continue to be so.

A1.2 Option 7(E)

Option 7(E) – RAG blanking over the proposed wind farm array locations. Simplified polygon TMZ ‘rubber banded’ around the proposed windfarm locations with no buffer.

From a safety perspective, Option 7(E) provides a radar mitigation solution suitable for managing traffic within the vicinity of the proposed wind farm. As a result of the introduction of primary radar blanking and a TMZ, controllers will have greater situational awareness of traffic operating in the vicinity and will not experience significant radar clutter caused by the presence of the wind farm. There may be a slight increase in controller workload, should an aircraft without a transponder and not in communication with ATC enter the TMZ, however, this is expected to be minimal. In addition, this option does present a hazard in terms of GA integration, however, this can be procedurally and tactically mitigated. Option 7(E) also provides a simplified TMZ airspace design which reduced complexity for both controllers and pilots.

With regards to environmental factors, due to the small scale of the proposed TMZ, any re-routing required by aircraft (without a transponder and not in communication with ATC) is expected to be minimal, resulting in minimal additional noise, greenhouse gas, fuel burn, access and economic impacts. The development consent process for the wind farm development included a detailed Environmental Impact Assessment (EIA) which assessed the significant environmental effects of the development. This included a carbon assessment which showed that the development is carbon positive for approximately 27.5 years of its 30 year lifetime, a factor which was balanced against the environmental effects when Scottish Ministers consented the project. This must be considered in balance against the minimal environmental impacts of displaced air traffic. There is expected to be no or very little additional costs for commercial airlines, GA and ANSPs as a direct result of this option. There may be a minor cost associated with controller training and that a cost shall be incurred for the staffing and management of the TMZ, however, this cannot be quantified at this time (and is likely to be paid for by the wind farm developer). It must also be noted that the development and construction costs of the wind farm itself are outside the scope of the CAP 1616 process and as such have not been considered.

The Change Sponsor considers Option 7(E) to be the minimum option to achieve the objectives of this ACP.

Group	Impact	Qualitative Assessment
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Communities	Noise impact on health and quality of life	Like the Do Nothing scenario, due to the limited population density within the vicinity of the wind farm development, there is expected to be a very limited impact by a small number of light aircraft (which are not equipped with a transponder or in communication with ATC) re-routing around the proposed TMZ, simply because of the minimal number of people within the area. However, it is acknowledged that aircraft may be concentrated around the periphery of the TMZ and not be as widely dispersed as they are in the baseline scenario, especially if they are not equipped with a transponder or are not in communication with ATC. As previously stated, it is estimated that, on average, only 8 aircraft per day will be flying in the vicinity of the TMZ without a transponder fitted; not all of these would have planned to route through the TMZ so would not be required to re-route. In addition, some of these aircraft may be fitted with radio equipment and would be able to gain clearance through the TMZ from the Controlling Authority. The conclusion from this is that the low traffic levels in the vicinity of the proposed Clash Gour Wind Farm would not produce adverse noise levels above those levels which DfT policy considers to be the point at which the adverse effects of noise on health and wellbeing begin to be seen on a community basis, as a result of implementing this option.
	Air Quality	This airspace solution is unlikely to result in more aircraft flying over the area, or at lower altitudes, than the baseline scenario. Like the Do Nothing scenario, to avoid nearby terrain/existing turbines and the proposed turbines, it is likely that any aircraft that overfly the area within the vicinity of the proposed wind farm would be above 1,000ft. Therefore, as per CAP 1616, Appendix B, Para B74, there is unlikely to be an impact on local air quality due to the effects of mixing and dispersion. In addition, any aircraft flying within the proposed TMZ or those required to re-route to avoid the turbines would not overfly an AQMA. There will be no change in Air Quality over the baseline scenario with this option.

