

Coille Beith Wind Farm

Technical Appendix 4.5: Aviation Lighting Impact Assessment

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1. Introduction

- 1.1.1 The lighting of wind turbines is a developing issue. It is evident that the onshore renewables industry is committed to finding a long-term solution to minimising effects arising from visible aviation lighting, potentially through the introduction of radar or transponder activated lighting systems, or other advanced technological solutions. However, in the meantime recent trend towards taller turbine proposals (i.e. with turbines with a maximum tip height 150 m or greater) necessitates the preparation of a suitable proportionate assessment of potential significant landscape and visual effects, especially where developments are located in remote rural locations where there are few artificial light sources and where darkness is an integral and valued aspect of the night landscape.
- 1.1.2 Daytime visualisations have been provided for all viewpoints. Three representative visualisations have been provided to illustrate the effects of the reduced intensity aviation lighting on the Proposed Development during the hours of darkness for Viewpoints 7, 8, and 9 (see **Figures 4.19h, 4.20h, and 4.21h** (EIA Report Volume 3b)). Turbines to be lit are highlighted in blue and numbered in the night photography wirelines (see **Figures 4.19i, 4.20i, and 4.21i** (EIA Report Volume 3b)). These turbines are shown lit in the photomontages during the hours of darkness.

2. Regulatory Requirements

- 2.1.1 Article 222 (1) of the Civil Aviation Authority's (CAA) Air Navigation Order 2016 and Regulations (ANO) states an: *"en-route obstacle" means any building, structure or erection, the height of which is 150 metres or more above ground level, but it does not include a building, structure or erection:*
- *which is in the vicinity of a licensed aerodrome; and*
 - *to which section 47 of the Civil Aviation Act 1982 (warning of presence of obstructions near licensed aerodromes) applies."*
- 2.1.2 These provisions mean that structures of 150 m or more in the United Kingdom are routinely lit with medium intensity (2,000 candela) steady red lights.
- 2.1.3 ANO Article 222 also contains provisions allowing for exemptions from its lighting requirements. Article 222 (6) provides that: *"A permission may be granted for the purposes of this article for a particular case or class of cases or generally."*
- 2.1.4 While Article 222 (7) states: *"This article does not apply to any en-route obstacle for which the CAA has granted a permission to the person in charge permitting that person not to fit and display lights in accordance with this article."*
- 2.1.5 The Proposed Developments turbines would have a maximum blade tip height of up to 200 m above ground level. Therefore, they would normally be subject to the lighting requirements set out in Article 222 (1). However, the provisions in the CAA Policy Statement that the intermediate-level lights are only required to be low intensity (32 candela) and that the intensity of the 2,000 candela light may be reduced to 10% of its peak intensity, *"if the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km."*
- 2.1.6 The technical specifications for medium intensity obstacle lights are set out in International Civil Aviation Organisation (ICAO) Code - Annex 14 Table 6-3 and, for European Union Aviation Safety Agency (EASA) member states such as the UK, in Table Q-3 of CS-ADR-DSN. The ICAO and EASA specifications are identical.
- 2.1.7 The ICAO and EASA specifications for lighting do not use the term "minimum peak intensity" set out in paragraph 4.g. of the CAA Policy Statement. The required and recommended intensity settings for 2,000 candela lights are illustrated in **Figure 4.5.1** and summarised as follows:
- Minimum average intensity between 0 and -3 degrees is 2,000 candela;
 - Between 0 and -1 degrees intensity would reduce from 2,000 to 750 candela;
 - Between -1 and -2 degrees intensity would reduce to from 750 to 80 candela;
 - Between -2 and -3 degrees intensity would reduce from 80 to 40 candela; and
 - Between -3 and -4 degrees intensity would reduce from 40 to 0 candela.
- 2.1.8 The implications of this for visibility of the lights from key viewpoints is that, depending upon the angle of receptors relative to the turbine lights, the intensity of light will vary, along with its perceived brightness. For example, for a light with a maximum intensity of 2,000 candela, views from below -3 degrees would see the light source as below 40 candela, a considerable reduction in perceived brightness from the maximum intensity, and if receptors view the light from below -4 degrees there would, theoretically be no

direct view of the light. However, depending upon the specification and design of the light, some light reflection off the back of turbine blades may be discernible.

