

Appendix 5.5 Night Time Lighting Assessment

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Appendix 5.5 Night Time Lighting Assessment

Background

The UK Air Navigation Order (ANO) 2016, Article 222, sets out the statutory requirement for the lighting on en-route obstacles, which applies to structures 150m or more above ground level. This article has been translated into the Civil Aviation Authority's (CAA) Policy Statement on the lighting of onshore wind turbines (June 2017). For turbines of 150m height to tip or more, medium intensity (2000 candela) steady red warning lights should be mounted as close as possible to the top of all structures, which in practice is on the turbine hubs. Additionally, at least three low-intensity (32 candela) lights should be provided at an intermediate level of half the nacelle height.

Light pollution is a recognised problem in the UK, with wind turbine lighting potentially contributing to an adverse effect on peoples' views, including their enjoyment of the night skies. SNH has noted the need to be cautious when proposing lighting in the UK's darker, more sensitive landscapes, and considered a range of potential mitigation solutions including radar activated lighting.

The need for lighting within a wind farm is typically decided during the consultation stage of a planning application, based on views from the CAA, Ministry of Defence (MOD) and local aerodromes. Turbines below 150m are not routinely lit, but where lighting is required, wind farm developers usually seek to agree on the use of infra-red lighting in the interests of public amenity, this being barely perceptible to the human eye. Radar activated lighting is also being investigated (refer to **Chapter 13** (Aviation and Radar) for further details).

Unless the use of infra-red or radar activated lighting can be agreed for the purpose of aviation safety, to reduce or remove the effects of lighting of the turbines on their hubs at night, then the proposed lights will extend visibility of the Proposed Development into hours of darkness.

Whilst there is as yet no specific published guidance for the preparation of a night time lighting assessment, the following publication provide limited information and guidance on lighting matters:

- Landscape Institute and Institute of Environmental Assessment. (2013). Guidelines for Landscape and Visual Assessment 3rd Edition. (GLVIA 3).
- SNH. (2017). Siting and Designing Wind Farms in the Landscape – Version 3a.
- SNH. (2017). Visual Representation of Windfarms: Guidance, Version 2.2.

Baseline

The baseline environment of Shetland and of the site is generally dark and relatively light free at night, with the only lighting being associated with settlements and residential properties, lighting around the ferry terminals and piers (e.g. at Cullivoe), and infrastructure such as fish farms, and the Sullom Voe Oil Terminal. Lighting on vehicles on roads, and on ferries at night, as well as on channel or hazard marker buoys in the sea between the islands also influences the night sky. Relative to the rest of the UK however, Shetland is characterised by very dark skies.

Assessment

The lights, mounted on the hubs will be seen in clear conditions over long distances. If required, they will be seen from all locations indicated on the hub height ZTV. Typically, brighter lights are used on the cardinals, marking the outer extent of the turbines, and lower intensity lights on other turbines, but this detail is subject to agreement with the CAA.

Shetland has long hours of daylight in the summer months, when the effects of aviation safety lighting at hub height on the turbines will be minimal, but long hours of darkness in winter when the effects would extend over longer durations. In Shetland in winter at this latitude it can be dark from 3pm through to 9am, which includes times when people will be active and able to be affected by the proposed lighting.

Lighting may also be seen to interfere with natural phenomena such as the Northern Lights, when it occurs.

As such, the effects of lighting on night time views will be Significant, particularly in closer views and where the sense of the lights appearing to flash will be apparent. It will be significant during hours of darkness at all locations within up to approximately 15-20km (depending upon atmospheric conditions) where the hubs of the proposed turbines are seen, as described in the tables in Chapter 5.

Seasonal variation in effects

The effect will be more noticeable and significant in winter months, when people are active during hours of darkness. In summer months however, when the islands are typically more populated with tourists and more people will be outside, most people will be asleep during the very short hours of darkness at this latitude, and the effect of the lighting be Not significant. Between these two extremes, the duration and thus level of significance of effects will gradually increase the taper off again.