Wider Society	Greenhouse Gas impact	As part of this option, it is acknowledged that some light aircraft may have to re-route around the proposed wind farm in this scenario. Within this option, re-routing would likely only be required by a very small percentage of aircraft, estimated to be a maximum of 8 aircraft per day on average, who do not have a transponder or who are not in communication with ATC. As a result, the majority of aircraft should not require a re-route, but it is noted that a small percentage may do so, which will lead to increased track mileage and therefore increased greenhouse gas emissions. However, due to the small scale of the proposed TMZ this is expected to be minimal, when compared to the baseline scenario. For example, an aircraft routing from Aberdeen Airport to Inverness Airport could travel as little as an additional 0.5 nm to avoid the TMZ. It is also worth noting that a detailed Environmental Impact Assessment (EIA) has been carried out on the development as a whole as part of the development consent process. The EIA concluded that the overall development would be carbon positive, which should be considered, in balance against any adverse greenhouse gas emissions caused by the re-routing of aircraft.
	Capacity and resilience	The introduction of a TMZ is not expected to have any impact on capacity and resilience due to the small scale of the change and nature of operations in the vicinity.
	Tranquillity	Like the baseline scenario, the location of the wind farm (and proposed TMZ) is out with the boundaries of any NSA or NP. Due to the small scale of the proposed TMZ, any aircraft that may have to route around it would unlikely overfly an NSA but may overfly the northern extent of the Cairngorms National Park. However, as there are no restrictions on aircraft flying over the National Park and some aircraft may already overfly this area. In addition, the topography of the local area is more likely to result in aircraft re-routing to the north of the TMZ, rather than over the higher ground that forms part of the National Park. Therefore, the impact of this option on Tranquillity is very limited with very small numbers of aircraft overflying the National Park. The impact on tranquillity with option is not expected to be significantly different to the Do Nothing scenario.

	Biodiversity	<p>It is acknowledged that the development of the proposed wind farm may have an impact on biodiversity, when assessed as a stand-alone airspace solution, this option would have a minimal impact on biodiversity. Although the wind farm is located in close proximity to the Moidach More Special Conservation Area (SAC), any impacts of aircraft overflying this designated area are expected to be minimal. The rationale being that this particular designation specifically refers to the conservation of an area of blanket bog, which is subject to negative pressures such as burning or water management issues. As the Moidach More SAC specifically refers to a ground-based eco-system, this ACP is expected to be a very minimal impact as the effects of fuel dispersion and mixing above 1,000ft are unlikely to cause an impact on local air quality in this area. No Special Protection Areas (SPAs) or European Protected species are expected to be adversely impacted by this option.</p> <p>Any impact on biodiversity as a result of the development of the wind farm itself is subject to development consent and is outside the scope of the CAP 1616 process.</p>
General Aviation	Access	<p>The change sponsor acknowledges that the implementation of a TMZ will have a minor impact on airspace access for some GA users. This is applicable to those GA aircraft that are not equipped with a transponder and are not in communication with ATC. As detailed in paragraph above, this is estimated to be a maximum of 8 aircraft per day on average. For these aircraft a route around the proposed TMZ would be required, however, given the size and scale of this option, any re-routing is expected to be minimal. For those aircraft equipped with a transponder and/or in communication with ATC, this option should have a very limited impact and will not hinder their level of airspace access. Based on traffic analysis conducted by the change sponsor, at this stage, it is not believed that this option would significantly alter the traffic levels within the area.</p>
General Aviation / commercial airlines	Economic impact from increased effective capacity	<p>As specified in the Statement of Need, this ACP is aimed at mitigating the impacts of the proposed Clash Gour wind farm. Therefore, there will be no change to the number of air traffic movements in the area as a direct result of this ACP, this is reflected in the baseline scenario. For those aircraft that are not equipped with a transponder or in communication with ATC, a minor re-route may be required which may lead to a minor additional fuel cost, but due to the scale of the proposed TMZ and the small number of aircraft likely to be affected, this is expected to be very minor.</p>

	Fuel burn	The change sponsor acknowledges that the introduction of a TMZ would require some aircraft (those without a transponder and not in communication with ATC) to re-route around the TMZ, causing increased track mileage and fuel burn. However, due to the scale of the proposed TMZ, this re-route is expected to be minimal and is mainly only applicable to those aircraft which do not meet the requirements to fly within the TMZ. The number of aircraft impacted are anticipated to be small. It should be noted that all commercial aircraft are fitted with transponders and as such there should be no impact on commercial traffic.
Commercial airlines	Training costs	There is no anticipated training cost to commercial airlines as a result of this option, especially as there is a limited amount of commercial traffic within the vicinity of the proposed wind farm. In addition, all commercial aircraft are fitted with a transponder, therefore, there is no adverse impact on this group of airspace users.
	Other costs	There are no anticipated additional costs to commercial airlines associated with this option.
Airport / Air navigation service provider	Infrastructure costs	There is expected to be a possible small cost associated with software updates to accommodate for the RAG blanking and the establishment of the TMZ but these are expected to be minor.
	Operational cost	Any cost incurred by the controlling authority associated with the staffing and management of the proposed TMZ would be subject to commercial negotiations and likely a Letter of Agreement. At this stage of the CAP 1616 process, it is unclear how much this cost is likely to be but shall be investigated in subsequent stages of the process.
	Deployment costs	There may be a small amount of additional controller training associated with the management of the TMZ, however, this is expected to be minimal and are likely to be covered by the Change Sponsor in forming the agreements required to discharge the planning conditions.