- 2.1.9 In conditions where horizontal meteorological visibility exceeds a 5 km radius from the position of the light significant reductions in light intensity would be experienced, as lighting intensity would be reduced to 10% of the maximum intensity, as summarised below.
- Minimum average intensity at 10% between 0 and -3 degrees would be 200 candela;
 - Between 0 and -1 degrees intensity would reduce from 200 to 75 candela;
 - Between -1 and -2 degrees intensity would reduce to from 75 to 8 candela;
 - Between -2 and -3 degrees intensity would reduce from 8 to 4 candela; and
 - Between -3 and -4 degrees intensity would reduce from 4 to 0 candela.
- 2.1.10 Consequently, receptors located over 5 km from the turbines would only ever experience clear visibility to lights at these reduced intensities. In conditions of meteorological visibility less than 5 km the perceived brightness of turbine lights, whilst possibly still visible, are likely to be reduced by such conditions. Additionally, when combined with local sources of light (including internal and /or external lighting and car lights) such as those present along the A837 corridor and in the settled landscape to the east, approaching the coast, the impact of the turbine lighting on such distant receptor locations may decrease to slight or even negligible magnitude.

3. Assessment Methodology

3.1 Guidance

- 3.1.1 The following assessment takes cognisance of NatureScot's Guidance on Aviation Lighting Impact Assessment and is consistent with the broader LVIA methodology provided in **Chapter 4** (EIA Report Volume 2). In accordance with NatureScot's guidance, the assessment comprises the following steps:
- Step 1: A definition of the lighting proposals for the Proposed Development;
 - Step 2: A description of the baseline landscape and visual context; and
 - Step 3: An assessment of the effect of Proposed Development's aviation lighting on the landscape and visual resource.

3.2 Step 1: Lighting Proposals

Lighting Proposals

- 3.2.1 From a CAA perspective the Proposed Development is sited outside controlled airspace and away from airports and airfields. As a result, it will be assessed against visible lighting in accordance with Class G 'en-route' airspace requirements as detailed in CAP 764 (latest draft). The following factors have been taken into account:
- To accommodate Ministry of Defence (MOD) requirements the Site will be assessed for Night Vision Goggles (NVG) compatible lighting in accordance with MOD published obstruction lighting specifications.
 - Where possible the recommended final lighting configuration will be optimised to reduce light impact on the local area.
 - CAA obstruction lighting dispensations that are currently offered where flight safety can be maintained will be included.
- 3.2.2 In accordance with the CAP 764 (draft) conditions, the CAA requires:
- That all perimeter turbines be lit unless removing a light will leave a gap of less than 900 m total between the remaining lit turbines.
 - That any turbine within 200 m of a 'string perimeter' be lit unless the distance between adjacent turbines is less than 900 m total. Additional spacing dispensation is sometimes available for the above criteria.
 - That any unlit turbine does not exceed a 10° up-slope from adjacent lit turbines.
 - No turbine shall be more than 1,800 m (1 Nautical Miles (nm)) from a lit turbine.
- 3.2.3 Applying these criteria dictates that ten of the Proposed Development turbines would require ANO visible red lighting. However, as stated in **Chapter 11** (EIA Report Volume 2) a reduced lighting scheme has been designed resulting in only three visible steady red lights being required for the Proposed Development (turbines 2, 7 and 11). This has been agreed by the CAA as per **Chapter 11** (EIA Report Volume 2).

- 3.2.4 Aviation lights would be fitted on the nacelles of the selected turbines and would be located at around 114 m above ground level.
- 3.2.5 Whilst all 11 of the Proposed Development's turbines would require infrared lights to meet the MoD requirements such lighting is not visible to the naked eye and has therefore not been considered further in this assessment.

Mitigation

- 3.2.6 There are principally five current sources of potential mitigation in respect of aviation lighting on turbines, comprising four technological (in addition to one inherent) which have been introduced and accepted to varying degrees by aviation authorities in countries around the world (including by the United States Federal Aviation Authority ('FAA'), German Federal Aviation Office ('LBA'), and the Netherlands Aerospace Centre ('NAC')):
- The reduction in lighting intensity during periods of meteorological visibility in excess of 5 km (as discussed previously).
 - The inherent reduction in apparent light intensity from source and size of light when viewed over distance.
 - The reduction in lighting intensity for receptors at different elevations relative to source, as a result of design of the lights.
 - The design of the lights to avoid illumination of turbine nacelles, towers, and blades.
 - The lighting of only certain turbines along the perimeter of the wind farm, thereby limiting the number of lights visible at any given location, as outlined previously.
 - Use of a transponder or radar activated lighting solution. Such a system would mean that lights would only be activated by 'nearby' aircraft and could therefore only be on for a small proportion of time.