Supporting Graphics – ZTV indicating visibility of lighting, and illustrated representative viewpoints

Figures are provided to illustrate the effects of lighting. **Figure 5.7.4**, Night Time Lighting ZTV, Comparison of Nacelle and Tower Lighting indicates the extent of visibility of the lights. Visibility is equivalent to the extent of the Hub Height ZTV and will be broadly as set out in paragraphs 5.6.21 -5.7.27 of **Chapter 5**.

The following viewpoint figures have been prepared to illustrate the effects of night time lighting at three selected viewpoints, representative of the local residential clusters that will experience direct views towards the Proposed Development.

- Night Time Lighting Viewpoint 1: (Viewpoint 4) Haa of Houlland
 - **Figure 5.7.1a**: Haa of Houlland – Night Time Lighting Viewpoint Location Plan
 - **Figure 5.7.1b**: Haa of Houlland – 90° Existing View (Daytime) and 90° Predicted Wireframe View (Cylindrical)
 - **Figure 5.7.1c**: Haa of Houlland – Low Light - 53.5° Predicted Photomontage View (Planar)
 - **Figure 5.7.1d**: Haa of Houlland – Dusk - 53.5° Predicted Photomontage View (Planar)
 - **Figure 5.7.1e**: Haa of Houlland – Darkness - 53.5° Predicted Photomontage View (Planar)
- Night Time Lighting Viewpoint 2: (Viewpoint 8) Cunnister
 - **Figure 5.7.2a**: Cunnister – Night Time Lighting Viewpoint Location Plan
 - **Figure 5.7.2b**: Cunnister – 90° Existing View (Daytime) and 90° Predicted Wireframe View (Cylindrical)
 - **Figure 5.7.2c**: Cunnister – Low Light - 53.5° Predicted Photomontage View (Planar)
 - **Figure 5.7.2d**: Cunnister – Dusk - 53.5° Predicted Photomontage View (Planar)

- **Figure 5.7.2e:** Cunnister – Darkness - 53.5° Predicted Photomontage View (Planar)
- Night Time Lighting Viewpoint 3: (Viewpoint 10) Westing
 - **Figure 5.7.3a:** Westing – Night Time Lighting Viewpoint Location Plan
 - **Figure 5.7.3b:** Westing – 90° Existing View (Daytime) and 90° Predicted Wireframe View (Cylindrical)
 - **Figure 5.7.3c:** Westing – Low Light - 53.5° Predicted Photomontage View (Planar)
 - **Figure 5.7.3d:** Westing – Dusk - 53.5° Predicted Photomontage View (Planar)
 - **Figure 5.7.3e:** Westing – Darkness - 53.5° Predicted Photomontage View (Planar)

The individual assessment from each of these representative locations is provided below.

Table 1- Operational Effects at Night Time Lighting, Viewpoint 1 (Viewpoint 3), Haa of Houlland, Yell

<i>Night Time Lighting, Viewpoint 1, Haa of Houlland, Figure 5.7.1 a – eii</i>	
Distance and Direction to Yell Wind Farm	2.3km to the south west
LCA/CCA and Designations	LCA E3: Coastal Crofting and Grazing Lands
Receptor and Sensitivity to Change	Residents - High
Theoretical visibility	15 turbines to Hub Height, 13 turbines to parts of blades
<i>Location and Rationale for Selection</i>	
The viewpoint is located adjacent to the settlement cluster at the Haa of Houlland. It has been selected to illustrate the effects of night time lighting on local residents along the northern coast of Yell.	
<i>Description of Existing View</i>	
The viewpoint is positioned immediately to the west of the cluster of settlement at the Haa of Houlland, on an access track leading towards the enclosed pastures on the edge of the settlement. The view looks away from the settlement towards the gently rising hills within the interior of Yell, Houlland Hill frames the view to the left of the image. The continuation of the access track is seen, snaking across the northern flank of Houlland Hill, in the distance.	
<i>Determination of Visual Sensitivity</i>	
The sensitivity to change associated with the Proposed Development at this location is considered to be High for residents: Value – Medium The viewpoint is within the Gloup Voe and Bluemull Sound LLA. Susceptibility to Change – Medium The main focus of scenic views and majority of the residential properties will be to the north and north east towards the Atlantic Coast and Bluemull Sound.	
<i>Magnitude of Change</i>	
The overall magnitude of change on receptors at this viewpoint will be a Moderate . Size or Scale	

The proposed aviation lighting will be visible in the distance varying from being dimly visible at low light, more resolved and noticeable at dusk, to being seen as a clear red lights at darkness.