	<p>Safety</p>	<p>The management and integration of GA traffic (including gliders) is a potential hazard associated with this option as GA aircraft may be required to route around the proposed TMZ, which may cause ‘choke points’, however, this is mitigated by airspace design constraints and tactical management of traffic by ATC. To avoid the development of ‘choke points’ and need for tactical management, there will be clear designation and promulgation of the TMZ within the UK AIP. It is acknowledged that any tactical management may cause a slight increase in controller workload, however, due to the low traffic flows of light aircraft within the area, this is expected to be minimal. Furthermore, within Class G airspace, the pilot is ultimately responsible for collision avoidance. It is recognised that adverse weather conditions may hamper a pilot’s ability to maintain visual separation with the turbines. This is mitigated through the effective use of flight planning by pilots. Furthermore, loss of communication with non-transponding aircraft is acknowledged but is an existing hazard which is not impacted by the establishment of a TMZ, especially within Class G airspace. The size and shape of this proposed option is simpler than some others meaning it is easier for both pilots and controllers to interpret/manage. A potential loss of the TMZ boundary (as displayed on the controllers display) is also acknowledged, however this is an unlikely failure mode which may have more serious consequences for factors that do not relate to the establishment of TMZ and as such is an existing hazard, which can be mitigated procedurally.</p>
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A1.3 Option 7(F)

Option 7(F) – RAG blanking over the proposed wind farm array locations. Simplified polygon TMZ ‘rubber banded’ around the proposed windfarm locations extended to include 2 nm buffer.

From a safety perspective, Option 7(F) provides a radar mitigation solution suitable for managing traffic within the vicinity of the proposed wind farm. As a result of the introduction of radar blanking and a TMZ, controllers will have greater situational awareness of traffic operating in the vicinity and will not experience significant radar clutter caused by the presence of the wind farm. There may be a slight increase in controller workload, should an aircraft without a transponder and not in communication with ATC enter the TMZ, however, this is expected to be minimal. In addition, this option does present a hazard in terms of GA integration, however, this can be procedurally and tactically mitigated. Furthermore, this option includes a 2 nm buffer, which provides controllers with additional warning and reaction time, should a non-participating aircraft enter the TMZ. Option 7(F) also provides a simplified TMZ airspace design which reduced complexity for both controllers and pilots.

With regards to environmental factors, due to the small scale of the proposed TMZ, even when the 2 nm buffer is considered, any re-routing required by aircraft (without a transponder and not in communication with ATC) is expected to be minimal, resulting in minimal additional noise, greenhouse gas, fuel burn, access and economic impacts. The larger area of the TMZ may result in more aircraft needing to re-route to avoid the area. This may have an increase in the impact of noise and greenhouse gas emission over the previous option. Although the impact of noise on communities is likely to be slightly higher due to more aircraft needing to re-route, the impact will be distributed over a greater area so the change is not considered to be significant. More aircraft may overfly the Cairngorms National Park if re-routing to the south. There is likely to be an increase in track miles, and therefore greenhouse gas emissions and increased cost, due to the larger area to avoid compared to Option 7(E), but this is not expected to be significant. The development consent process for the wind farm development included a detailed Environmental Impact Assessment (EIA) which assessed the significant environmental effects of the development. This included a carbon assessment which showed that the development is carbon positive for approximately 27.5 years of its 30 year lifetime, a factor which was balanced against the environmental effects when Scottish Ministers consented the project. This must be considered in balance against the minimal environmental impacts of displaced air traffic. Furthermore, there is expected to be no or very little additional costs for commercial airlines, GA and ANSPs as a direct result of this option. There may be a minor cost associated with controller training and that a cost shall be incurred for the staffing and management of the TMZ, however, this cannot be quantified at this time. It must also be noted that the development and construction costs of the wind farm itself are outside the scope of the CAP 1616 process and as such have not been considered.

The Change Sponsor considers Option 7(F) to be the preferred option to achieve the objectives of this ACP as the inclusion of the 2 nm buffer enhances safety. The introduction of a 2 nm buffer is intended to give ATC some warning (and time to react) between a non-transponder

equipped aircraft infringing the TMZ and it disappearing from the radar screen. Furthermore, a 2 nm buffer would allow the PSR sufficient processing time to re-establish a target/plot once an aircraft has exited the RAG (blanked) area.