Reduced Lighting Intensity Over Distance

- 3.2.7 As observed during field reconnaissance, the perceived brightness and size of the light source, as experienced at different locations, will vary according to distance and atmospheric conditions. The intensity and brightness of the visible light, whilst constant in actuality, reduces as distance increases, due primarily to a reduction in the size of the lights surface and light energy reaching receptors. Clearly, any water droplets or air borne particles compounds this effect, partially or entirely obscuring the light source.

Reduced Lighting Intensity by Relative Elevation

- 3.2.8 **Figure 4.5.1** illustrates the intensity of turbine lights at different locations across the LVIA Study Area taking account of the angle at which they are seen from receptor locations. It is apparent from this figure that the greatest intensity and brightness experienced would occur at elevated locations which are infrequently visited after dark, whilst considerable reductions in intensity and brightness would be witnessed from low lying locations close by to the turbines, at primary visual receptor locations.

Lighting Design

- 3.2.9 The degree of mitigation achieved through careful design of lights is crucial. Lights on the side of towers can be designed to minimise illumination of the tower, however its assumed these are not required for the Proposed Development. Similarly, the incorporation of light caps and collars can restrict up-lighting effects and the degree of downlighting and illumination of the nacelle of the turbine. In the case of the Proposed Development these are not required given the location of the proposed turbines.

Radar/Transponder Activated Lights

- 3.2.10 There is some uncertainty as to the availability and practicality of using radar/transponder activation at the Proposed Development. Further examination/consideration of the frequency and duration of any lighting activation may be needed in order to better understand the likely effects of radar/transponder activated lights. Depending upon the frequency and regularity of light activation this could prove more intrusive than lights that are on constantly during the hours of darkness. For avoidance of doubt, the current assessment has assumed no radar activation.

3.3 Step 2: Baseline Context

Landscape Character

- 3.3.1 **Technical Appendix 4.2** (EIA Report Volume 4) describes the landscape character types (LCTs) considered elsewhere in the LVIA and describes the sensitivity of each landscape to the type of development proposed. **Figure 4.3** (EIA Report Volume 3a) shows the location the LCTs.

- 3.3.2 It is noted that NatureScot's character descriptions¹ do not discuss night character. Whilst a number of landscape characteristics may be evident during periods of low ambient light levels (including dusk), it is also the case that perceived brightness of turbine lights would be lessened during such times of day, the greatest potential for significant effects would occur after dark. Of the 'daytime' characteristics described it is the predominance of wild and remote characteristics that are of the most relevance, especially in respect of elevated uplands, including:
- LCT135: Rounded Hills – Caithness and Sutherland (in which the consented Strath Oykel wind farm will, if constructed, introduce a prominent artificial light source to this landscape);
 - LCT139: Rugged Mountain Massif – Caithness and Sutherland;
 - LCT328: Rugged Mountain Massif;
 - LCT329: Rounded Mountain Massif;
 - LCT330: Rounded Hills and Moorland Slopes – Ross and Cromarty; and
 - LCT332: High Rocky Moorland and Plateau – Ross and Cromarty
- 3.3.3 These landscapes are essentially dark, largely uninhabited, and relatively difficult to access with limited incidence of artificial lighting with the exception of some scattered farmsteads and dwellings on lower slopes adjoining straths, lochs, and farmed landscapes and/or where roads bisect these LCTs.
- 3.3.4 Key receptors within these LCTs comprise hill walkers, a small number of which may camp overnight at summits and value the dark and remote nature of such locations.
- 3.3.5 In contrast to the preceding elevated landscapes, LCT142: Strath – Caithness and Sutherland is a lower lying incised landscape comprising fairly straight deeply incised troughs to more winding valleys with a number of minor side glens where highly scenic backdrop of mountains is often revealed in some of the upper reaches of these straths. This landscape is associated with an increased level of settlement, including hamlets, small farms, and crofts located on the floor and lower strath sides and on the broader and more fertile parts of the straths which are connected by a network of public highways and tracks. Despite the degree of habitation, there is limited incidence of artificial lighting. However, interior and external lighting at dwellings and the movement of vehicles on roads such as the A837 form notable interruptions to the otherwise dark appearance of the LCT. Such existing light sources are low-lying in the strath, with prominent strath edges and skylines being essentially dark. However, the recently consented Strath Oykel turbines (8 of which will be lit) will be visible on the skyline from parts of this LCT.