Geographical Extent

The aviation lighting visible from this location will be tower lighting on turbines 4, 26, 27, 28, 29. The terrain masks the tower lighting on the other turbines and the angle of view prevents visibility of the nacelle lighting.

Duration

The effect will be more noticeable and Significant in winter months, when people are active during hours of darkness. In summer months however, when the islands are typically more populated with tourists and more people will be outside, most people will be asleep during the very short hours of darkness at this latitude, and the effect of the lighting will not be significant. Between these two extremes, the duration and thus level of significance of effects will gradually increase the taper off again.

Significance of Effect

The combination of the individual judgements of **High** sensitivity and a **Moderate** magnitude of change are considered to result in a **Major/Moderate** effect on residents, which in the context of this assessment is considered to be **Significant**.

Table 2m - Operational Effects at Night Time Lighting, Viewpoint 2, Cunnister, Yell

Night Time Lighting Viewpoint 2, Cunnister, Yell, Figure 5.7.2 a – eii	
Distance and Direction to Yell Wind Farm	2.6.7km to the north
LCA/CCA and Designations	LCA F5: Scattered Settlement/Crofting and Grazing Lands
Receptor and Sensitivity to Change	Residents – High
Theoretical visibility	28 turbines to Hub Height
Location and Rationale for Selection	
<p>The viewpoint is located on the minor road at Cunnister, to the south of Sellafirth. It was selected to illustrate the typical nature of effects on the residents of the Cunnister.</p> <p>There are no built or consented wind farm developments influencing the baseline.</p>	
Description of Existing View	
<p>The sweeping view looks north across the northern extent of Basta Voe, towards the interior moorland hills of northern Yell. The settlement at Sellafirth is seen in the middle ground, with scattered housing either side of the A968. The view is contained by the low ridge of the Hill of Dalsetter to the left and set against the backdrop of Tittynans Hill to the right. The derelict settlement at Dalsetter is seen in the background to the centre of the image. Sheds and a pier are seen on the western shoreline, used to service the aquaculture developments within Basta Voe.</p>	
Determination of Visual Sensitivity	
<p>The sensitivity to change associated with the Proposed Development at this location is considered to be High for residents:</p> <p>Value – Medium/Low</p> <ul style="list-style-type: none"> ▪ The viewpoint is within the West Sandwick to Gloup Holm LLA. <p>Susceptibility to Change – High</p>	

<ul style="list-style-type: none"> ▪ Residents are highly likely to be aware of any changes to their existing visual amenity. ▪ Relative simplicity of landform with smooth and rounded pastures and expansive views. ▪ Orientation of buildings predominantly away from the Proposed Development and towards the coast.
Magnitude of Change
<p>The overall magnitude of change on receptors at this viewpoint will be a Substantial.</p> <p>Size or Scale</p> <p>The proposed aviation lighting will be visible in the distance varying from being dimly visible at low light, more resolved and noticeable at dusk, to being seen as a clear red light at darkness.</p> <p>Geographical Extent</p> <p>The aviation lighting visible from this location will be tower lighting on turbines 7, 10, 12, 14, 15, 20, 24, 25. The terrain masks the tower lighting on the other turbines and the angle of view prevents visibility of the nacelle lighting.</p> <p>Duration</p> <p>The effect will be more noticeable and Significant in winter months, when people are active during hours of darkness. In summer months however, when the islands are typically more populated with tourists and more people will be outside, most people will be asleep during the very short hours of darkness at this latitude, and the effect of the lighting will not be significant. Between these two extremes, the duration and thus level of significance of effects will gradually increase the taper off again.</p>
Significance of Effect
<p>The combination of the judgements of High sensitivity and a Substantial magnitude of change are considered to result in a Major effect on residents, which in the context of this assessment are considered to be Significant.</p>