Group	Impact	Qualitative Assessment
Communities	Noise impact on health and quality of life	Like the Do Nothing scenario, due to the limited population density within the vicinity of the wind farm development, there is expected to be a very limited impact by a small number of light aircraft (which are not equipped with a transponder or in communication with ATC) re-routing around the proposed TMZ, simply because of the minimal number of people within the area. However, it is acknowledged that aircraft may be concentrated around the periphery of the TMZ and not be as widely dispersed as they are in the baseline scenario, especially if they are not equipped with a transponder or are not in communication with ATC. As previously stated, it is estimated that, on average, only 8 aircraft per day will be flying in the vicinity of the TMZ without a transponder fitted; not all of these would have planned to route through the TMZ so would not be required to re-route. In addition, some of these aircraft may be fitted with radio equipment and would be able to gain clearance through the TMZ from the Controlling Authority. The conclusion from this is that the low traffic levels in the vicinity of the proposed Clash Gour Wind Farm would not produce adverse noise levels above those levels which DfT policy considers to be the point at which the adverse effects of noise on health and wellbeing begin to be seen on a community basis, as a result of implementing this option.
	Air Quality	This airspace solution is unlikely to result in more aircraft flying over the area, or at lower altitudes, than the baseline scenario. Like the Do Nothing scenario, to avoid nearby terrain/existing turbines and the proposed turbines, it is likely that any aircraft that overfly the area within the vicinity of the proposed wind farm would be above 1,000 ft. Therefore, as per CAP 1616, Appendix B, Para B74, there is unlikely to be an impact on local air quality due to the effects of mixing and dispersion. In addition, any aircraft flying within the proposed TMZ or those required to re-route to avoid the turbines would not overfly an AQMA. There will be no change in Air Quality over the baseline scenario with this option.

Wider Society	Greenhouse Gas impact	As part of this option, it is acknowledged that some light aircraft may have to re-route around the proposed wind farm in this scenario. Within this option, re-routing would likely only be required by a very small percentage of aircraft, estimated to be a maximum of 8 aircraft per day on average, who do not have a transponder or who are not in communication with ATC. As a result, the majority of aircraft should not require a re-route, but it is noted that a small percentage may do so, which will lead to increased track mileage and therefore increased greenhouse gas emissions. However, due to the small scale of the proposed TMZ this is expected to be minimal, even when the 2 nm buffer is considered, when compared to the baseline scenario. For example, an aircraft routing from Aberdeen Airport to Inverness Airport could travel as little as an additional 1 nm to avoid the TMZ plus buffer zone. It is also worth noting that a detailed Environmental Impact Assessment (EIA) has been carried out on the development as a whole as part of the development consent process. The EIA concluded that the overall development would be carbon positive, which should be considered, in balance against any adverse greenhouse gas emissions caused by the re-routing of aircraft.
	Capacity and resilience	The introduction of a TMZ is not expected to have any impact on capacity and resilience due to the small scale of the change and nature of operations in the vicinity.
	Tranquillity	Like the baseline scenario, the location of the wind farm (and proposed TMZ) is out with the boundaries of any NSA or NP. Due to the small scale of the proposed TMZ, any aircraft that may have to route around it would unlikely overfly an NSA but may overfly the northern extent of the Cairngorms National Park. However, as there are no restrictions on aircraft flying over the National Park and some aircraft may already overfly this area. In addition, the topography of the local area is more likely to result in aircraft re-routing to the north of the TMZ, rather than over the higher ground that forms part of the National Park. Therefore, the impact of this option on Tranquillity is very limited and not expected to be significantly different to the Do Nothing scenario.