Landscape Designations and Classifications

National Scenic Area (NSA) 36: Assynt – Coigach

- 3.3.6 **Technical Appendix 4.2** (EIA Report Volume 4) lists the special qualities of the NSA based on NatureScot's 'Special qualities of the National Scenic Areas: NatureScot Commissioned report No. 374'² Of the qualities described, the most relevant to the Aviation Lighting Impact Assessment is the NSAs significant tracts of wild land which is characterised by:
- A largely uninhabited inland;
 - Large areas without roads or tracks, with access inland only possible on foot; and
 - The absence of modern artefacts, or overt human activity, over much of the landscape emphasises the feelings of openness, remoteness, and wildness.
- 3.3.7 These special qualities point to an essentially dark landscape where artificial light sources are rare. However, views of aviation lights on the consented Strath Oykel array will occur once this wind farm is constructed. Such visibility would be distant and concentrated on elevated sections of the NSA with the consequence that the dark night character of the NSA will remain largely unchanged.
- Special Landscape Area (SLA) 18: Fannichs, Beinn Dearg and Glen Calvie*
- 3.3.8 **Technical Appendix 4.2** (EIA Report Volume 4) lists the special qualities of the SLA based on The Highland Councils (THC) 'Assessment of Highland Special Landscape Areas'.³ Of the qualities described, the most relevant to the Aviation Lighting Impact Assessment include:

¹NatureScot (2019) Scottish Landscape Character Assessment. Available at <https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions> (last accessed 11th May 2025).

²Scottish Natural Heritage (2010). The Special Qualities of the National Scenic Areas. SNH Commissioned Report No. 374. Available at <https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/national-designations/national-scenic-areas/special-landscape-qualities> (last accessed 11th May 2025).

³ The Highland Council in Partnership with Scottish Natural Heritage (2011) Commissioned Horner + MacLennan. Assessment of Highland Special Landscape Areas Available at https://www.highland.gov.uk/downloads/file/2937/assessment_of_highland_special_landscape_areas (last accessed 11th May 2025).

- The wide extent of the mountain ranges, limited access routes, rough ground and uninhabited character combine to create a great sense of wildness within an expansive, mountain vastness; and
- Small areas of clear human habitation, vast areas where there is none. The majority of human interaction within the landscape is centred around the River Broom in Strath More, at the western extents of the SLA.

3.3.9 These special qualities point to a largely dark landscape where artificial light sources are rare. However, views of settlement around the River Broom and Strath More interrupt this quality. Similarly, aviation lighting on the consented Strath Oykel wind farm, once installed, will establish a new light source in views from elevated locations within the SLA.

Wild Land Area (WLA) 29: Rhiddoroch – Beinn Dearg – Ben Wyvis

3.3.10 **Technical Appendix 4.6** (EIA Report, Volume 4) lists the wild land qualities of this WLA (based on NatureScot's descriptions⁴). Of the qualities described, the most relevant to the aviation lighting impact assessment are the WLAs very large interior with a strong sense of remoteness, sanctuary, solitude, and isolation.

3.3.11 Whilst the WLA description provided by NatureScot does not make reference to night characteristics, it is acknowledged that the essentially dark condition of this WLA at night and general absence of artificial light sources contributes to its perceived wildness. However, once constructed, the consented Strath Oykel wind farm will introduce prominent sources of artificial light close to the northeastern boundary of the WLA with consequent effects on the perceived remoteness of the WLA and its essentially undeveloped context.

Visual Amenity

3.3.12 The principal receptors and sources of artificial light within the landscape include residents of dwellings as well as road users.

3.3.13 The main residential receptors in the Study Area are located within Strath Oykel and the Kyle of Sutherland, which comprise:

- **Rosehall:** A hamlet/small village comprising detached and semi-detached properties that are associated with a number of artificial light sources including interior lighting, street lighting and vehicle lights along the A837 and in Cassley Drive, on the floor of Strath Oykel.
- **Properties between Achintoul and Altass:** Comprising scattered detached dwellings aligned along a minor access road that runs east – west parallel to the A837. Artificial lighting sources associated with these properties include internal domestic lighting and vehicle lighting on the access road. Lighting associated with properties south of the Kyle of Sutherland (including those of Achnahanat) are evident from this location.
- **Achnahanat:** Which comprises a series of scattered dwellings and small farms located on the low lying farmlands on the southern side of the Kyle of Sutherland. Artificial light sources in this location are associated within internal lighting and vehicles on the minor access road that connects to the properties. Lighting associated with properties north of the Kyle of Sutherland (including those of Achintoul and Altass) are evident from this location.
- **Properties between Oykel Bridge and the River Einig:** Comprising a series of semi-detached one and two storey properties set within an incised glen and which are associated with internal lighting and vehicle lighting on the local access road. Few other sources of light are evident in views from these properties.
- **Doune and Brae:** Comprises a series of scattered dwellings and small farms located on the low lying farmlands on the southern side of the Kyle of Sutherland. Artificial light sources in this location are associated within internal lighting and vehicles on the minor access road that connects to the properties. Lighting associated with a small number of properties north of Strath Oykel and vehicles on the A837 are evident from these properties.

3.3.14 The perception of both receptor and light sources is conditioned, in part, by whether dwellings have internal blinds or curtains (effectively screening views out from the property and views of internal lights) and whether there are any external lights at properties or settlements.

3.3.15 The prominence of the lighting associated with settlements dwellings can be exacerbated by its contrast with the otherwise essentially dark context in which they are viewed, especially where they are backclothed by darkened landforms of the straths in which they are located.

⁴ NatureScot (2020) Assessing the Impacts on Wild Land Area – Technical Guidance. Available at: <https://www.nature.scot/doc/assessing-impacts-wild-land-areas-technical-guidance>. Available at (last accessed 11th May 2025).

- 3.3.16 Key roads that are both receptor locations and sources of artificial light after dark comprise:
- **The A837:** An unlit road travelling along the base of Strath Oykel and the northern side of the Kyle of Sutherland, which is essentially dark save for occasional lighting at scattered dwellings in the strath and along the side of the Kyle of Sutherland.
 - **The A836:** A largely unlit road travelling along the base of Glen Shin and the Kyle of Sutherland, but subject to the intermittent influence of lighting associated with settlements along its length.
 - Minor local access roads, which are unlit and generally dark, but subject to the intermittent influence of lighting at scattered properties and from vehicles on other nearby roads.
- 3.3.17 Vehicles moving on roads can form prominent and intrusive features in what is otherwise a largely dark strath landscape but are low-lying and intermittent sources of impact.
- 3.3.18 The experience of the night landscape and views from vehicles is affected by dashboard lights and headlight beams, thereby lessening the perceived darkness of the adjacent landscape. The perception of road users is also transitory, and of limited duration in comparison to that of residents of dwellings.
- 3.3.19 Much of the Study Area comprises remote uplands. These areas are typically devoid of artificial lighting. However, the number and frequency of visual receptors' present on elevated summits is likely to be relatively low and generally restricted to small number of wild campers.