Table 3 - Operational Effects at Night Time Lighting Viewpoint 3, (LVIA Viewpoint 10), Westing, Unst

Night Time lighting Viewpoint 3, Westing, Unst, Figure 5.3.10	
Distance and Direction to Yell Wind Farm	6.7km to the west
LCA/CCA and Designations	LCA E4: Unst Coastal Crofting
Receptor and Sensitivity to Change	Residents – High
Theoretical visibility	28 turbines to Hub Height
Location and Rationale for Selection	
<p>The viewpoint is located on the minor road at Westing, on Unst, above the properties at Newgord. It has been selected to illustrate the effects on the residents of Westing.</p>	
Description of Existing View	
<p>The view is located above the northern extent of the Bluemull Sound with panoramic views along the northern edge of Yell and Gloup Holm, and south west to Bluemull Sound. The settlement at Greenbank and the Haa of Houlland is seen along the distant coastal edge of north Yell. The headland at Blue Mull juts into the sound, breaking up the view to the left of the image. The evenly spaced five turbine linear array of Garth Wind Farm is seen to the south west, following the distant profile of Yell.</p>	
Determination of Visual Sensitivity	

The sensitivity to change associated with the Proposed Development at this location is considered to be **High** for residents:

Value – Medium

- The viewpoint is within the Gloup Voe and Bluemull Sound LLA.

Susceptibility to Change – High

- Residents are highly likely to be aware of any changes to their existing visual amenity.
- Orientation of buildings towards the coast and the Proposed Development.

Magnitude of Change

The overall magnitude of change on receptors at this viewpoint will be a **Moderate**.

Size or Scale

The proposed aviation lighting will be visible in the distance varying from being dimly visible at low light, more resolved and noticeable at dusk, to being seen as a clear red light at darkness.

Geographical Extent

The aviation lighting visible from this location will be tower lighting on turbines: 1, 2, 3, 4, 5, 6, 17, 18, 20, 21, 24, 25, 26, 27, 28, 29 and lighting on the nacelles of all the turbines with the exception of T13 and T19 which are hidden by foreground turbines. The terrain masks the tower lighting on the other turbines.

Duration

The effect will be more noticeable and Significant in winter months, when people are active during hours of darkness. In summer months however, when the islands are typically more populated with tourists and more people will be outside, most people will be asleep during the very short hours of darkness at this latitude, and the effect of the lighting will not be significant. Between these two extremes, the duration and thus level of significance of effects will gradually increase the taper off again.

Significance of Effect

The combination of the judgements of **High** sensitivity and a **Moderate** magnitude of change are considered to result in a **Major/Moderate** effect on residents, which in the context of this assessment is considered to be **Significant**.

Summary

Shetland has long hours of daylight in the summer months, when the effects of aviation safety lighting at hub height on the turbines will be minimal, but long hours of darkness in winter when the effects would extend over longer durations. In Shetland in winter at this latitude it can be dark from 3pm through to 9am, which includes times when people will be active and able to be affected by the proposed lighting.

As such, the effects of lighting on night time views will be Significant, particularly in closer views. It will be significant during hours of darkness at all locations within approximately 15-20km where the hubs of the proposed turbines are seen, as described in the tables earlier in this Chapter.

The effect will be more noticeable and Significant in winter months, when people are active during hours of darkness. In summer months however, when the islands are typically more populated with tourists and more people will be outside, most people will be asleep during the very short hours of darkness at this latitude, and the effect of the lighting will not be significant. Between these two extremes, the duration and thus level of significance of effects will gradually increase then taper off again.

References

UK Air Navigation Order (ANO). (2016). *Article 222*.

Civil Aviation Authority (CAA). (June 2017). *Policy Statement on the lighting of onshore wind turbines*.

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