	Biodiversity	<p>It is acknowledged that the development of the proposed wind farm may have an impact on biodiversity, when assessed as a stand-alone airspace solution, this option would have a minimal impact on biodiversity. Although the wind farm is located in close proximity to the Moidach More Special Conservation Area (SAC), any impacts of aircraft overflying this designated area are expected to be minimal. The rationale being that this particular designation specifically refers to the conservation of an area of blanket bog, which is subject to negative pressures such as burning or water management issues. As the Moidach More SAC specifically refers to a ground-based eco-system, this ACP is expected to be a very minimal impact as the effects of fuel dispersion and mixing above 1,000ft are unlikely to cause an impact on local air quality in this area. No Special Protection Areas (SPAs) or European Protected species are expected to be adversely impacted by this option.</p> <p>Any impact on biodiversity as a result of the development of the wind farm itself is subject to development consent and is outside the scope of the CAP 1616 process.</p>
General Aviation	Access	<p>The change sponsor acknowledges that the implementation of a TMZ will have a minor impact on airspace access for some GA users. This is applicable to those GA aircraft that are not equipped with a transponder and are not in communication with ATC. As detailed in paragraph above, this is estimated to be a maximum of 8 aircraft per day on average. For these aircraft a route around the proposed TMZ would be required, however, given the size and scale of this option, any re-routing is expected to be minimal. It is noted that additional re-routing may be required as part of this option to completely avoid the TMZ, including the 2 NM buffer. For those aircraft equipped with a transponder and/or in communication with ATC, this option should have a very limited impact and will not hinder their level of airspace access. Based on traffic analysis conducted by the change sponsor, at this stage, it is not believed that this option would significantly alter the traffic levels within the area.</p>
General Aviation / commercial airlines	Economic impact from increased effective capacity	<p>As specified in the Statement of Need, this ACP is aimed at mitigating the impacts of the proposed Clash Gour wind farm. Therefore, there will be no change to the number of air traffic movements in the area as a direct result of this ACP, this is reflected in the baseline scenario. For those aircraft that are not equipped with a transponder or in communication with ATC, a minor re-route may be required which may lead to a minor additional fuel cost, but due to the scale of the proposed TMZ this is expected to be very minor although it is acknowledged that complete avoidance of the TMZ, including the 2 nm buffer would incur additional minor cost. It should be noted that all commercial aircraft are fitted with transponders and as such there should be no impact on commercial traffic.</p>

	Fuel burn	The change sponsor acknowledges that the introduction of a TMZ would require some aircraft (those without a transponder and not in communication with ATC) to re-route around the TMZ, causing increased track mileage and fuel burn. However, due to the scale of the proposed TMZ, this re-route is expected to be minimal and is mainly only applicable to those aircraft which do not meet the requirements to fly within the TMZ. The complete avoidance of the additional 2 nm would add further track mileage and fuel burn, but again, this is expected to be minimal due to the scale of the proposed TMZ. The number of aircraft impacted are anticipated to be small. It should be noted that all commercial aircraft are fitted with transponders and as such there should be no impact on commercial traffic.
Commercial airlines	Training costs	There is no anticipated training cost to commercial airlines as a result of this option, especially as there is a limited amount of commercial traffic within the vicinity of the proposed wind farm. In addition, all commercial aircraft are fitted with a transponder, therefore, there is no adverse impact on this group of airspace users.
	Other costs	There are no anticipated additional costs to commercial airlines associated with this option.
Airport / Air navigation service provider	Infrastructure costs	There is expected to be a possible small cost associated with software updates to accommodate for the RAG blanking and the establishment of the TMZ but these are expected to be minor.
	Operational cost	Any cost incurred by the controlling authority associated with the staffing and management of the proposed TMZ would be subject to commercial negotiations and likely a Letter of Agreement. At this stage of the CAP 1616 process, it is unclear how much this cost is likely to be but shall be investigated in subsequent stages of the process.
	Deployment costs	There may be a small amount of additional controller training associated with the management of the TMZ, however, this is expected to be minimal and are likely to be covered by the Change Sponsor in forming the agreements required to discharge the planning conditions.

	<p>Safety</p>	<p>The management and integration of GA traffic (including gliders) is a potential hazard associated with this option as GA aircraft may be required to route around the proposed TMZ, which may cause ‘choke points’, however, this is mitigated by airspace design constraints and tactical management of traffic by ATC. To avoid the development of ‘choke points’ and need for tactical management, there will be clear designation and promulgation of the TMZ within the UK AIP. It is acknowledged that any tactical management may cause a slight increase in controller workload, however, due to the low traffic flows of light aircraft within the area, this is expected to be minimal. In the case of this option, an additional mitigation is the 2 nm buffer which will give the controller additional warning of an unauthorised aircraft entering the TMZ. Furthermore, within Class G airspace, the pilot is ultimately responsible for collision avoidance. It is recognised that adverse weather conditions may hamper a pilot’s ability to maintain visual separation with the turbines. This is mitigated through the effective use of flight planning by pilots. Furthermore, loss of communication with non-transponding aircraft is acknowledged but is an existing hazard which is not impacted by the establishment of a TMZ, especially within Class G airspace. The size and shape of this proposed option is simpler than some others meaning it is easier for both pilots and controllers to interpret/manage. A potential loss of the TMZ boundary (as displayed on the controllers display) is also acknowledged, however this is an unlikely failure mode which may have more serious consequences for factors that do not relate to the establishment of TMZ and as such is an existing hazard, which can be mitigated procedurally.</p>
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