4. Visibility and Intensity of Lights

- 4.1.1 According to the analysis presented in **Figure 4.5.1** the greatest theoretical light intensity and perceived brightness would be experienced at a number of elevated locations, including:
- The Cul Mor summit (Viewpoint 1) which is around 27 km to the northwest of the Proposed Development and is located at an elevation of 849 m AOD (Ref. **Figure 4.13e**, EIA Report Volume 3b).
 - The Canisp summit (Viewpoint 2) which is around 28 km to the northwest of the Proposed Development at an elevation of 847 m AOD (Ref. **Figure 4.14e**, EIA Report Volume 3b).
 - Ben Mor Asynt (Viewpoint 3) which is located around 23 km northwest of the Proposed Development at an elevation of 998 m AOD (Ref. **Figure 4.15e**, EIA Report Volume 3b).
 - Glas Mheall Mor summit (Viewpoint 4) which is 34 km to the southwest of the Proposed Development at an elevation of 979 m AOD (Ref. **Figure 4.16e**, EIA Report Volume 3b).
 - Bodach Moor (Viewpoints 5) which is located approximately 9 km southwest of the Proposed Development at an elevation of 821 m AOD (Ref. **Figure 4.17e**, EIA Report Volume 3b).
 - Carn Salaceidh (Viewpoint 6) which is 13.5 km to the southeast of the Proposed Development at an elevation of 647 m AOD (Ref. **Figure 4.18e**, EIA Report Volume 3b).
 - The summit of Ben Wyvis (Viewpoint 12), which is located around 29 km to the southeast of the Proposed Development at an elevation of 1,046 m AOD (Ref. **Figure 4.24e**, EIA Report Volume 3b).
 - Diebdale Ridge (Viewpoint 13) which is 13.5 km to the south of the Proposed Development at an elevation of 686 m AOD (Ref. **Figure 4.25e**, EIA Report Volume 3b).
 - The summit of Beinn Eoin (Viewpoint 14), which is located around 9.5 km to the north of the Proposed Development at an elevation of 544 m AOD (Ref. **Figure 4.26e**, EIA Report Volume 3b).
 - Ben Kilbreck (Viewpoint 18) which is 34.5 km to the northeast of the Proposed Development at an elevation of 961 m AOD (Ref. **Figure 4.30e**, EIA Report Volume 3b).
 - The Creag Mhor summit (Viewpoint 19) which is 36 km to the northeast of the Proposed Development at an elevation of 713 m AOD (Ref. **Figure 4.31e**, EIA Report Volume 3b).
 - The summit of Carn a Choin Dearg (Viewpoint 23) which is located around 5 km to the south of the Proposed Development at an elevation of 695 m AOD (Ref. **Figure 4.35e**, EIA Report Volume 3b).
- 4.1.2 The majority of these locations are over 5 km from the Proposed Development and so the maximum intensity of light that would be experienced in clear meteorological conditions would be 200 candela. Moreover, a large proportion of these viewpoints are over 20 km from the Proposed Development and therefore subject to further mitigation due to distance; distant aviation lights appear as small points of light within what are generally expansive views. It is also the case that these receptor locations are infrequently visited after dark. Seen from such elevated locations, the Proposed Development may be seen in the context of the consented Strath Oykel wind farm which if constructed, would establish aviation lighting as a feature of the upland landscape immediately adjacent to the Proposed Development. In this context the Proposed Developments lighting would not represent a wholly new feature in the night landscape.

- 4.1.3 Lower lying positions, in contrast, would be subject to limited or no views of turbine lights and lower degrees of brightness and intensity, turbine lights often being obscured by intervening topography and/or vegetation. Views from such low-lying positions are illustrated at:
- Oykel Bridge (Viewpoint 7) which is 2.7 km to the northwest of the Proposed Development at an elevation of 35 m AOD (Ref. **Figures 4.19e - 4.19h**, EIA Report Volume 3b).
 - The A837 Strath Oykel (Viewpoint 8) which is around 4 km northeast of the Proposed Development at an elevation of 12 m AOD (Ref. **Figures 4.20e - 4.20h**, EIA Report Volume 3b).
 - The A837, Kyle of Sutherland (Viewpoint 9) which is around 7 km southeast of the Proposed Development at an elevation of 12 m AOD (Ref. **Figure 4.21h** and **Figure 4.21g**, EIA Report Volume 3b).
 - The track west of Strath Cuileannach (Viewpoint 15) which is 2.5 km west of the Proposed Development at an elevation of 183 m AOD (Ref. **Figure 4.27e**, EIA Report Volume 3b).
 - Strath Cuileannach (Viewpoint 16) which is 2 km to the south of the Proposed Development at an elevation of 138 m AOD (Ref. **Figure 4.28e**, EIA Report Volume 3b).
 - The Oykel Bridge to Glen Einig footpath (Viewpoint 20) which is 2 km to the northwest of the Proposed Development at an elevation of 32 m AOD (Ref. **Figure 4.32e**, EIA Report Volume 3b).
- 4.1.4 Much of the coast and interior of straths and glens where settlement and transportation routes occur would not be affected by the Proposed Developments turbine lighting due to the screening effect of intervening topography and/or vegetation, as evidenced by Viewpoint 22 (Ref. **Figure 4.34f**, EIA Report Volume 3b).
- 4.1.5 Where turbine lights are visible, they would often be seen in conjunction with the lights on the adjacent consented Strath Oykel wind farm such as is the case at Viewpoints 7, 8, 9, and 11.

5. Aviation Lighting Effects on Landscape and Visual Resource

5.1 Effects on Landscape Character

- 5.1.1 A large proportion of the lighting effects arising from the Proposed Development would occur at elevated locations within:
- LCT135: Rounded Hills – Caithness and Sutherland;
 - LCT139: Rugged Mountain Massif – Caithness and Sutherland;
 - LCT328: Rugged Mountain Massif;
 - LCT329: Rounded Mountain Massif;
 - LCT330: Rounded Hills and Moorland Slopes – Ross and Cromarty; and
 - LCT332: High Rocky Moorland and Plateau – Ross and Cromarty.
- 5.1.2 Such locations are typically devoid of artificial lighting. However, the number and frequency of receptors present on elevated summits is likely to be relatively low and generally restricted to a small number of wild campers. Viewed from these uplands, the Proposed Developments lights would be viewed distantly and may be seen in the context of the consented Strath Oykel wind farm. It is also the case that the majority of the key characteristic elements of these landscapes would not be apparent after dark, with the exception of the relative wildness or perceived remoteness of these landscapes. In the absence of the consented Strath Oykel array, which would establish lighting as a characteristic element, the Proposed Development would represent a new feature of the night landscape. The lighting would, however, not constitute a significant effect on the relative wildness or perceived remoteness of these landscapes.
- 5.1.3 Lower-lying and incised landscapes would be entirely screened from the Proposed Developments lights and would therefore be unaffected. However, localised views of a number of the Proposed Developments lights would be provided from LCT142: Strath – Caithness and Sutherland. Where visible, the lights would be of reduced perceived brightness due to the angle at which the lights would be seen. Notwithstanding this, localised significant effects are anticipated on sections of the strath where the introduction of new elevated light sources would interrupt the generally dark horizon in the LCT. This includes locations at:
- Oykel Bridge (Viewpoint 7) - (Ref. **Figure 4.19e - 4.19h**, EIA Report Volume 3b).
 - The A837 Strath Oykel (Viewpoint 8) - (Ref. **Figure 4.20e - 4.20h**, EIA Report Volume 3b).
 - The A837, Kyle of Sutherland (Viewpoint 9) - (Ref. **Figure 4.21h** and **Figure 4.21g**, EIA Report Volume 3b).

- Strath Cuileannach (Viewpoint 16) - (Ref. **Figure 4.28e**, EIA Report Volume 3b).
- The Oykel Bridge to Glen Einig footpath (Viewpoint 20) - (Ref. **Figure 4.32e**, EIA Report Volume 3b).

5.2 Effects on Landscape Designations and Classifications

NSA 36: Assynt – Coigach

- 5.2.1 A comparison of **Figure 4.5.1** and **Figure 4.5** (EIA Report Volume 3a) indicates that views of the Proposed Developments lights would be provided from a small number of open summits in the NSA including Cul Mor (Viewpoint 1), Canisp (Viewpoint 2) and Ben More (Viewpoint 3) where they would constitute a **Moderate/Minor** effect (non-significant) effect on the night qualities of the NSA. However, given the limited extent of the designation affected, the distance at which the lights would be seen and the lit context within which they would be seen if the consented Strath Oykel wind farm is constructed, the effect on the openness, remoteness and wildness is not expected to be significant and the integrity of the designation would not be undermined.

SLA 18: Fannichs, Beinn Dearg and Glen Calvie

- 5.2.2 A comparison of **Figure 4.5.1** and **Figure 4.5** (EIA Report Volume 3a) indicates that views of the Proposed Developments lights would be provided from a small number of open summits in the SLA including Bodach Mor (Viewpoint 5)) and Carn a Choin Dearg (Viewpoint 23) where there is potential for localised significant effects (**Major/Moderate**) on the perceived remoteness and wildness within the SLA. Such effects would arise where the Proposed Development would introduce a prominent new light source to an essentially dark outlook.
- 5.2.3 However, given the localised nature of such effects and the largely unaffected majority of the SLA and the lit context within which they would be seen once the consented Strath Oykel wind farm is constructed, the effect on the relative wildness of the SLA is not expected to be significantly affected overall and the integrity of the designation would not be undermined.

WLA 29: Rhiddoroch – Beinn Dearg – Ben Wyvis

- 5.2.4 A comparison of **Figure 4.5.1** and **Figure 4.5** (EIA Report Volume 3a) indicates that views of the Proposed Developments lights would be provided from a number of open elevated locations in the WLA including:
- Bodach Mor (Viewpoint 5);
 - Carn Salachaidh (Viewpoint 6);
 - Ben Wyvis (Viewpoint 12);
 - Diebdale Ridge (Viewpoint 13);
 - Seana Braigh (Viewpoint 17); and
 - Carn a Choin Deirg (Viewpoint 23).
- 5.2.5 Significant effects (**Major/Moderate**) would be localised to a small number of summits within 10 km of the Proposed Development (e.g. Bodach Mor, and Carn a Choin Deirg) from where the Proposed Development would introduce prominent new lights, extending and intensifying light sources associated with the consented Strath Oykel wind farm.
- 5.2.6 However, given the small proportion of the WLA affected, the localised nature of such effects, the effect on the relative wildness of the WLA is not expected to be significantly affected overall and the integrity of the WLA would not be undermined.

5.3 Visual Effects

Settlement

- 5.3.1 The Study Area is relatively unpopulated with the exception of a limited number of small settlements and scattered properties that are located to the lower sides and base of Strath Oykel and the Kyle of Sutherland where visibility is often restricted by the screening effect of intervening topography and vegetation. Moreover, a large proportion of settlements and transportation networks would be unaffected by lighting on the Proposed Development, as indicated in **Figure 4.5.1**. Where lights are visible, they would appear elevated and of a reduced brightness and would be seen in conjunction with those of the consented Strath Oykel wind farm if this scheme is constructed. Notwithstanding this context, localised significant visual effects (**Major**) are anticipated at properties in the vicinity of Oykel Bridge near Viewpoint 7 (Ref. **Figure 4.19h and i**, EIA Report Volume 3b), in the vicinity of Rosehall (as indicated at Viewpoint 8 (Ref. **Figure 4.20h and i**, EIA Report Volume 3b).

Roads

- 5.3.2 The road network in the Study Area is concentrated within incised straths and along the sides of the coast where views of the Proposed Developments lighting would be restricted by the screening effect of intervening topography and vegetation. Consequently, a large proportion of the transportation network would be unaffected by the Proposed Development, as indicated in **Figure 4.5.1**. Where lights are visible, they would appear elevated and of a reduced brightness and would often be seen in conjunction with those of the consented Strath Oykel wind farm, should this scheme be constructed. Significant visual (**Major**) effects are anticipated to be limited to locations on the A837 in the vicinity of Oykel Bridge and in the proximity of Rosehall, as well as sections of the A837 in the Kyle of Sutherland.

Recreational Routes, Trails and Summits

- 5.3.3 In contrast with low-lying and enclosed settlements and transportation routes, there are numerous elevated summits that would provide open views of the Proposed Developments are typically devoid of artificial lighting. Viewed from these uplands, the Proposed Developments lights would generally be seen distantly and in may be seen in the context of lighting on the consented Strath Oykel turbines if this is constructed. Irrespective of such a developed context, significant visual effects (**Major or Major/Moderate**) are anticipated at the following summits:
- Bodach Mor (Viewpoint 5) – Major/Moderate;
 - Carn Salachaidh (Viewpoint 6) – Major/Moderate;
 - Beinn an Eoin (Viewpoint 14) – Major Moderate;
 - Seana Braigh (Viewpoint 17) – Major /Moderate; and
 - Carn a Choin Deirg (Viewpoint 23) - Major.

6. Conclusions on Lighting Effects without Further Mitigation

- 6.1.1 The issue of lighting effects is complex and highly nuanced. How the lights are experienced will depend upon a range of factors from weather and visibility conditions, receptor elevation and distance relative to the Proposed Development, and whether receptors are moving or static.
- 6.1.2 Lighting effects on landscape character and visual amenity are primarily concerned with effects on the darkness and remoteness of landscapes. The visibility of the lights at the Proposed Development would primarily affect elevated upland landscapes which are substantially unpopulated after dark. Such elevated locations are typically over 5 km from the Proposed Development and would therefore experience lighting intensity of up to 200 candela. Currently, the landscape context is essentially dark. However, lights on the consented Strath Oykel wind farm, if constructed would provide a lit context that could lessen the extent of significant effects on the character of the landscape that are attributed to the Proposed Development.
- 6.1.3 Views of the lights from lower lying incised landscapes would be substantially restricted by intervening topography and vegetation within these areas in the Study Area. Such landscapes also have a lesser degree of perceived remoteness, often containing existing light sources associated with scattered farmsteads and dwellings as well as the headlights and interiors of vehicles. Significant effects in these landscapes would be confined mainly to road users in vehicles on the minor roads within 5 km of the Proposed Development where the lights would form prominent elevated points of light and pronounced focal points in views. However, car dash-lights and headlights coupled with the transient nature of views from vehicles would lessen the magnitude of impacts arising from the turbine lights.
- 6.1.4 The effects previously presented, represent a reasonable 'worst-case' based on a reduced lighting scheme. Whilst there is potential to reduce such effects further through the use of radar or transponder activated lighting, such systems are currently subject to uncertainty.